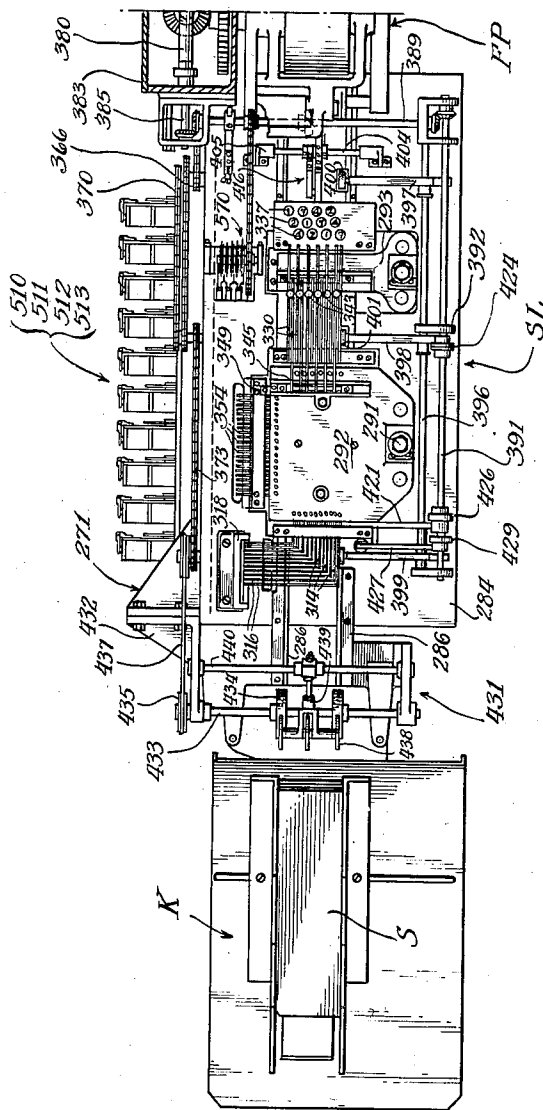


Fig. 1.



Inventor
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F. E. CURTIS

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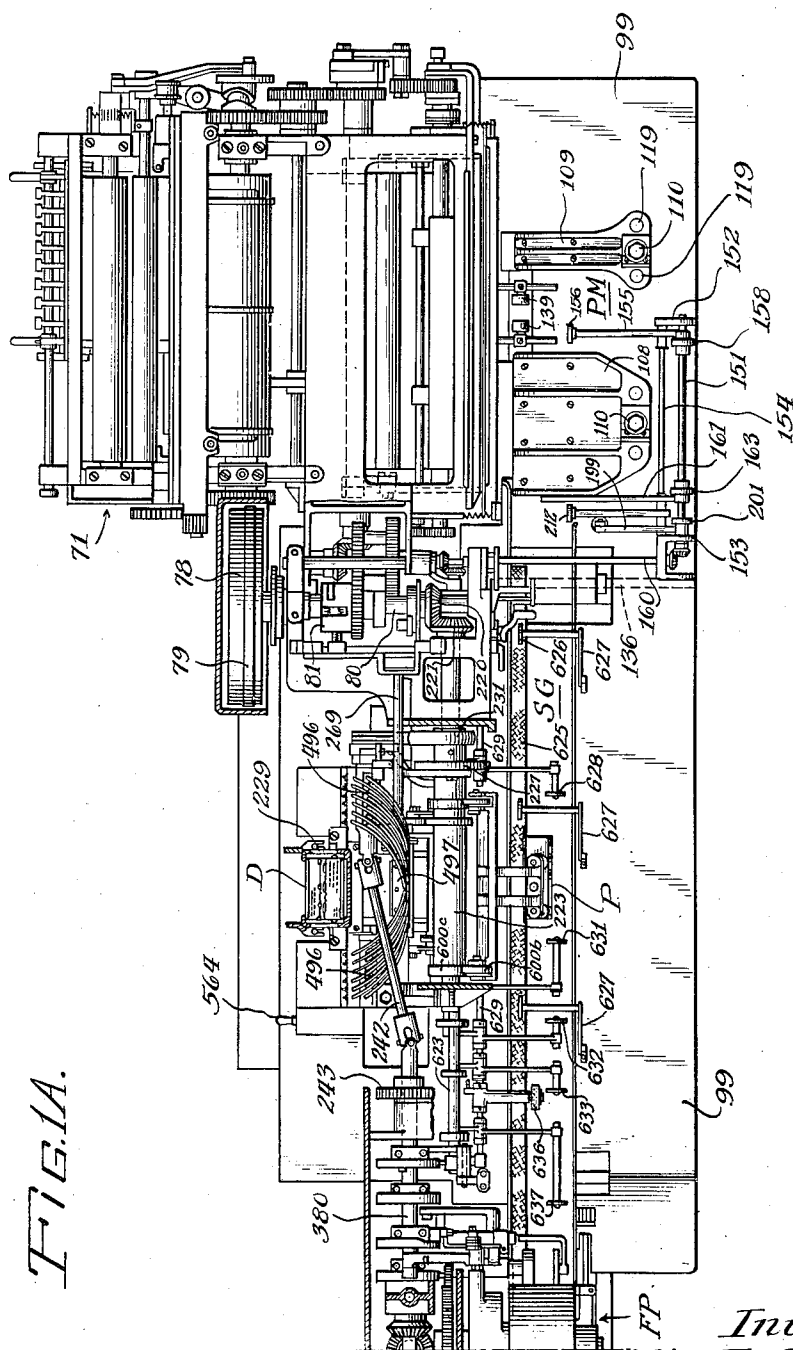


FIG. 1A.

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Jan. 1, 1946.

F. E. CURTIS

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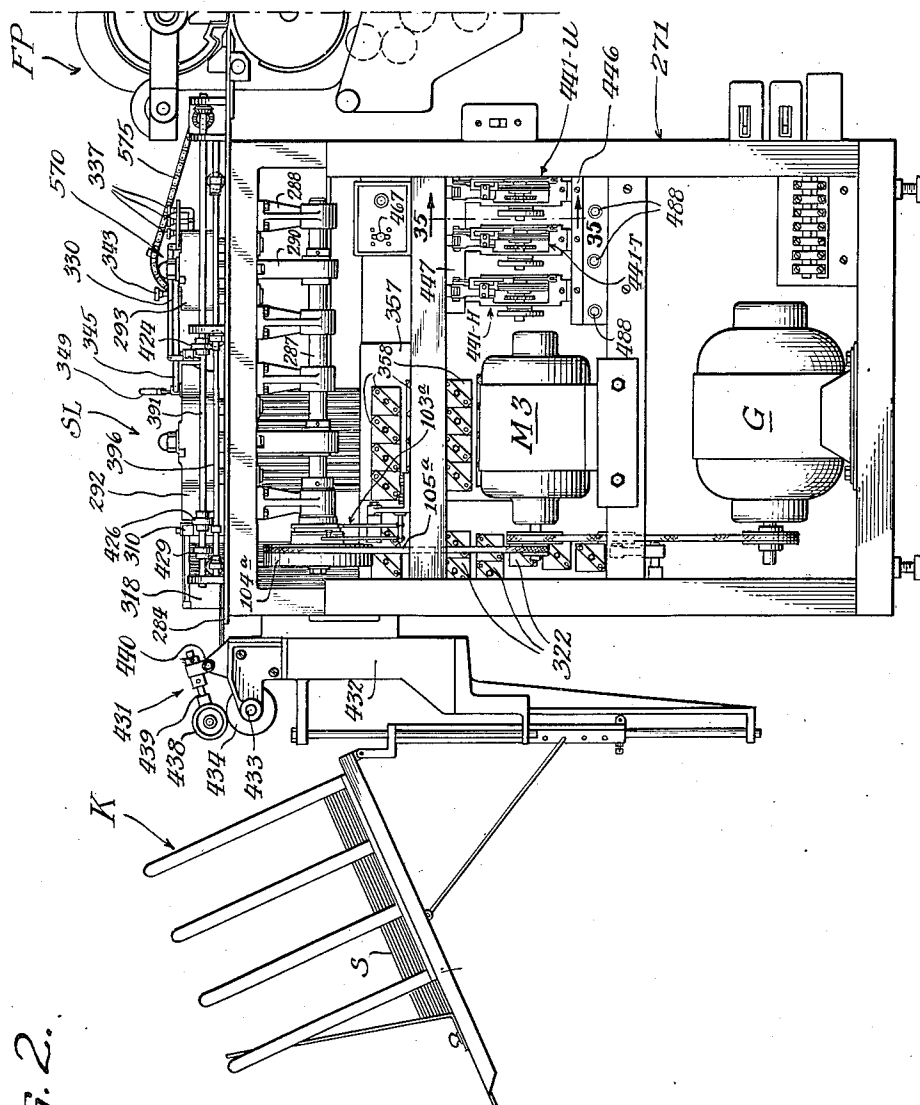


FIG. 2.

Inventor
Franklin E. Curtis.
By Wallace and Cannon
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Jan. 1, 1946.

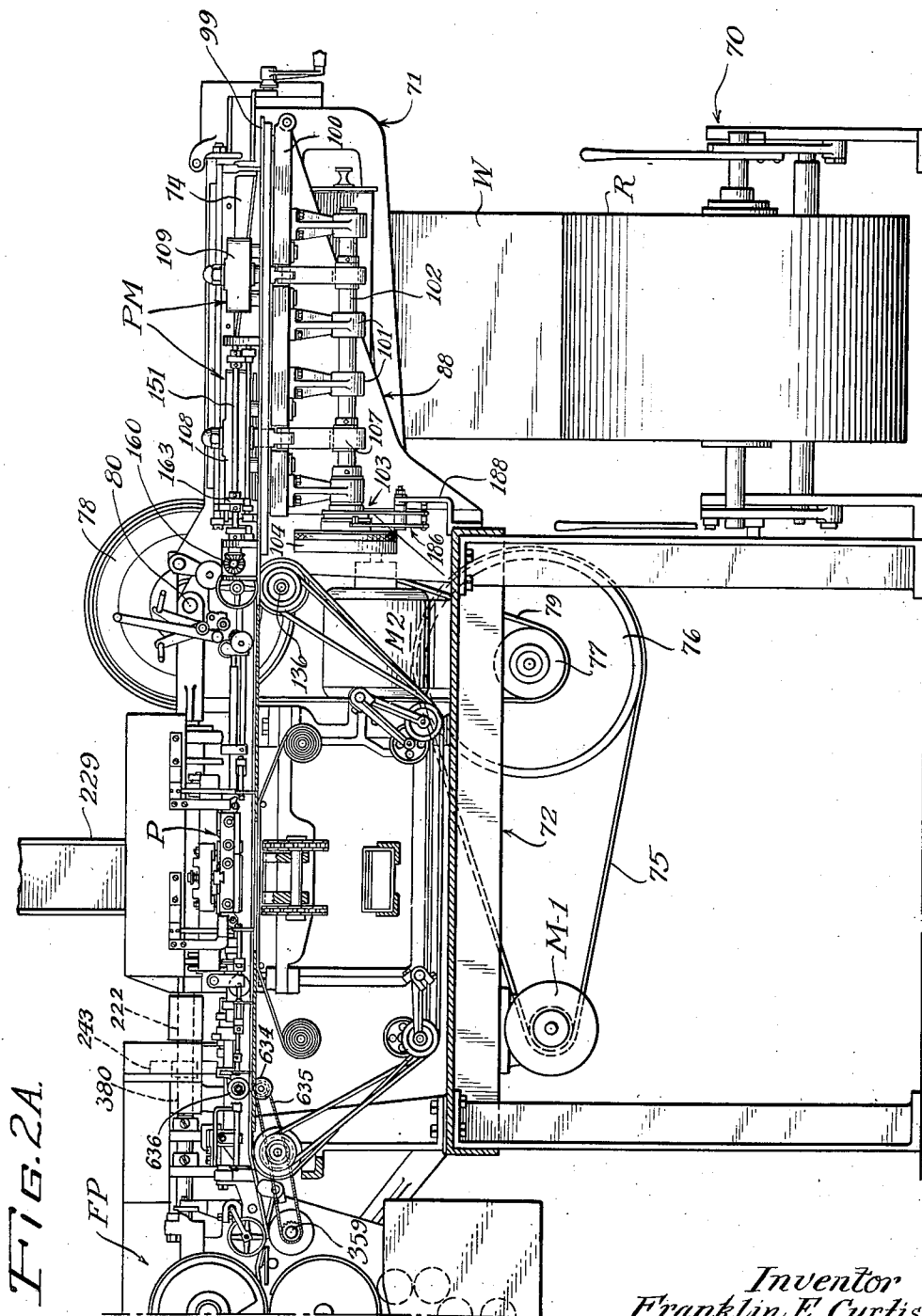
F. E. CURTIS

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44 Sheets-Sheet 4



Inventor
Franklin E. Curtis
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Jan. 1, 1946.

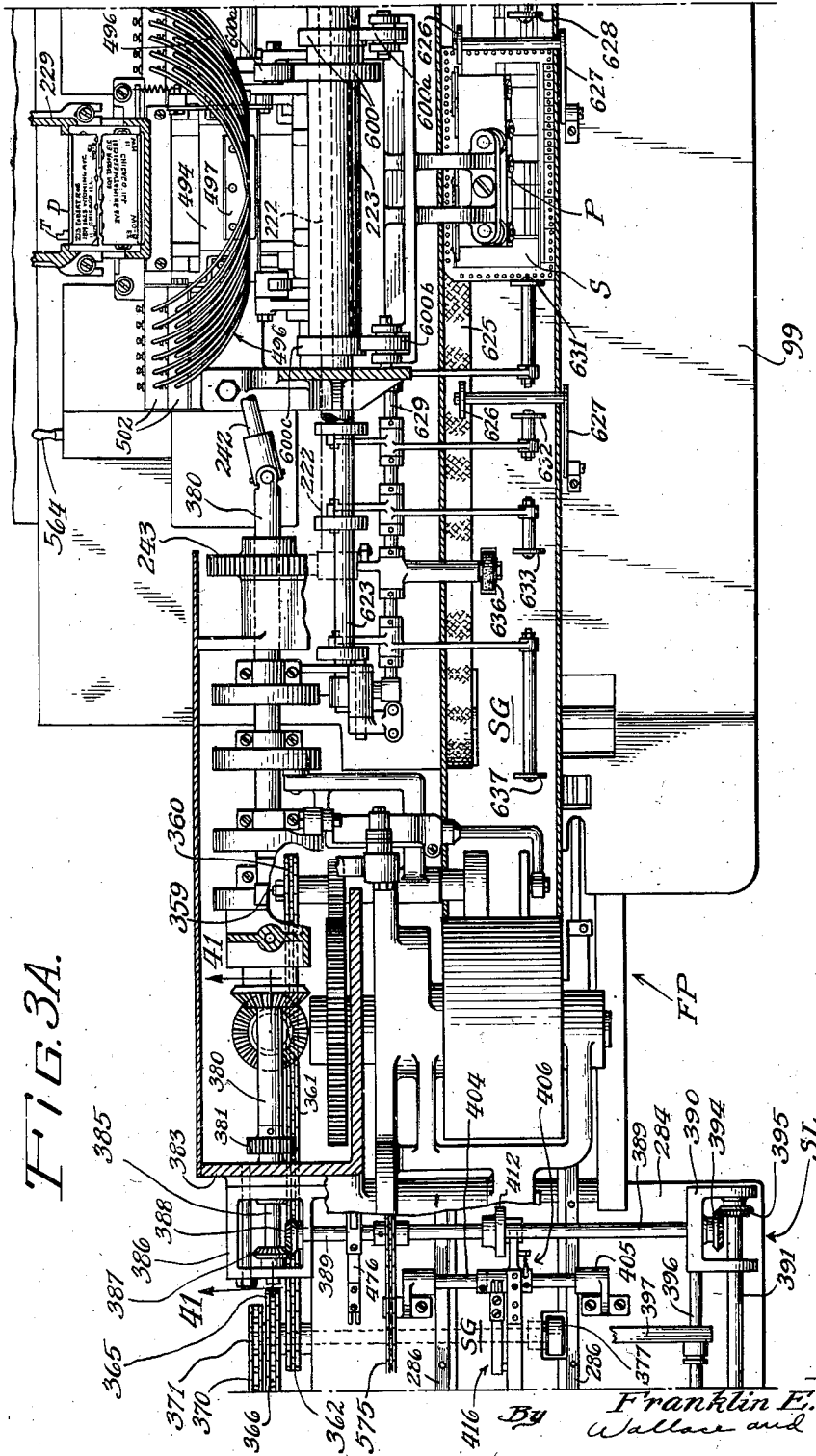
F. E. CURTIS

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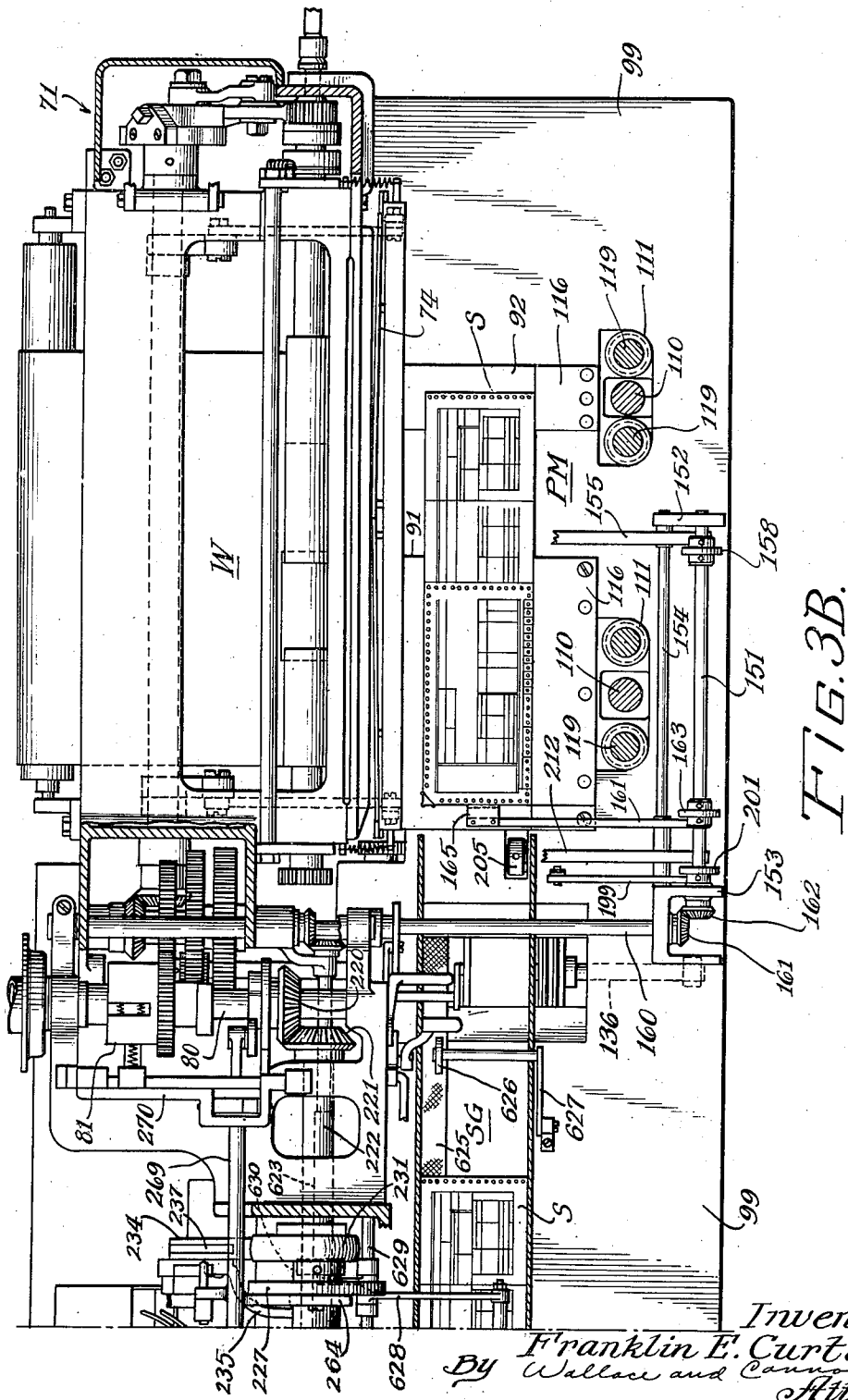
F. E. CURTIS

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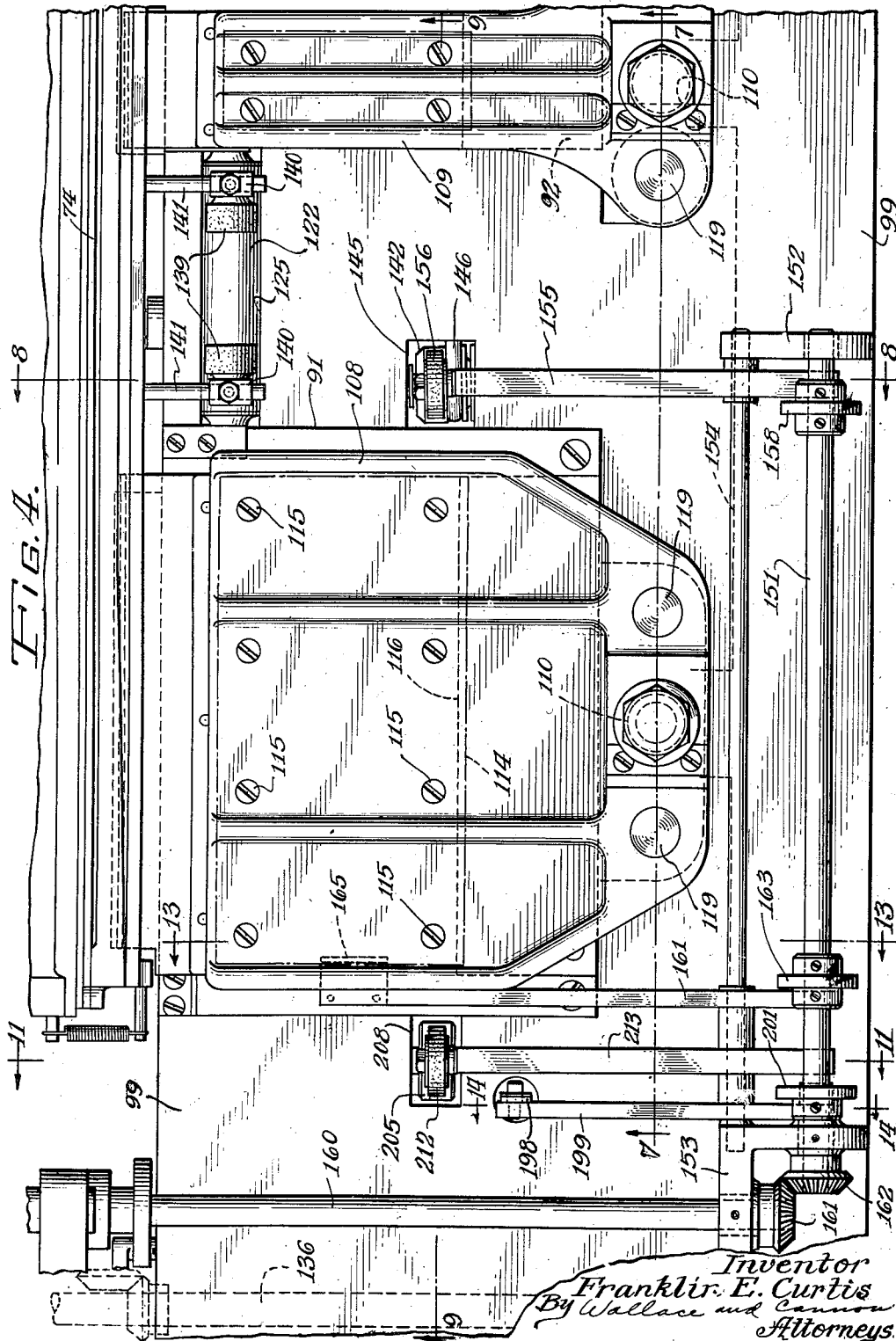
F. E. CURTIS

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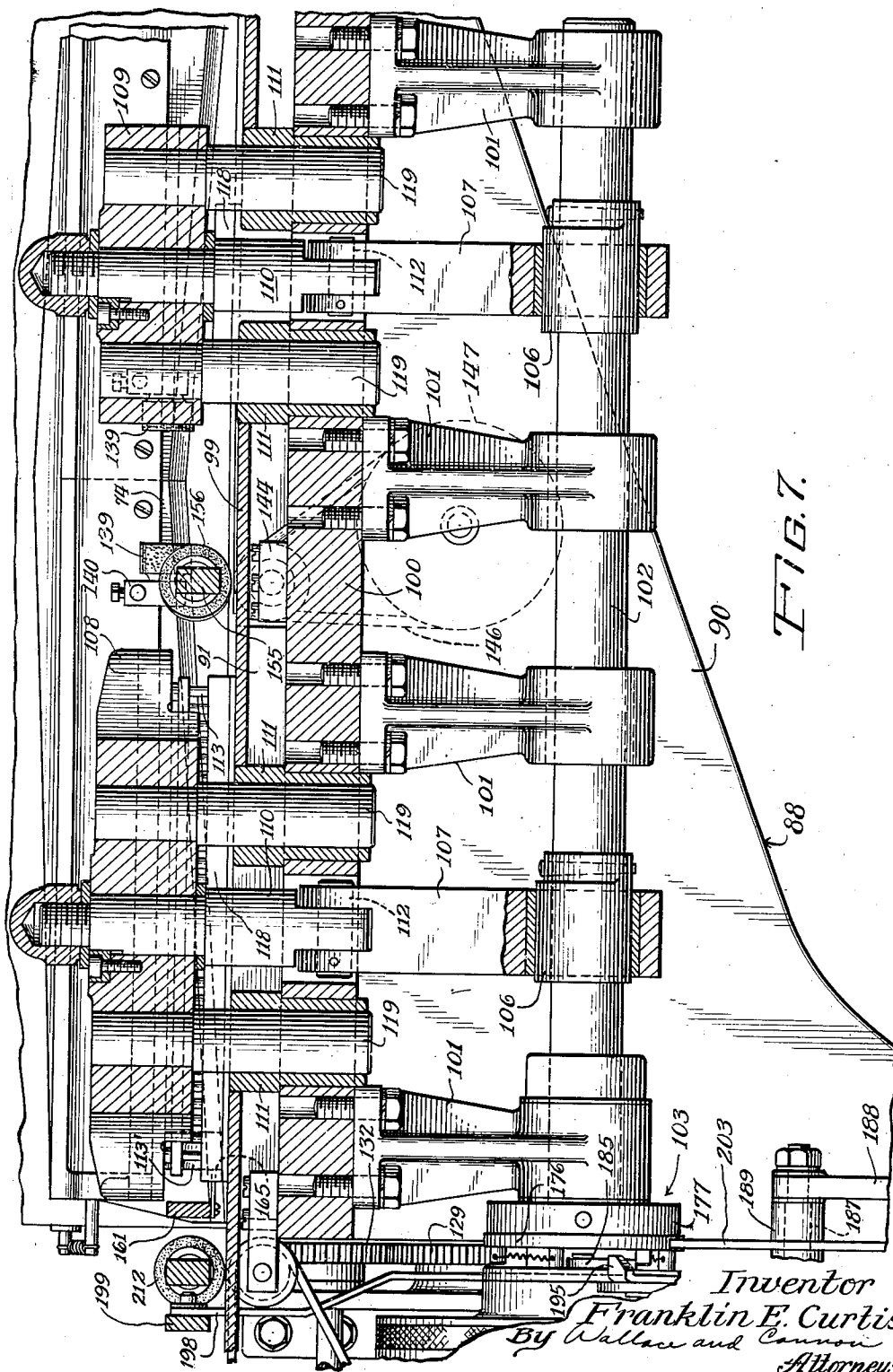
F. E. CURTIS

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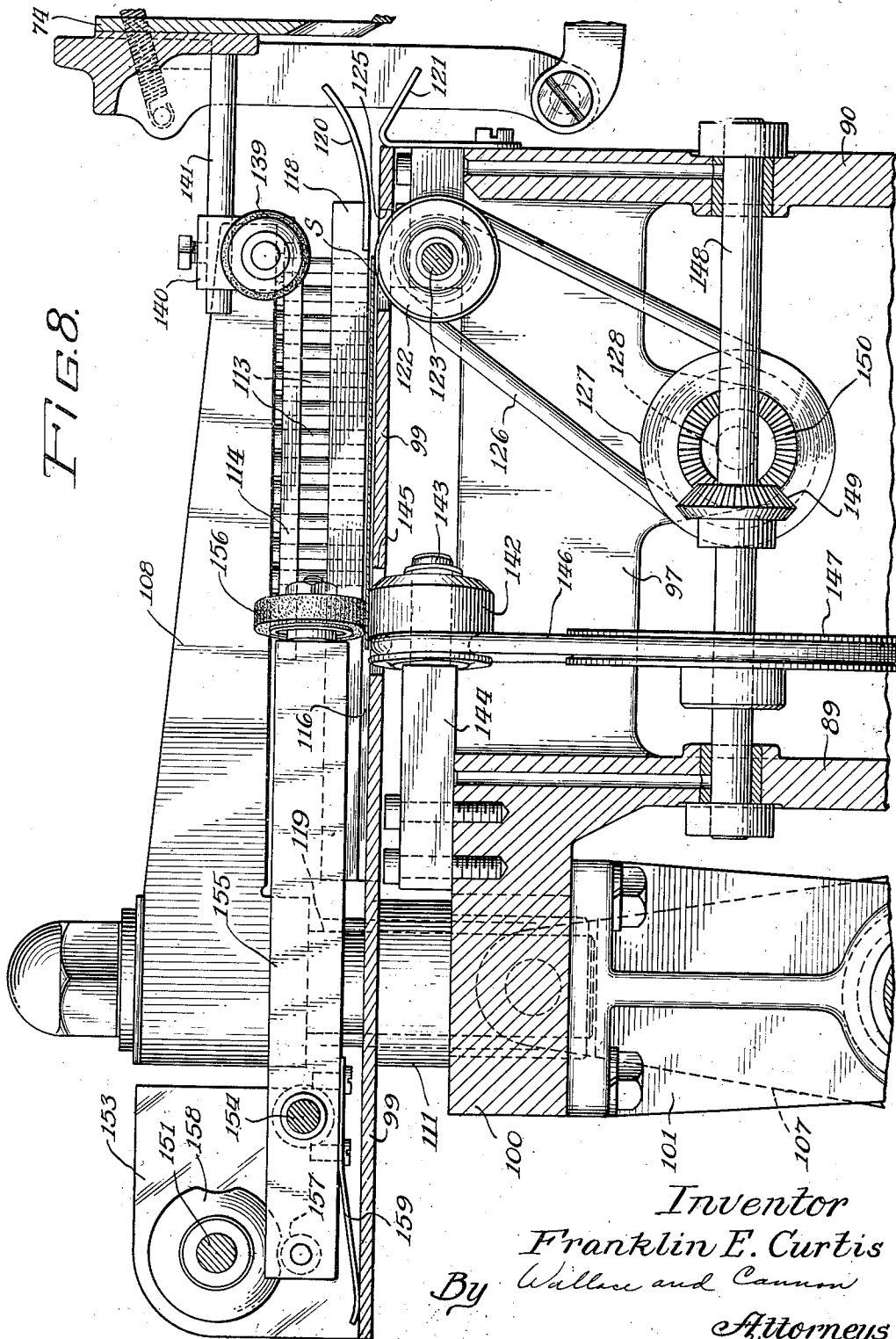
F. E. CURTIS

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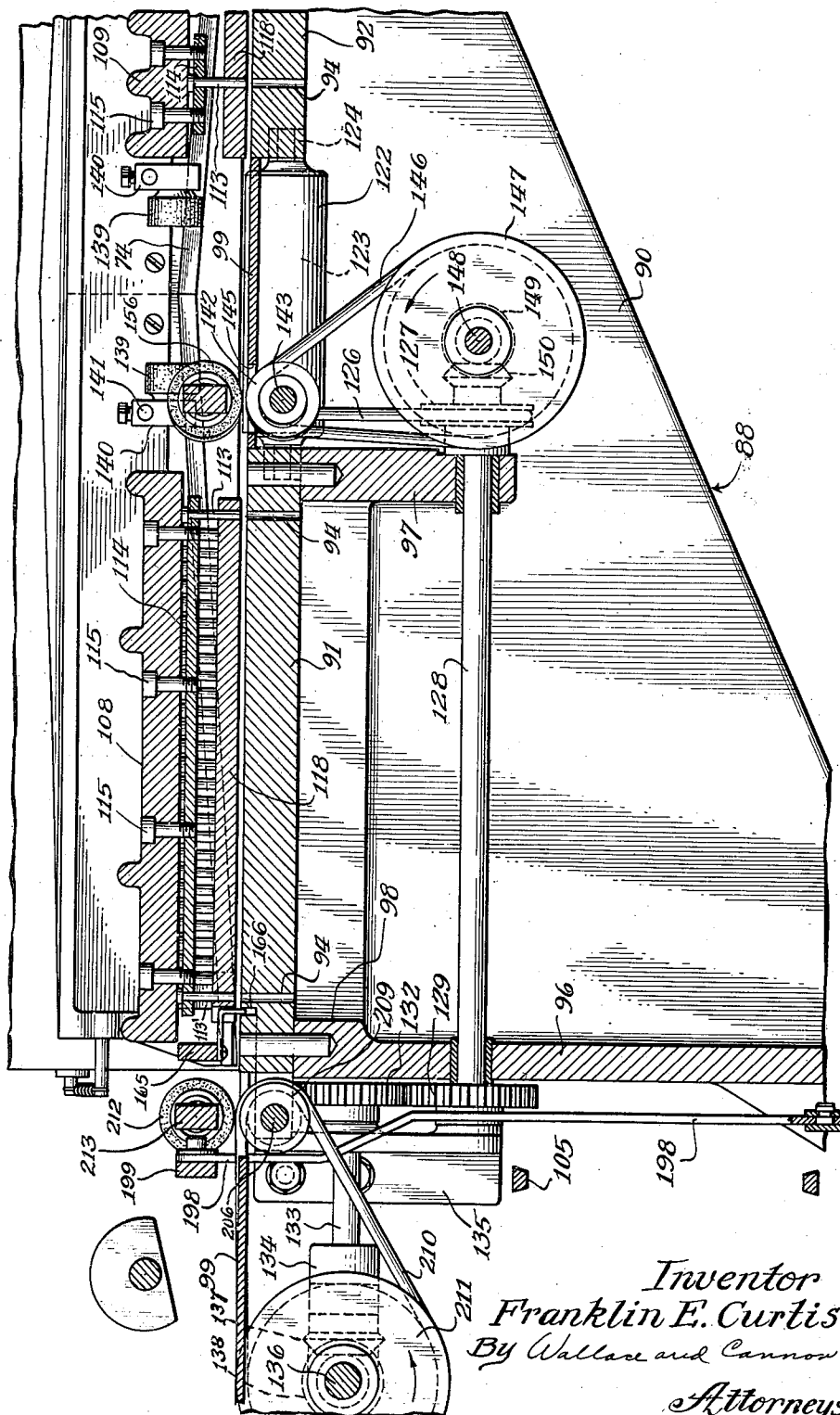
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FIG. 9.



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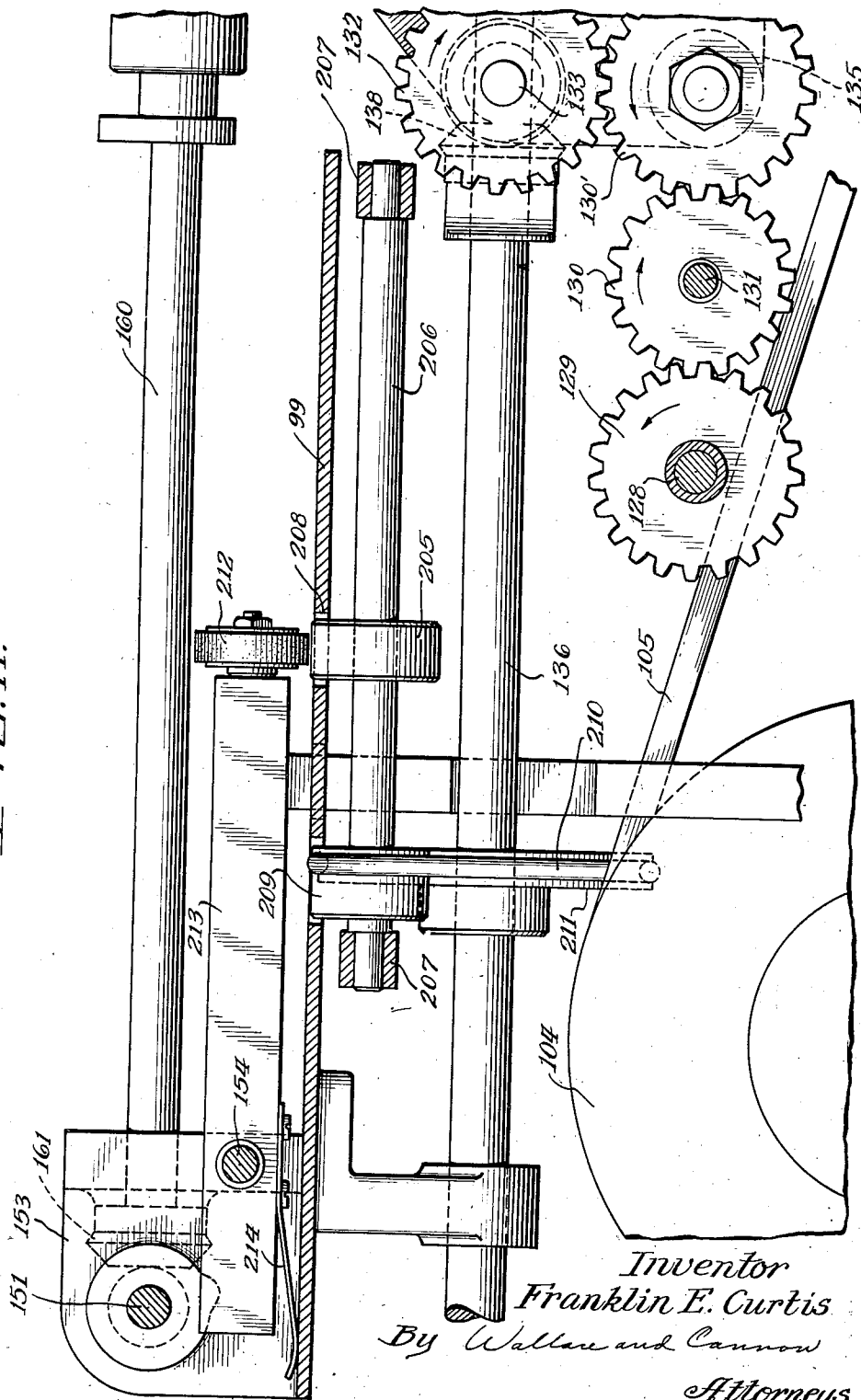
2,392,082

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FIG. 11.



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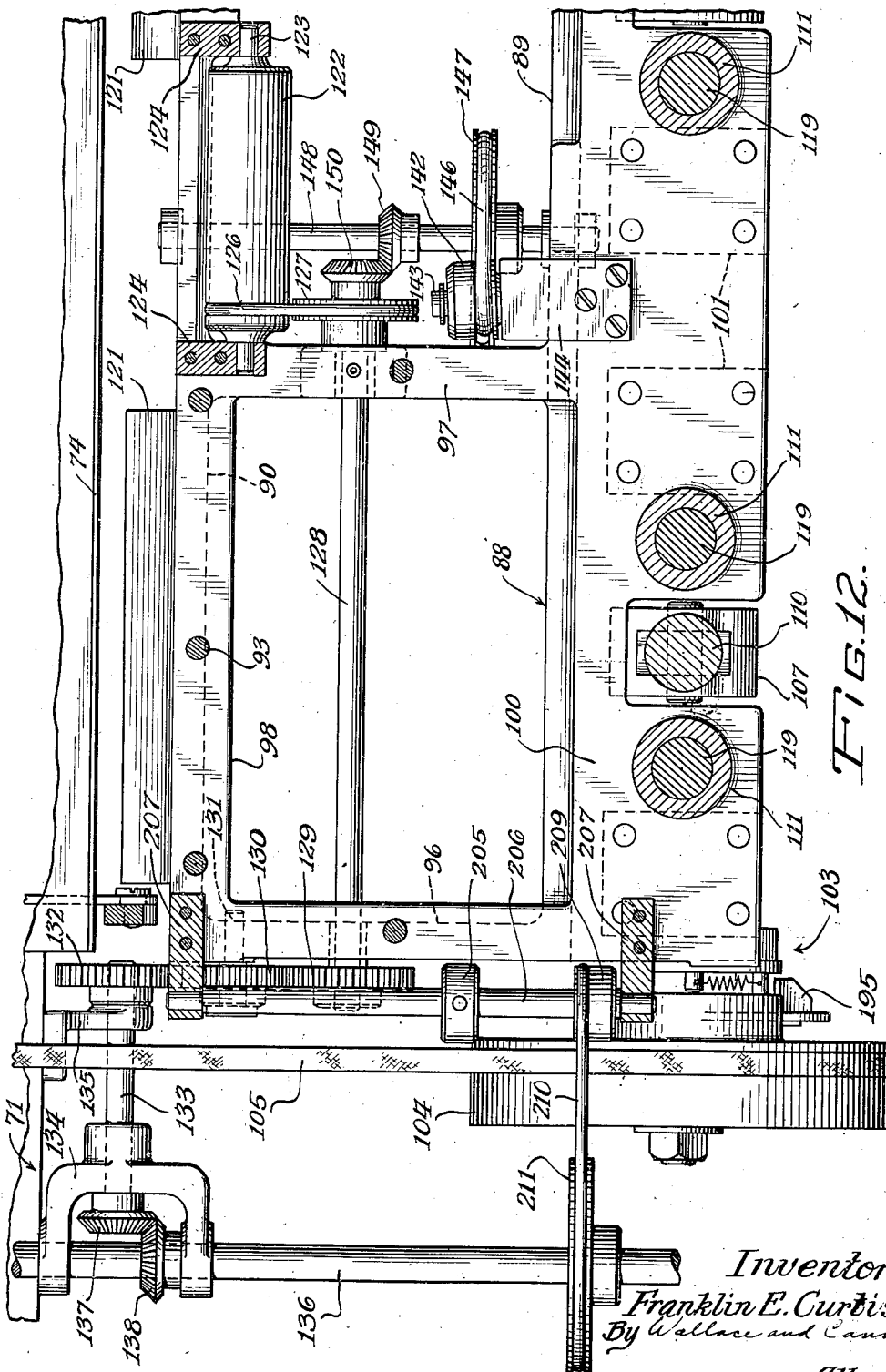
F. E. CURTIS

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44. Sheets-Sheet 16



 *Inventor*
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Jan. 1, 1946.

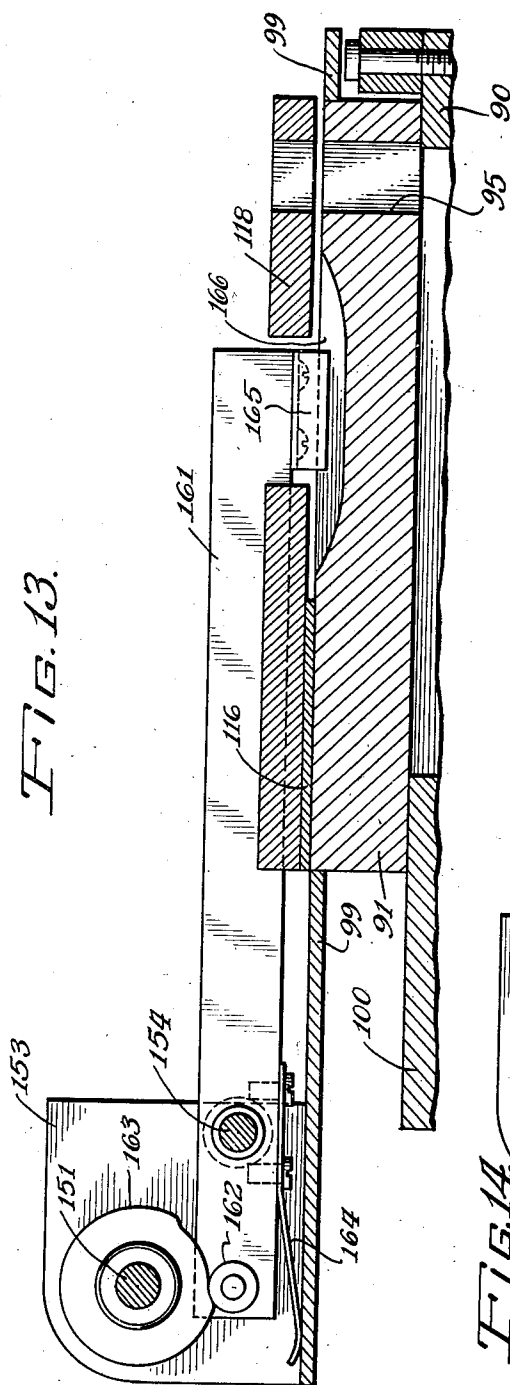
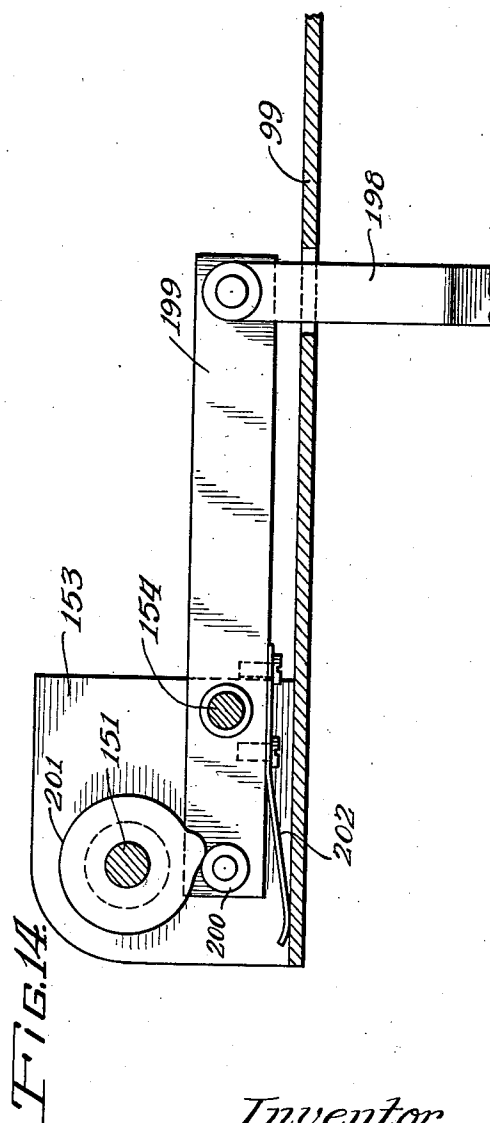
F. E. CURTIS

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Jan. 1, 1946.

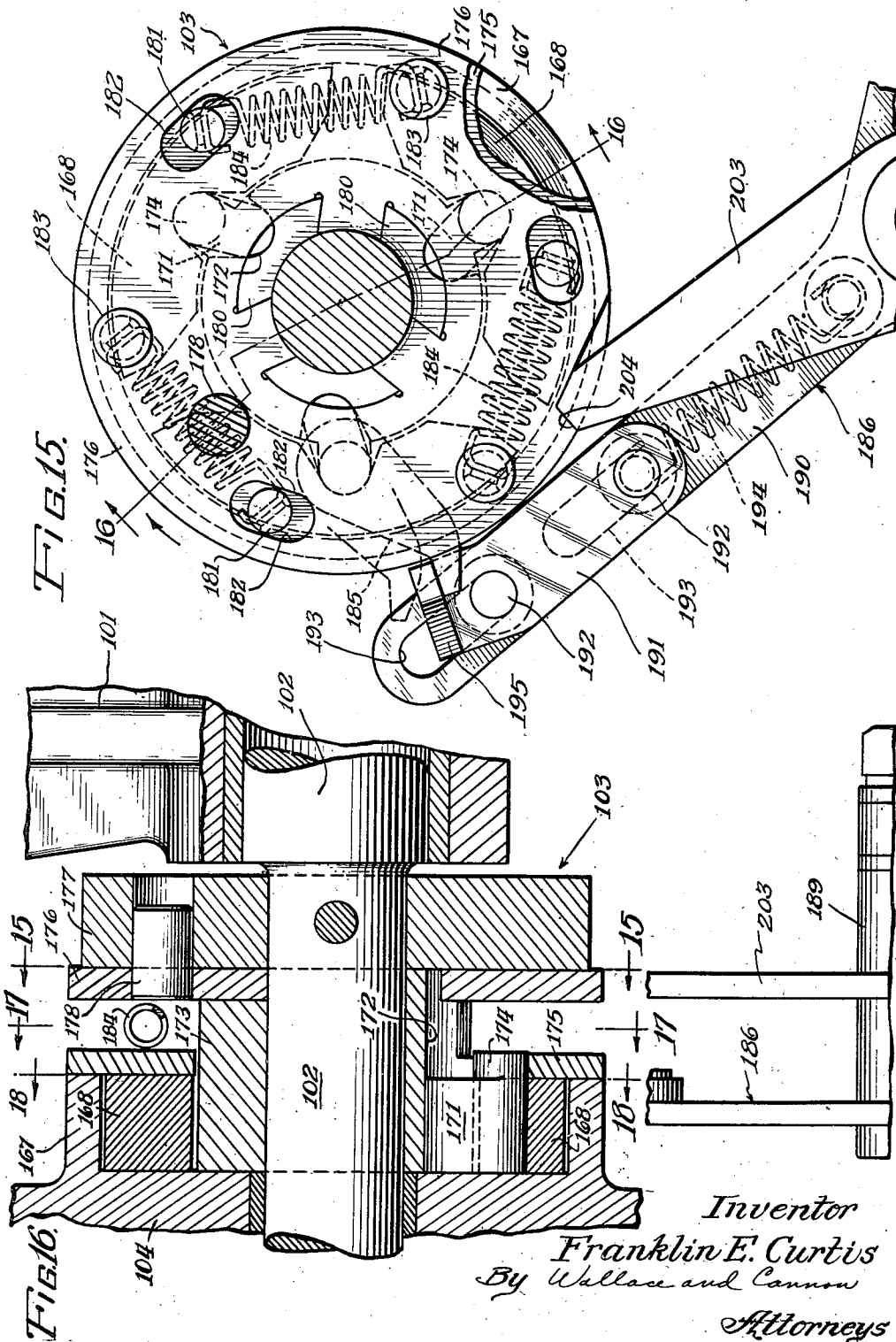
F. E. CURTIS

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Jan. 1, 1946.

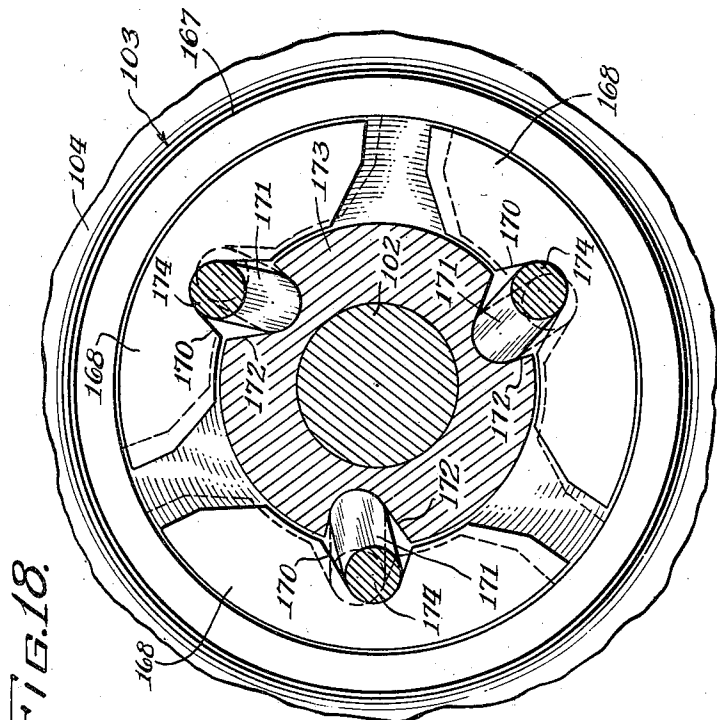
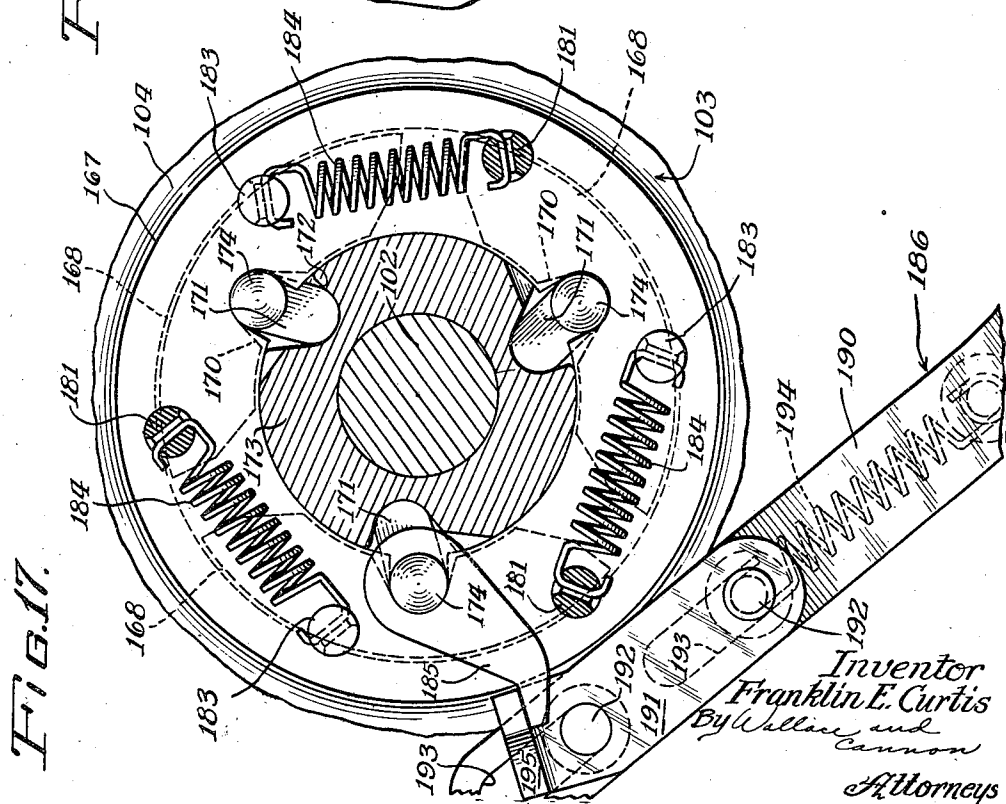
F. E. CURTIS

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Inventor
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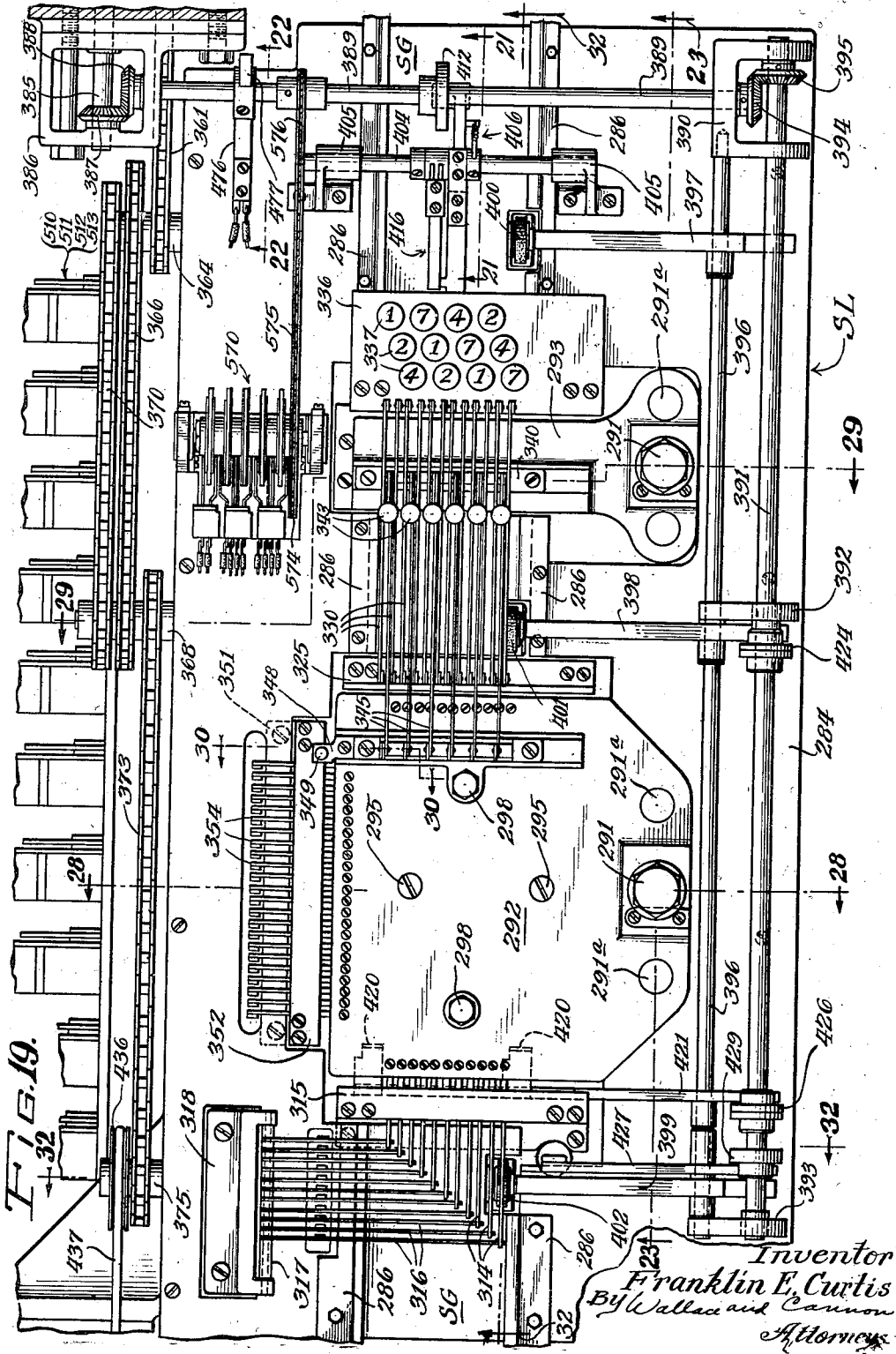
F. E. CURTIS

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FIG. 20.

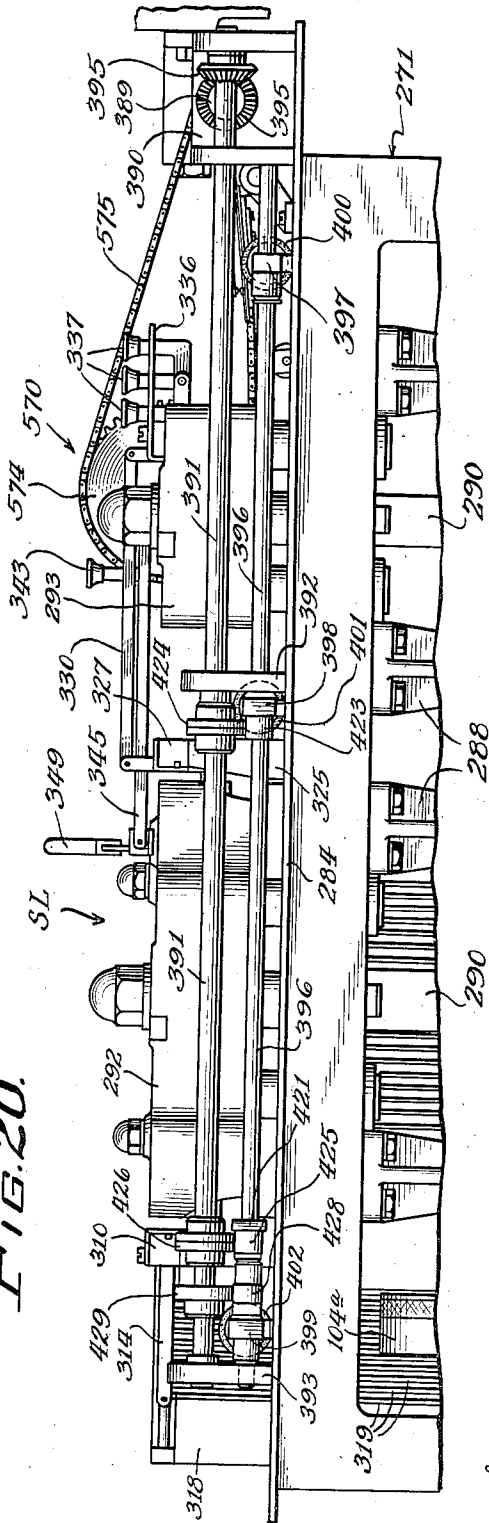
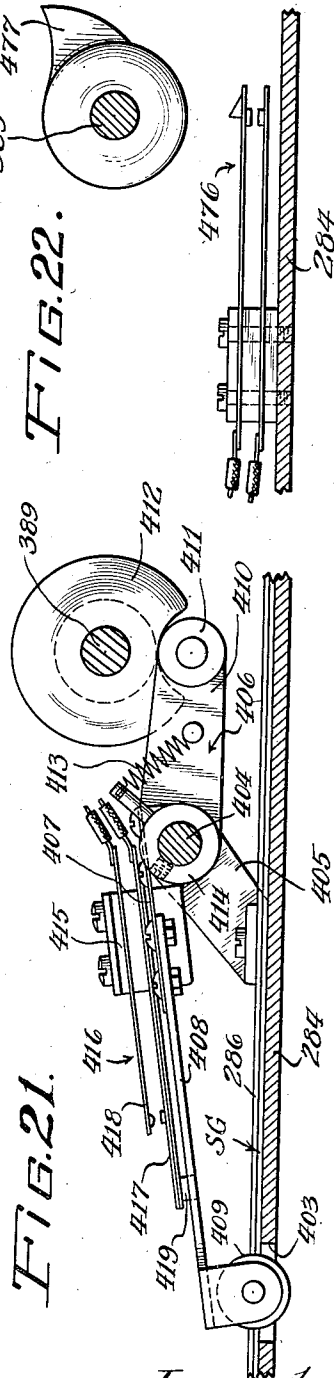


FIG. 21.



Inventor
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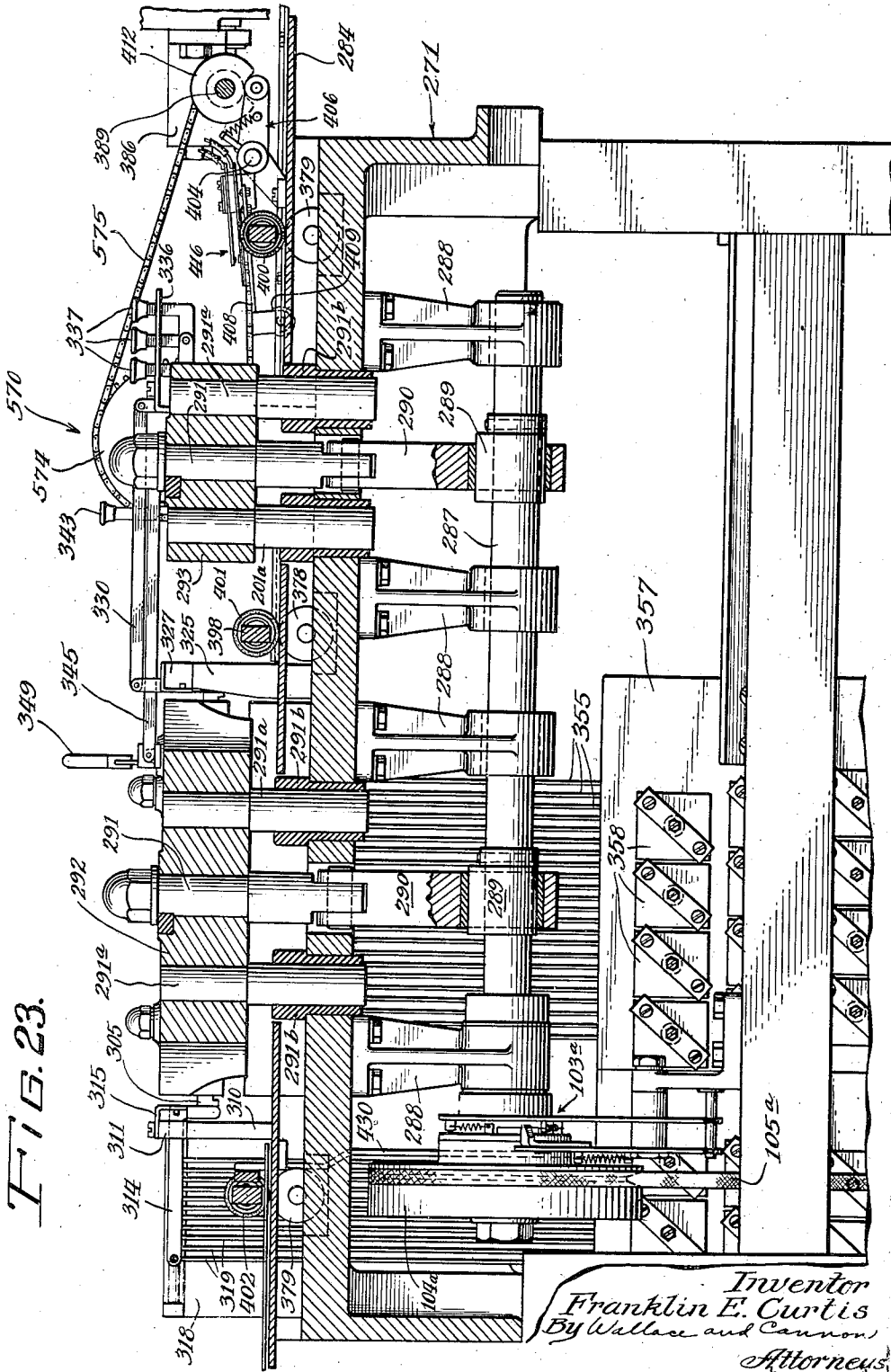
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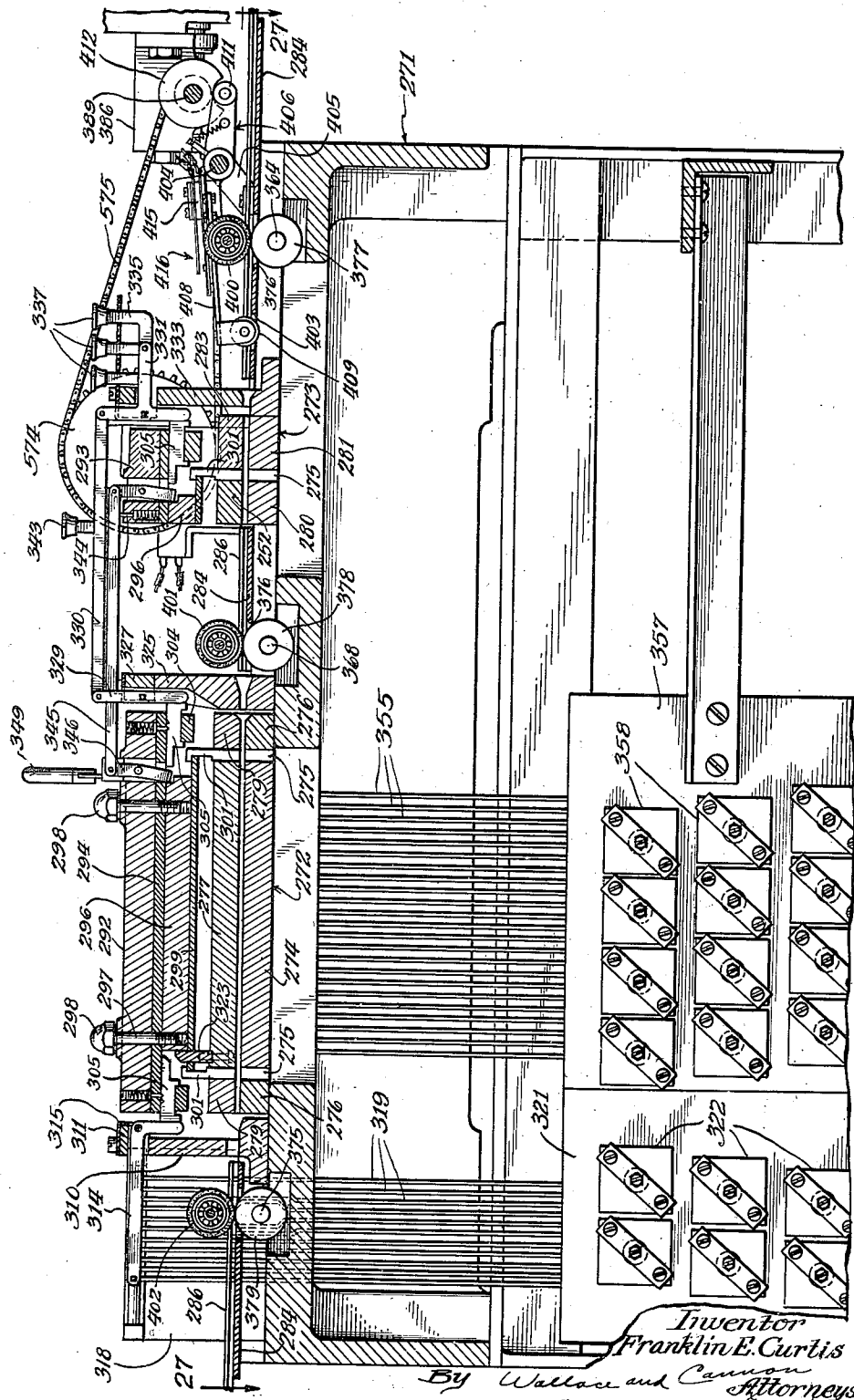
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FIG. 24.



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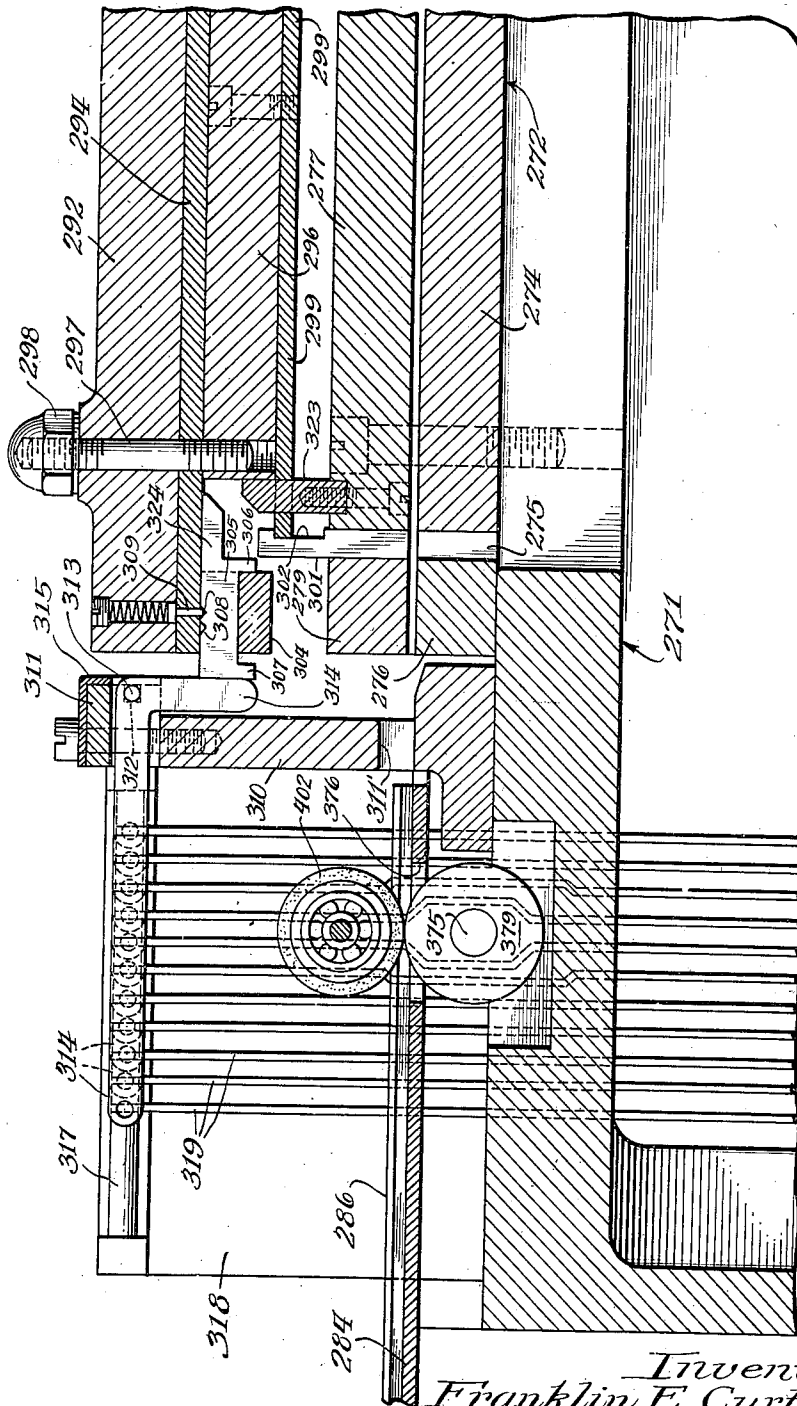
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FIG. 25.



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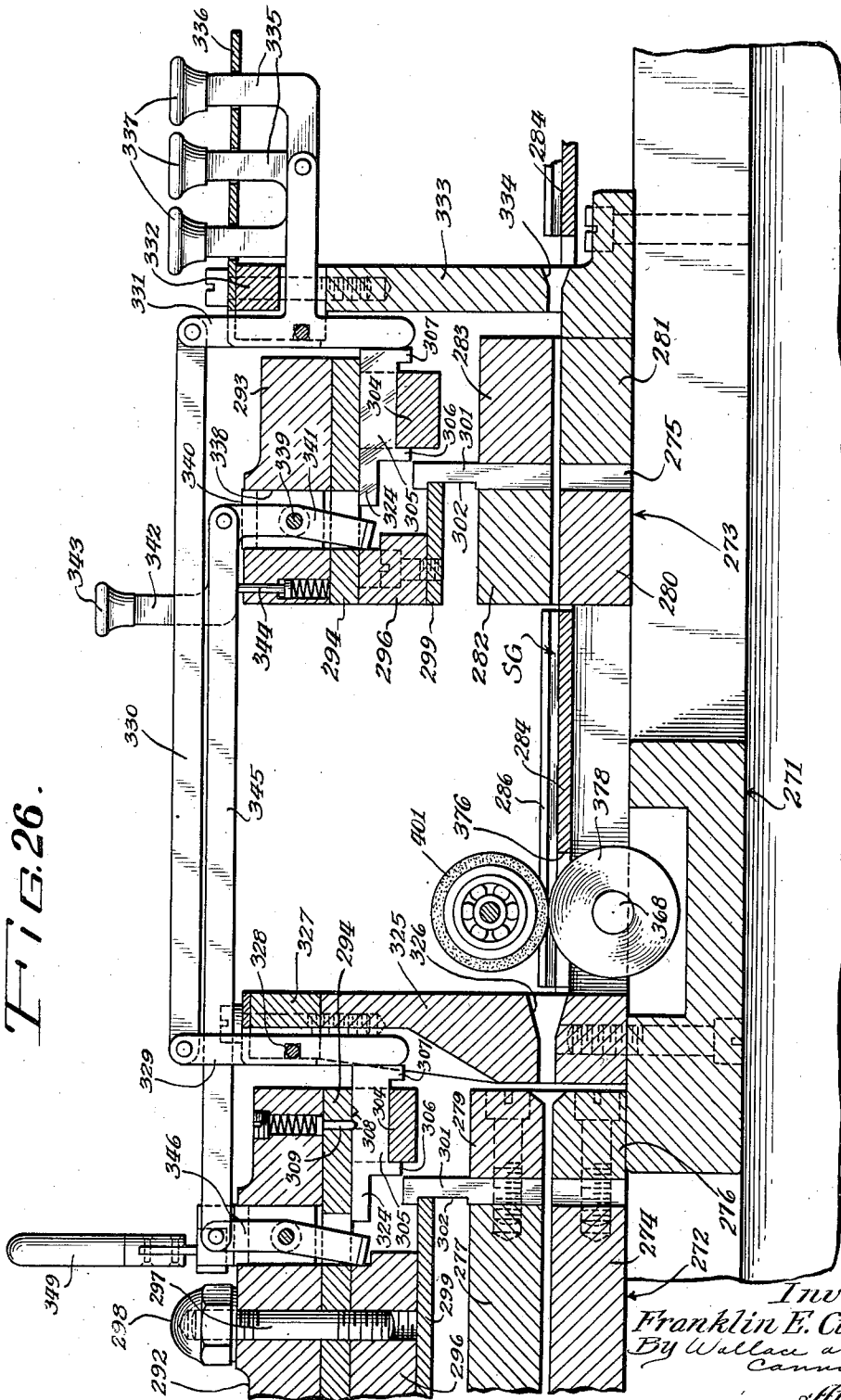


FIG. 26.

Inventor
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Jan. 1, 1946.

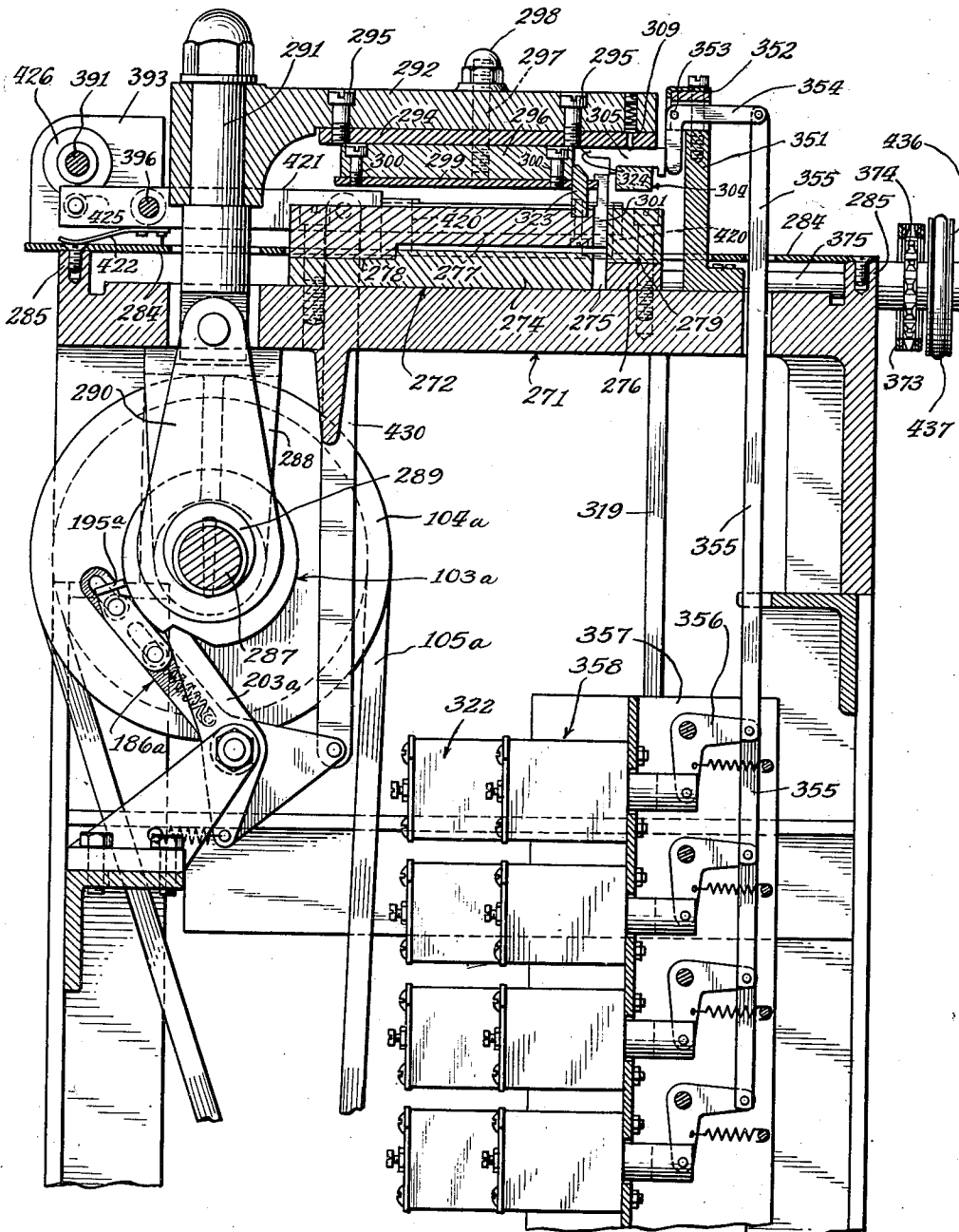
F. E. CURTIS
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FIG. 28.



Inventor
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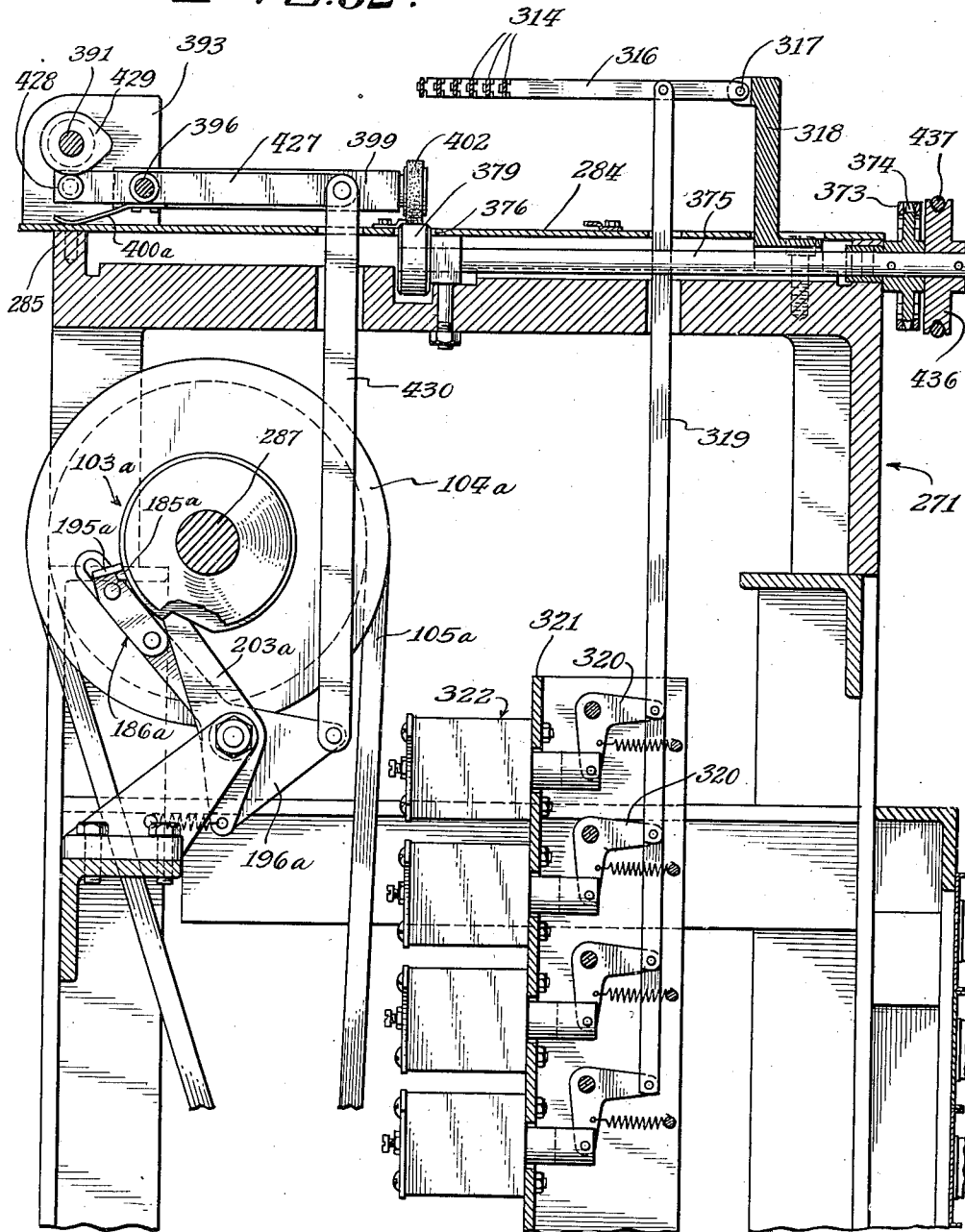
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FIG. 32.



Inventor
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FIG. 34

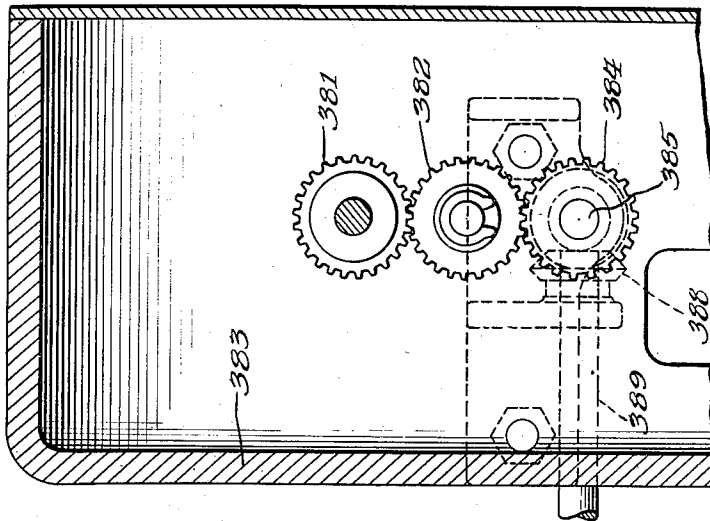
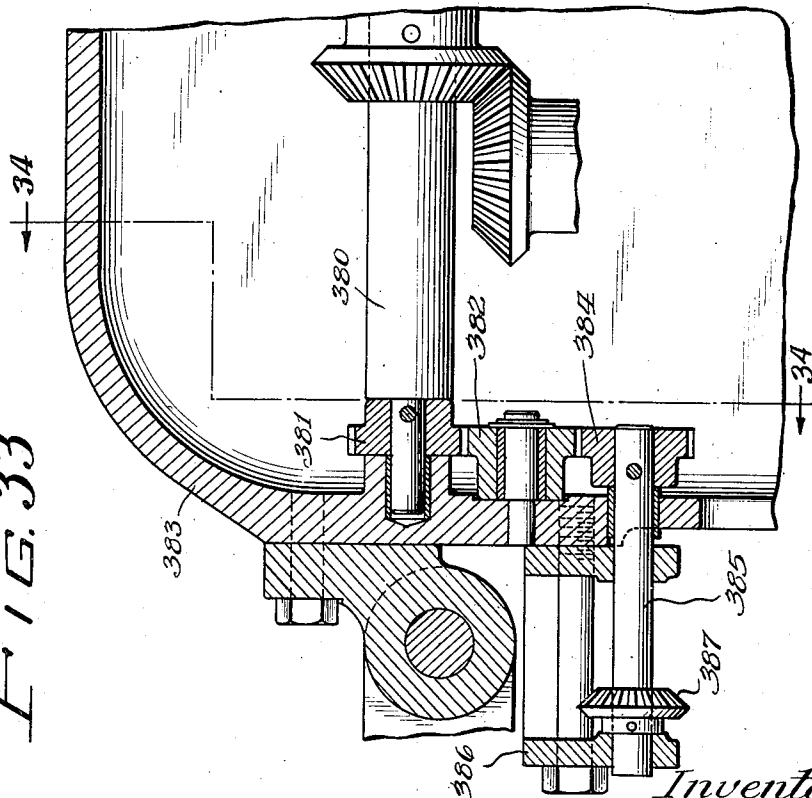


FIG. 33



Inventor
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Jan. 1, 1946.

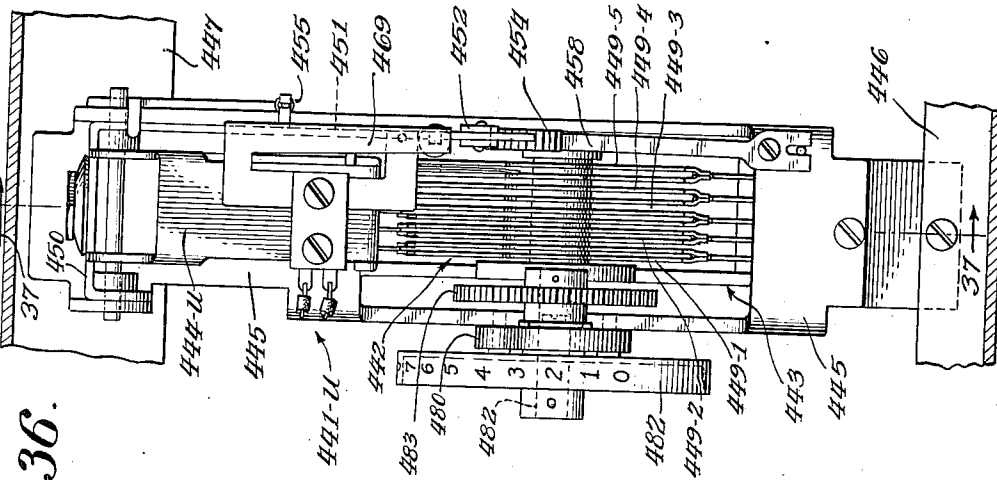
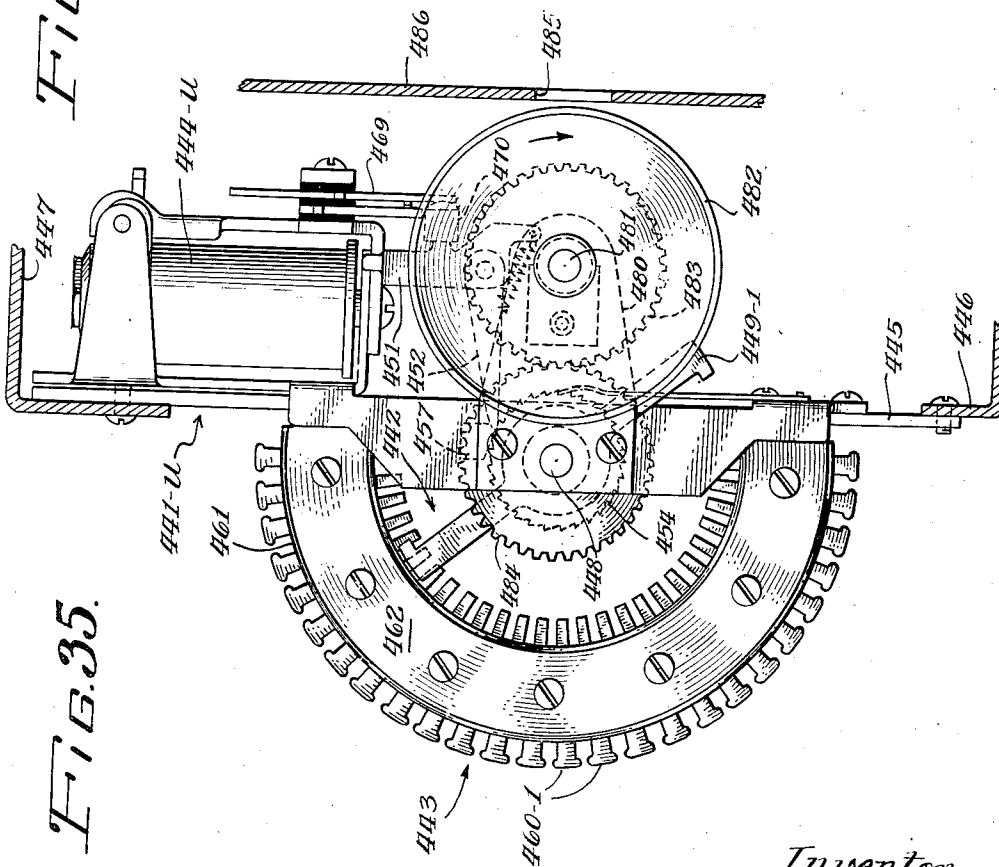
F. E. CURTIS

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Inventor
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FIG. 38.

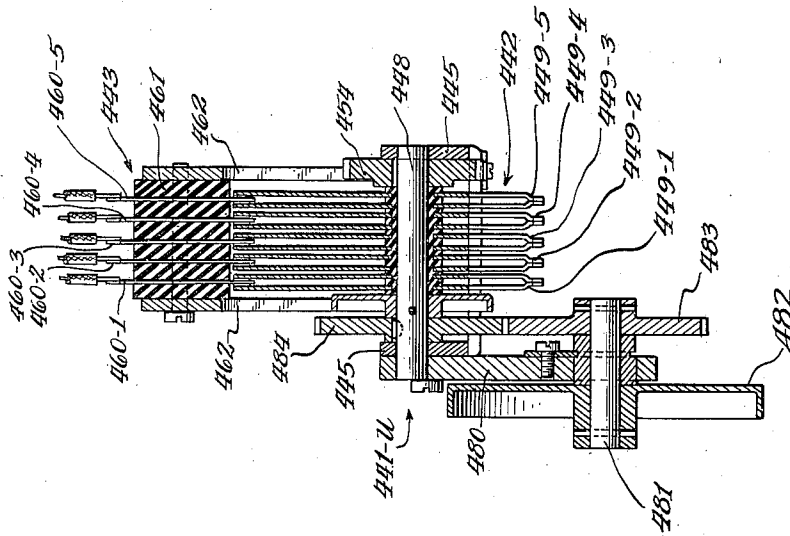
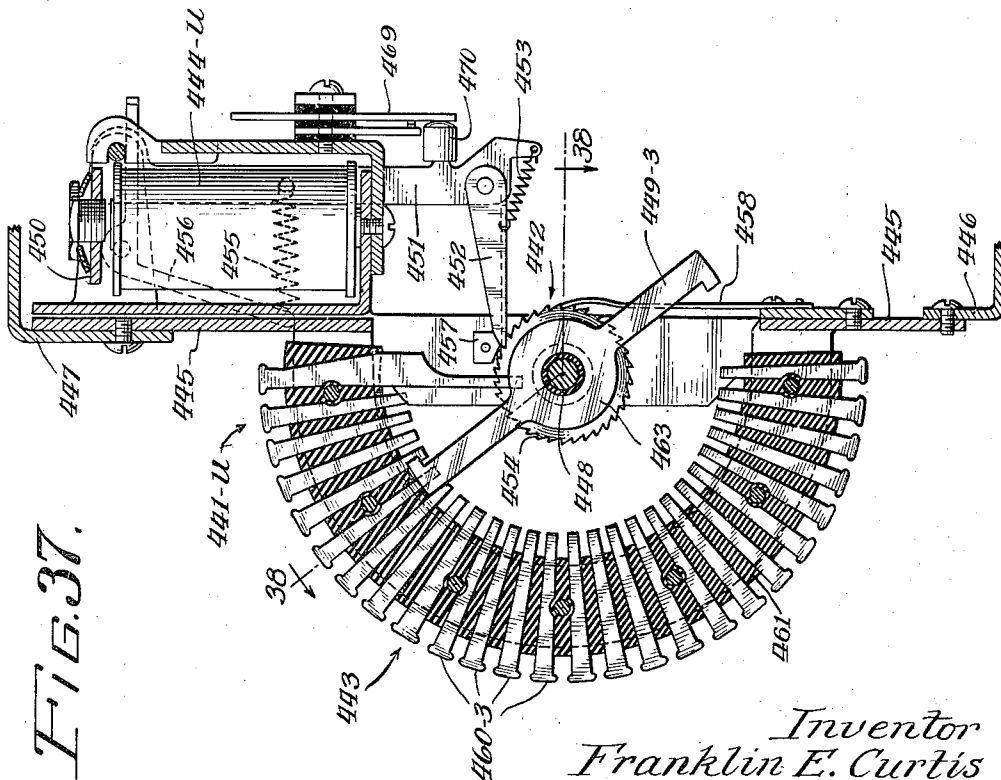


FIG. 37.



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Jan. 1, 1946.

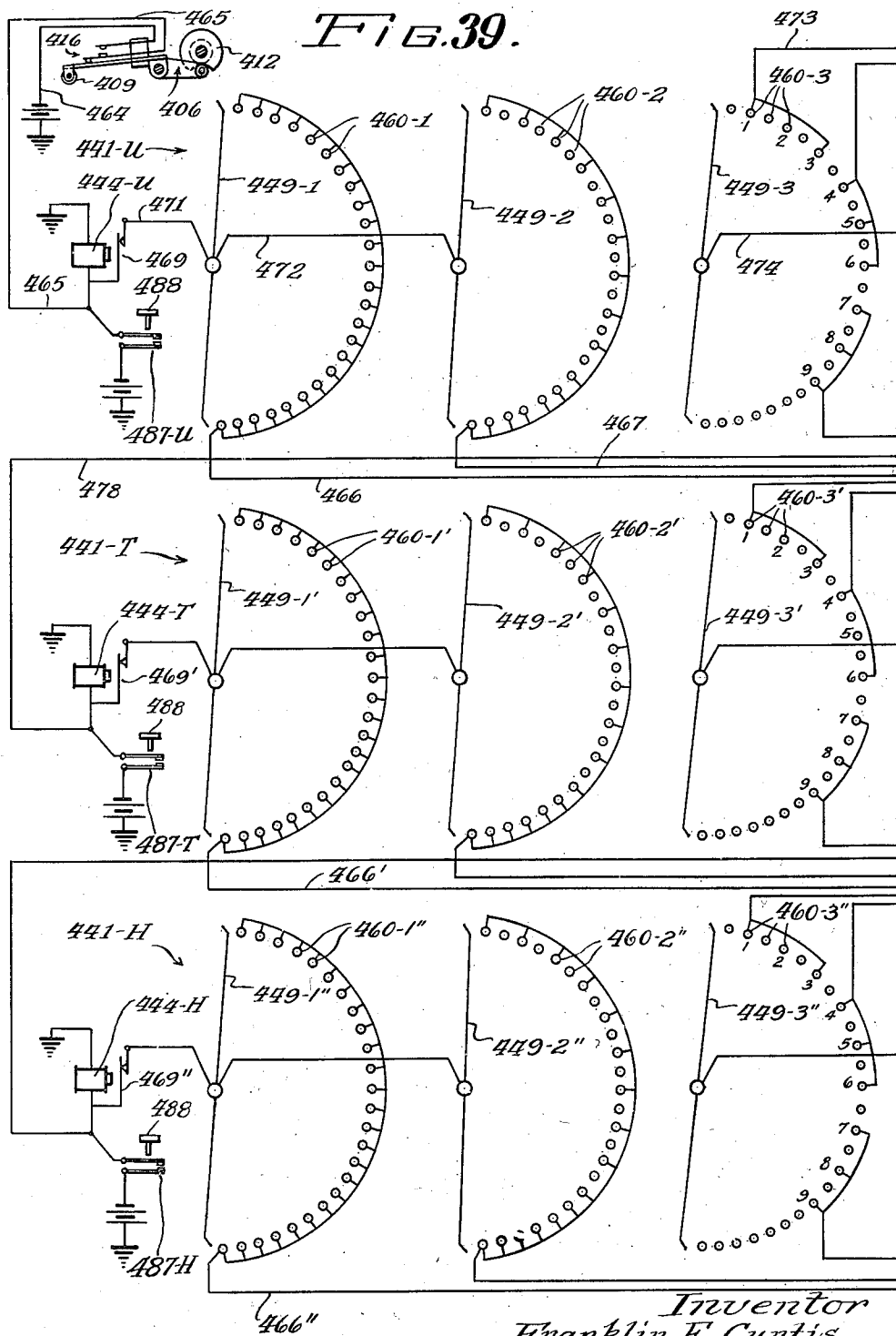
F. E. CURTIS

2,392,082

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Inventor
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Jan. 1, 1946.

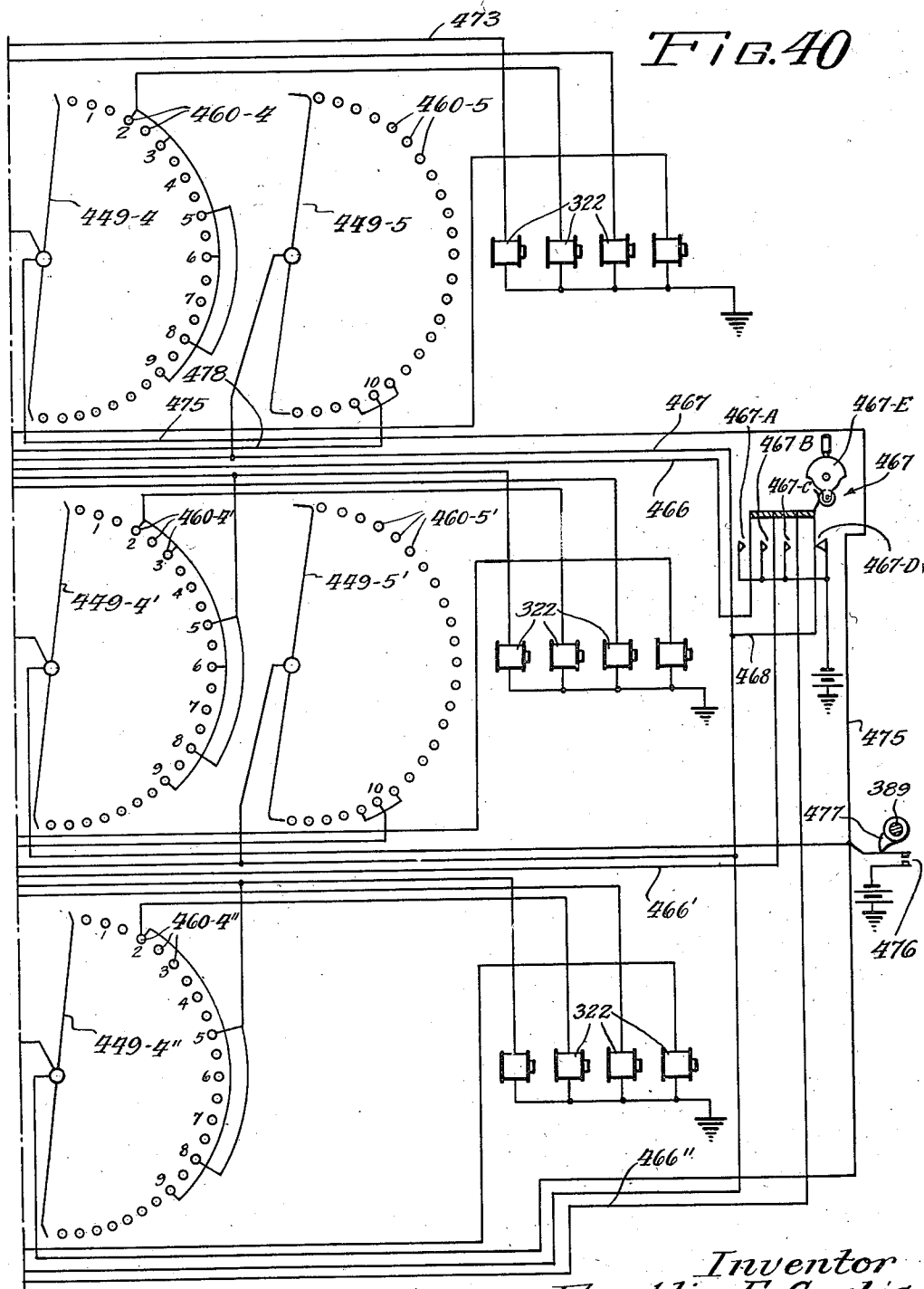
F. E. CURTIS

2,392,082

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Inventor
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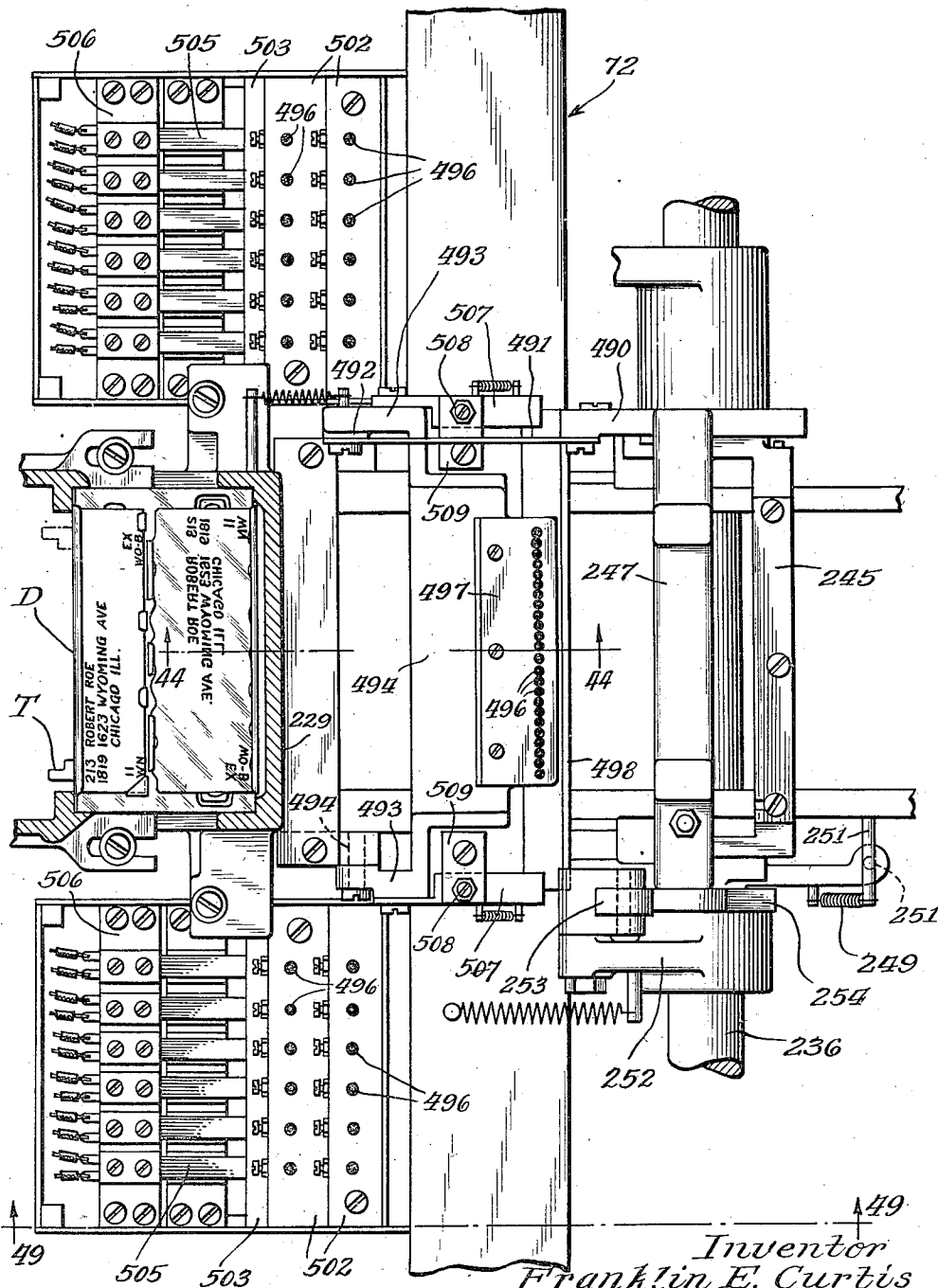
2,392,082

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FIG. 41.



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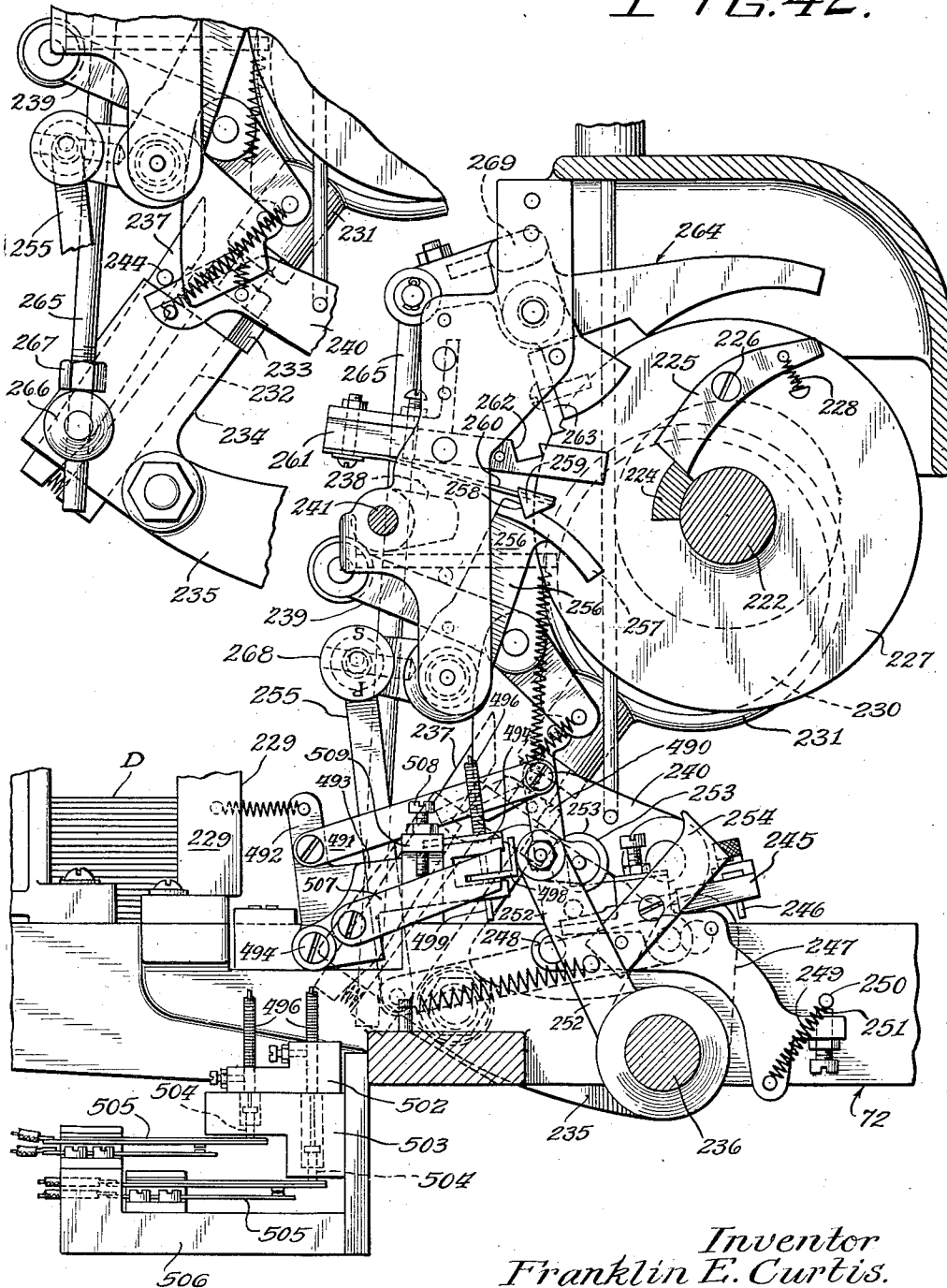
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FIG. 43

FIG. 42.



Inventor
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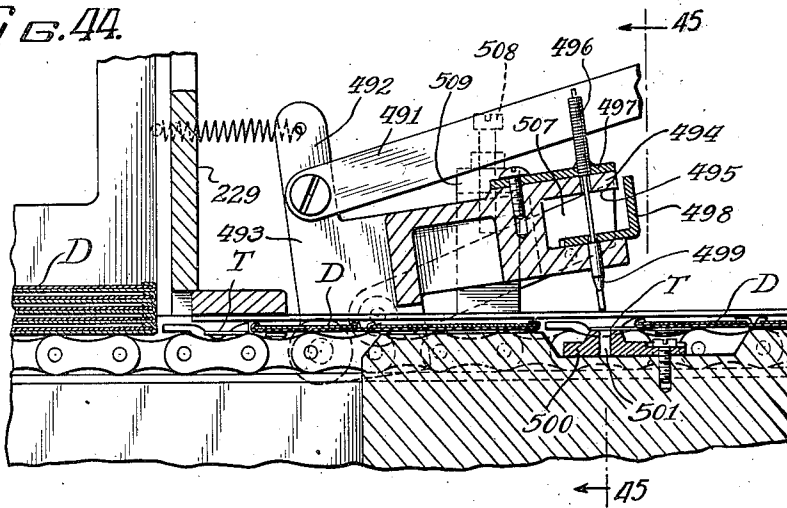
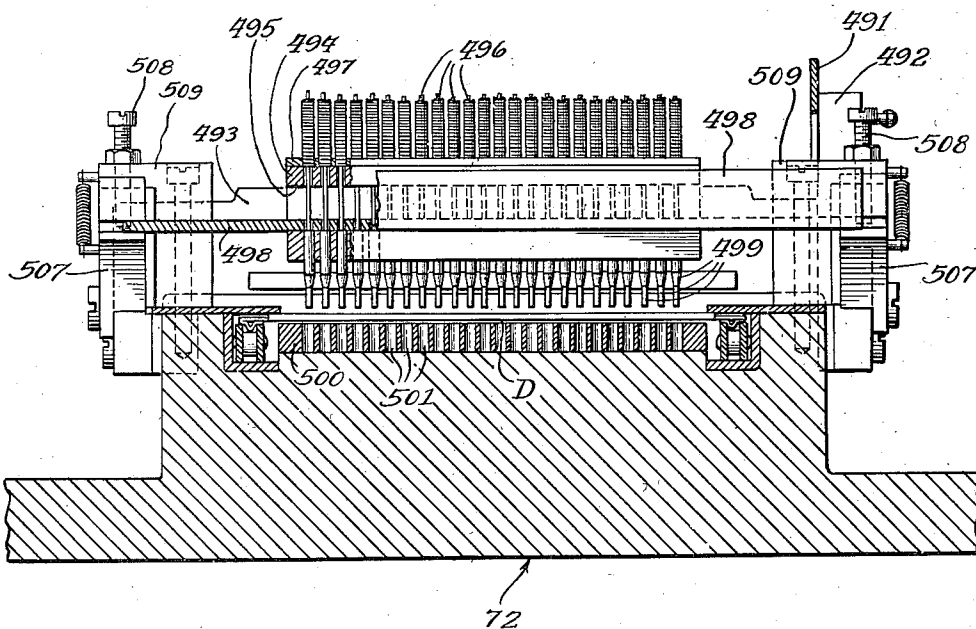
F. B. 44.

FIG. 45.



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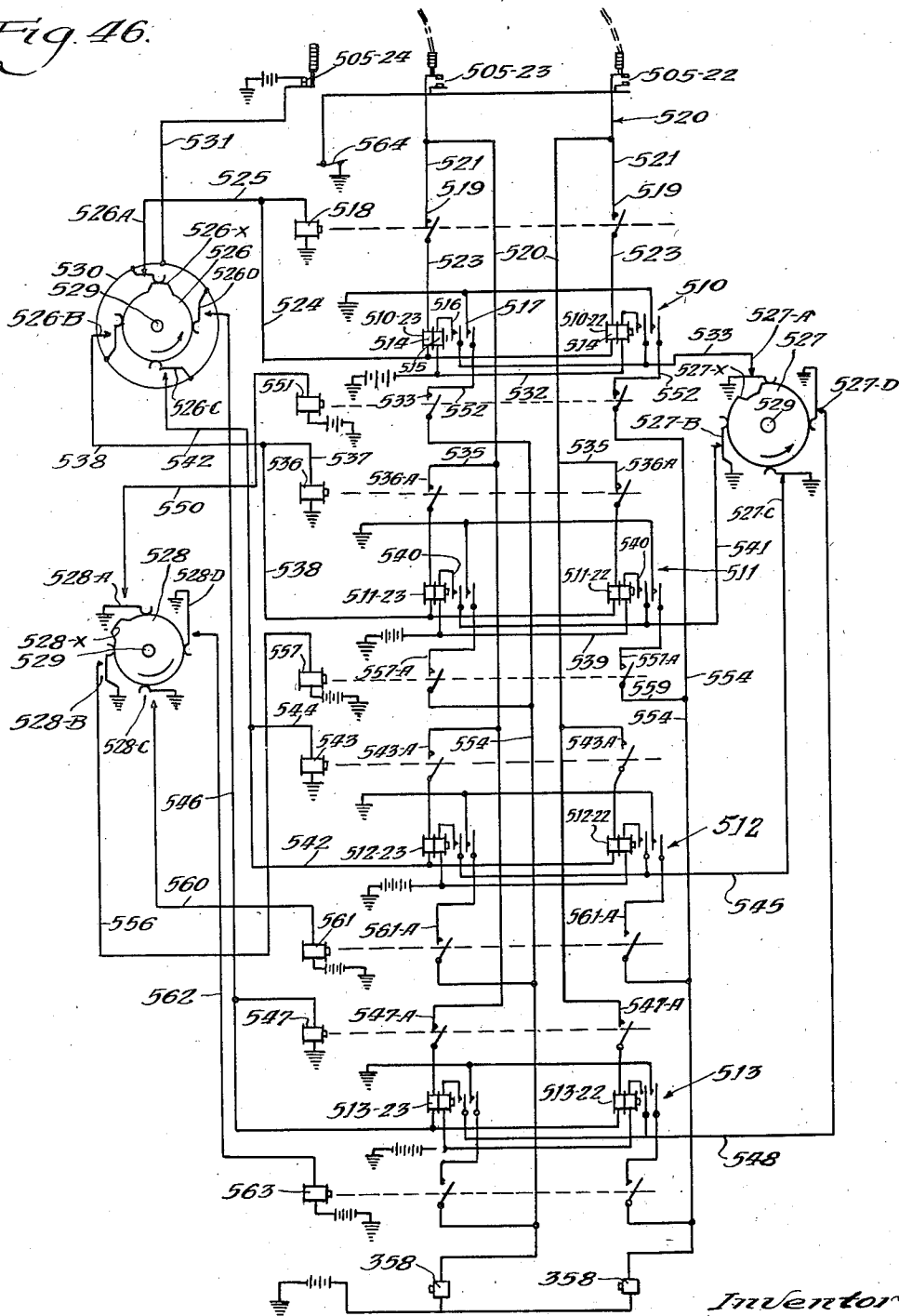
2,392,082

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Fig. 46.



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Jan. 1, 1946.

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FIG. 47.

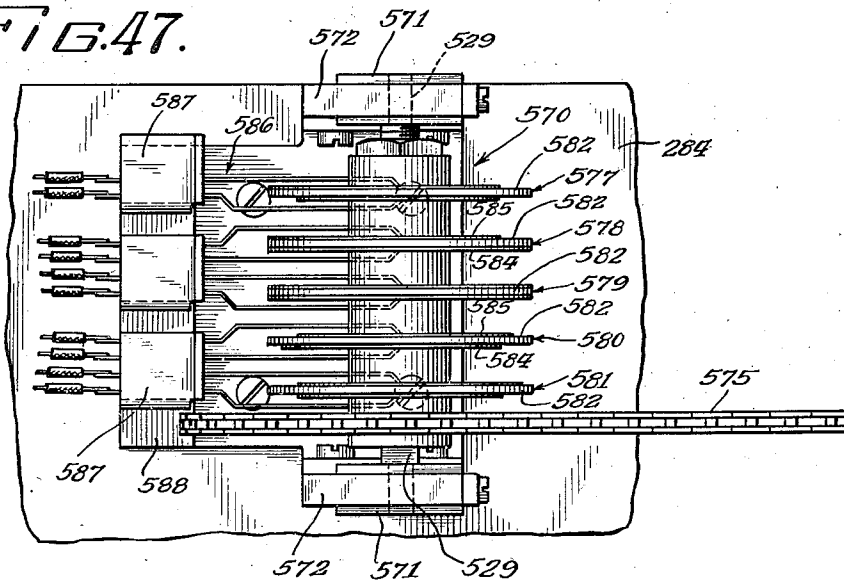
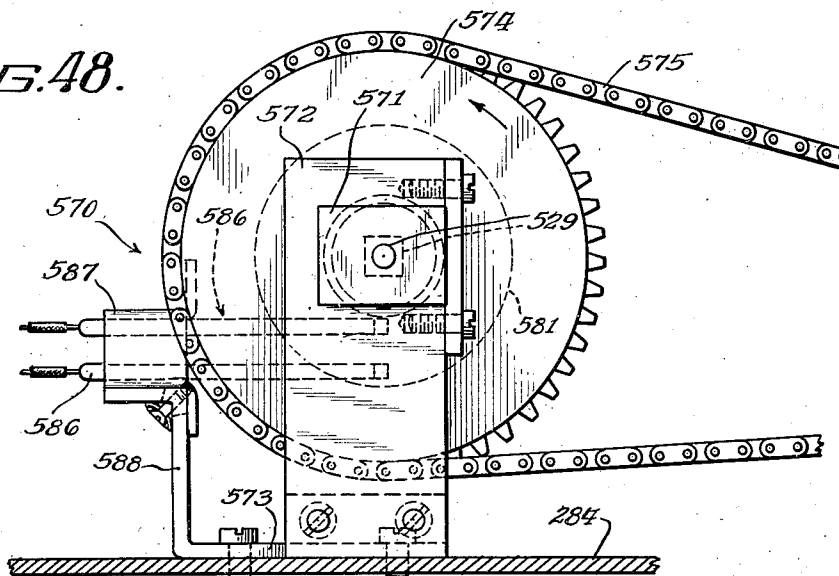


FIG. 48.



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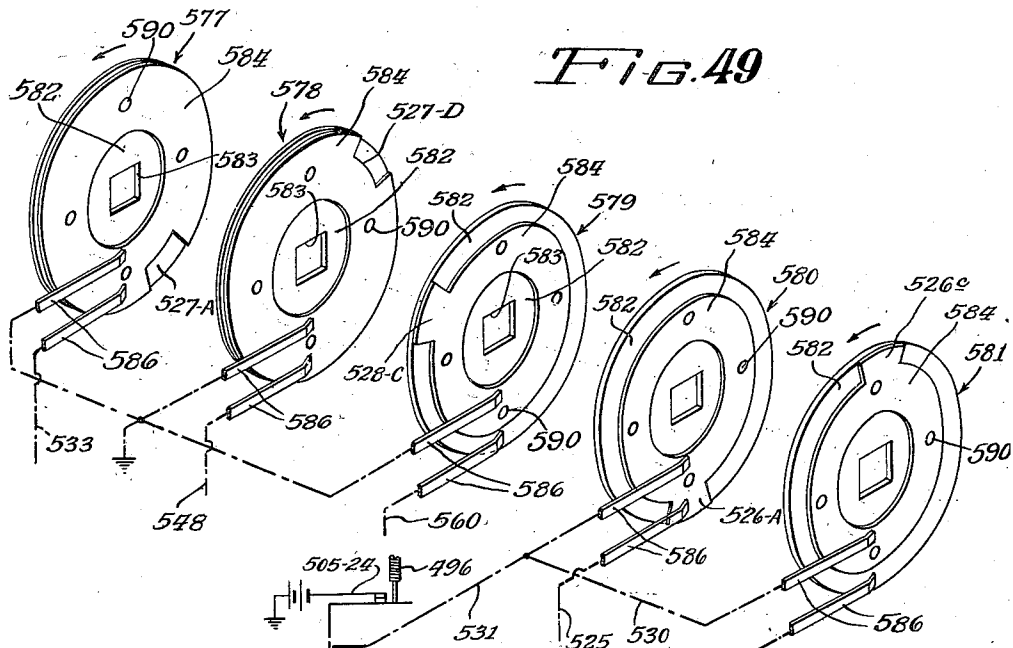
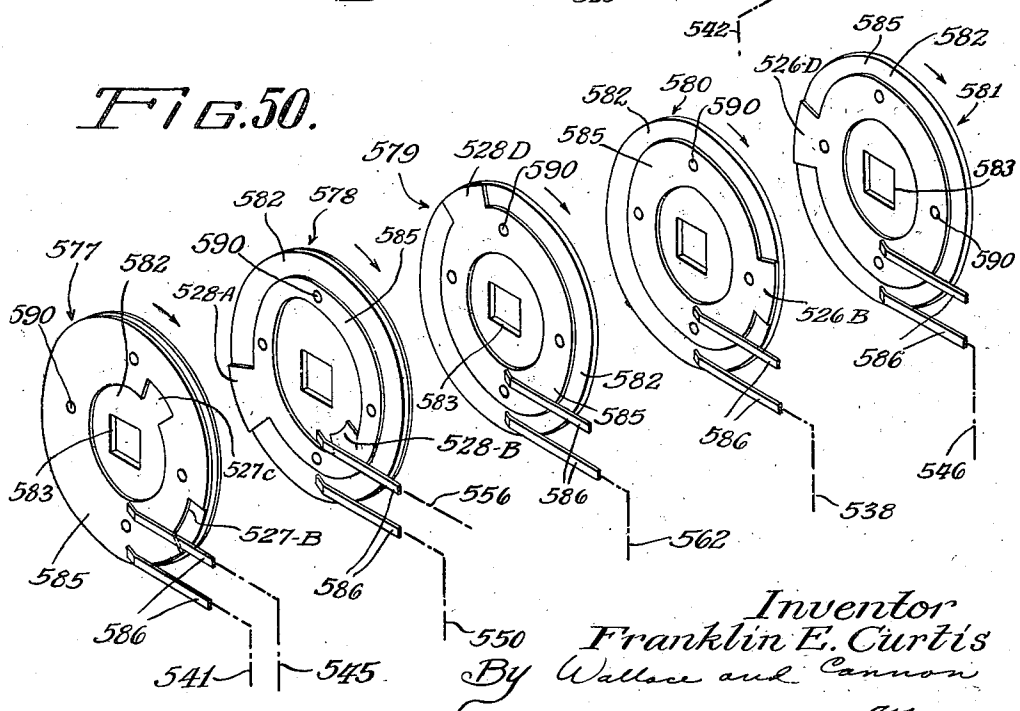
F. E. CURTIS

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Jan. 1, 1946.

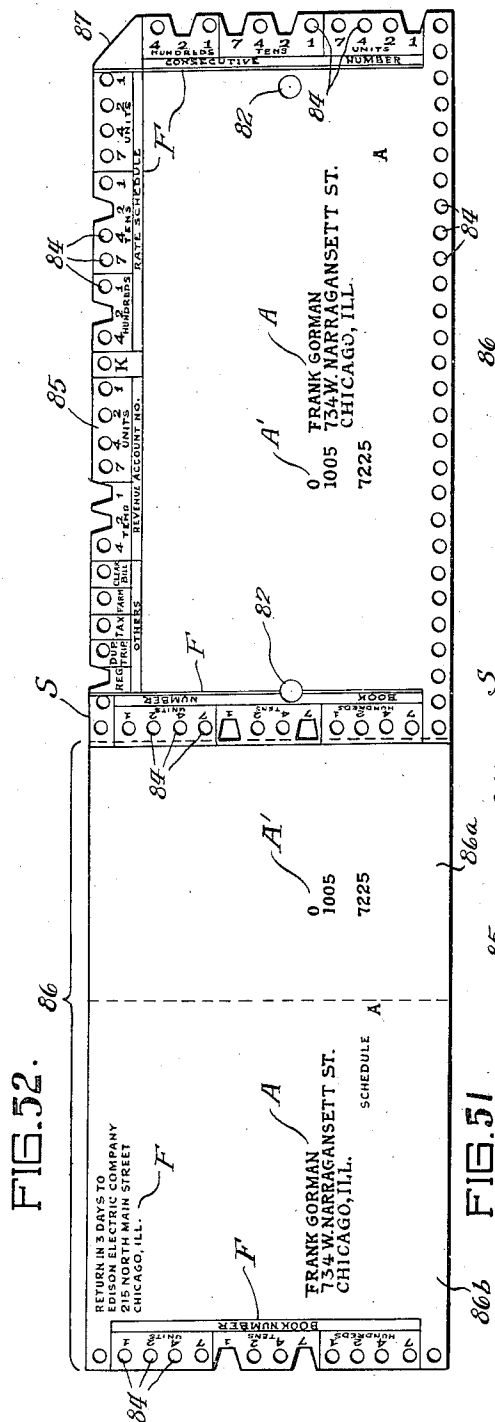
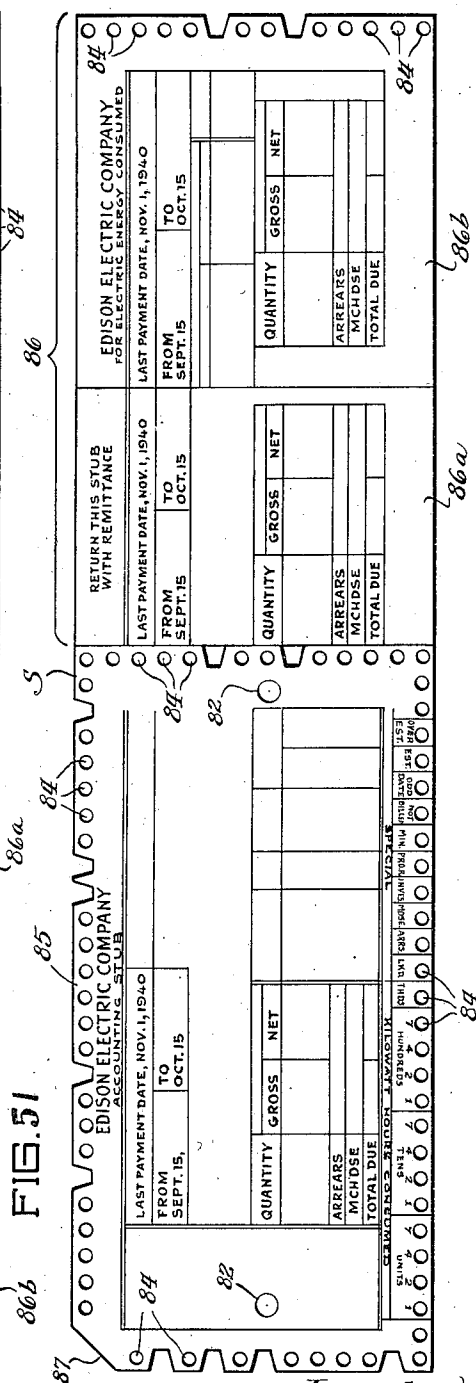
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Inventor:
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By Wallace and Cannon
Att. 7. 7.

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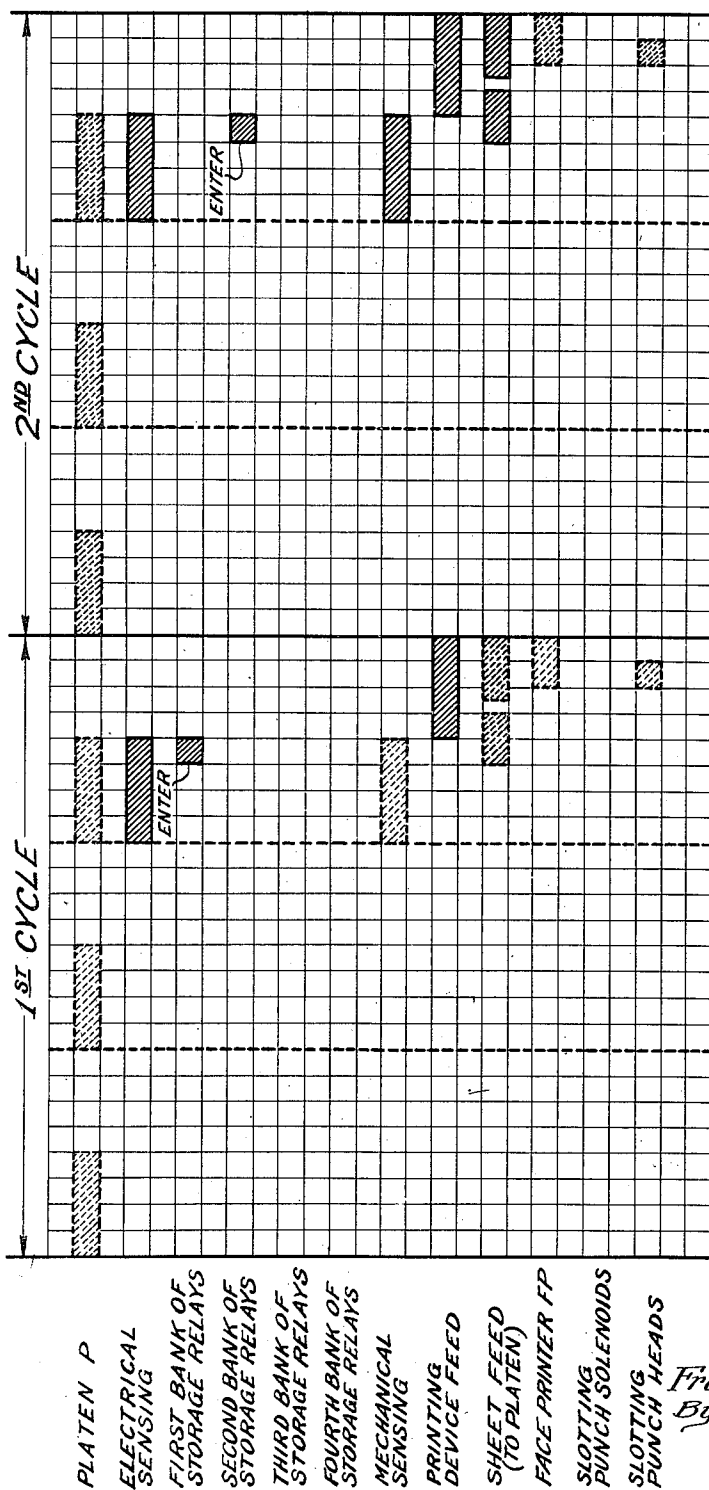


FIG. 57

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Jan. 1, 1946

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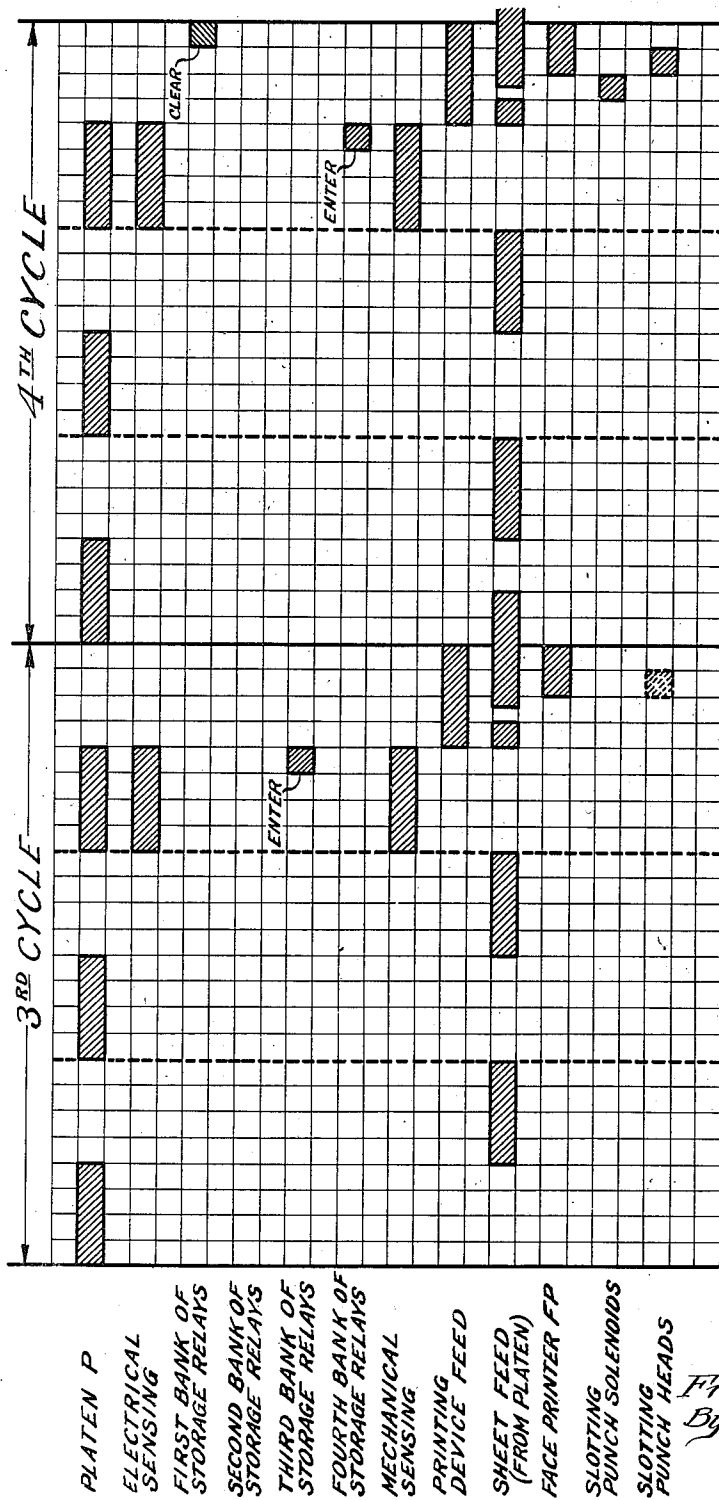


FIG. 58.

Inventor
 Franklin E. Curtis
 By Wallace and
 Cannon
 Attorneys

UNITED STATES PATENT OFFICE

2,392,082

PRINTING MACHINE

Franklin E. Curtis, Euclid, Ohio, assignor to
Addressograph-Multigraph Corporation, Wil-
mington, Del., a corporation of Delaware

Application January 13, 1941, Serial No. 374,259

27 Claims. (Cl. 101—53)

This invention relates to printing machines and particularly to those adapted for use in the preparation of business instruments such as public utility and tax bills, insurance premium notices, checks or other negotiable instruments and the like.

Business instruments of the character that may be prepared in the machine of the present invention usually bear a form consisting of the name of the institution or the like on whose behalf the instruments are being prepared, ruled lines dividing the instruments into areas wherein numerical and like variable data may be printed in association with identifications of the data and the like, these latter identifications and related data also being part of the form, such form commonly being referred to in the art as reoccurring matter or data.

Additionally, each business instrument of the character that may be prepared in the machine of the present invention customarily bears an identification, usually the name and address of the person for whom the particular business instrument is made out, and such data are commonly referred to as the identification data of the instrument.

Furthermore, in many instances business instruments of the character that may be prepared in the machine of this invention bear other data which, while such data vary from instrument to instrument, are nevertheless of a class which reoccur on a large number of instruments in a group thereof concurrently prepared, such data being, for example, the rate schedules under which customers of a public utility are billed, the tax rate or rates under which property owners are taxed for property owned by them and other kindred data, for example, in the case of a public utility bill, that which will indicate whether or not a tax is to be paid on the amount billed. Data of the aforesaid character may be conveniently referred to as classification data since such data serve to classify the instruments.

Still further, business instruments of the aforesaid character usually bear data which particularize the various instruments under a system as where the instruments are consecutively numbered or lettered or otherwise identified in such a way that they may be arranged, by reference to the data, in a predetermined order or system and data of this character may be conveniently referred to as particularizing data.

A specific example of a business instrument of the aforesaid character is a public utility bill which bears reoccurring data consisting of, for

example, the name of the utility, dates identifying the period to which the bill pertains, ruled portions defining areas in which meter readings and the difference between them, known as the consumption quantity, may be printed and other areas in which the amount charged may be printed, and the like. Public utility bills also commonly bear identification data which consist of the name and address of the customer of the utility for whom the bill is prepared. Variable data such as the meter readings and the consumption quantity and the charges therefor also appear on the bills as does classification data such as the rate schedule under which the customer is billed, a revenue account number which indicates whether the customer is using the commodity in a residence or for industrial power or heating purposes or for commercial lighting or the like, and still other like data as that indicating whether or not a tax is to be paid on the amount billed, for in the case of municipal and eleemosynary corporations it is not necessary for a utility to pay tax on charges for the commodity made to such corporations, the data such as the rate schedule, the revenue account number and the fact as to whether or not a tax is to be paid constituting, as stated, classification data. Furthermore, in order that the utility may insure against loss of a particular bill in the course of preparation of the bills and for other purposes, public utility bills are often consecutively numbered so that by arranging the bills in a group being prepared concurrently in accordance with the consecutive numbering thereof it may be readily ascertained whether or not a bill has been lost, such consecutive numbering constituting particularizing data.

The machine of the present invention is particularly adapted for producing reoccurring, identification, classification and particularizing or like data or representations thereof on business instruments, of which public utility bills are an example, and the primary object of the present invention is to enable data of the aforesaid character or representations thereof to be expeditiously and economically to be produced on business instruments of the kind to which reference has been made hereinabove.

Classification data that is to appear on a particular business instrument is usually related to and determined by the identification data that is to appear on the instrument. For example, in the case of a public utility bill where the classification data is the rate schedule under which a customer is to be charged, the revenue account

number, and the fact as to whether or not a tax is to be paid on the amount billed will definitely be related to and determined by the identification data, which identifies the customer, that appears on the bill. The reason for this is that the nature of the classification data is determined by factors dependent upon the identification data.

As is well understood in the art, identification data can be conveniently produced on business instruments by being printed thereon from printing devices of, for example, the character disclosed in Gollwitzer Patent No. 2,049,436, patented August 4, 1936. Hence, since the classification data, as has been explained, are definitely related to the identification data, it is possible to incorporate, in whatever means is employed for producing the identification data, means from or under control of which classification data or representations thereof may be produced on business instruments and so to do is still another object of the present invention.

Another object of the invention, ancillary to the foregoing, is to selectively locate means from or under control of which classification data or the like or representations thereof may be produced on business instruments on a device from or under control of which the identification data, upon which the classification or like data is based, may be produced so as to thereby afford a device from or under control of which business instruments bearing related data of the aforesaid nature may be produced; and a more specific object is to selectively locate index tabs, lacuna or the like on a printing device from which identification data, upon which classification or like data is based, may be printed and to so arrange the index tabs, lacuna or the like that classification or like data or representations thereof may be produced from or under control thereof on a business instrument intended for the customer or like identified by the identification data.

In printing machines of the character to which this invention pertains and which are particularly adapted for the production of business instruments of the kind to which reference has been made hereinabove, it is customary to pass the sheets that are to be formed into the business instruments into the machine and to print the identification data at one or more places thereon as the sheets pass through the machine, and usually the identification data is printed on the instruments from printing or like devices passed seriatim through the machine. However, in accordance with the present invention where classification data or representations thereof, related to the identification data appearing on a particular instrument, are also to appear on each instrument, it is advantageous to so arrange the machine that both identification and classification or like data may be produced on each instrument from or under control of a printing or like device arranged to enable such data to be produced from or under control thereof and so to do is still another object of this invention, and an ancillary object is to enable identification data to be produced on business instruments at one position in the machine and to enable classification or like data or representations thereof to be produced on the instruments at still another position in the machine for so to do, in pursuance of the primary object of this invention, enables the business instruments to be rapidly and economically prepared.

It is another object of this invention to enable

identification or like data to be produced on a business instrument at one position in a machine from or under control of a particular printing or like device and to enable classification or like data or representations thereof to be produced at another position and on the same instrument from or under control of the same device as that from or under control of which the identification or like data is produced on the particular instrument.

Printing and like devices are customarily advanced seriatim and in a step-by-step manner through machines of the character to which this invention pertains and such devices in the course of such step-by-step advancing come to rest in association with means operative to produce identification or like data on a sheet moved into association therewith from the device associated with the means. Further, where printing or like devices are advanced in the manner just described they may come to rest in association with means adapted to sense selectively located index tabs, lacuna or the like thereon, such as may represent classification or like data, and such sensing means may be utilized to effect set-up of means operative to produce classification or like data on a sheet moved into association therewith. Thus another object of the present invention is to correlate, in a novel manner, the advancing of printing or like devices through a machine, the operation of means operative to produce identification or like data on a sheet advanced thereto, the operation of a sensing means of the aforesaid character and the means under control thereof, and the advancing of a sheet from one means operative thereon to another whereby identification data or the like may be produced on a particular sheet from or under control of a particular device and classification or like data or representations thereof may also be produced from such device on such sheet.

Furthermore, where a business instrument is advanced from one position to another in a machine to enable the production thereon of data or representations thereof from or under control of a printing or like device, the devices will customarily advance into a position whereat certain of the data may be produced therefrom on the instruments as, for example, into a position whereat the identification data may be printed on the instruments directly from the devices. Moreover, after such data have been so produced, the device and the sheet advance from the aforesaid position and the instrument comes to rest in another position where the classification data or representations thereof are produced thereon and hence a time delay usually intervenes between the production of certain data as, for example, the identification data on a particular instrument and the production of the classification or like data or representations thereof on the instrument. In view of this it is still another object of the present invention to enable production of data of the aforesaid character or representations of such data in the just described manner notwithstanding the intervening time delay and an object related to the foregoing is to enable certain of the data or representations thereof to be determined from a printing or like device and stored and subsequently utilized to effect production of the data or representations thereof on the instrument on which identification or like data is produced from the particular device.

Other and more specific objects are to enable characteristics on printing or like devices fed through the machine to be sensed and to enable

storage means to be set up under control of characteristics so sensed; to effect set-up of means operative on business instruments to produce data or representations thereof on the instruments under control of storage means so set up; to enable characteristics or representations thereof sensed from a plurality of printing or like devices to be stored and to thereafter sequentially set up means under control of the storage means and to so synchronize the sensing and storing operations and the setting-up operations that in those instances where data is directly produced from a particular device on a particular sheet, means set up under control of stored characteristics or representations thereof sensed from the particular device will also operate on the aforesaid particular sheet.

Still another object is to feed printing or like devices serially through a printing machine in a step-by-step manner and to effect sensing and printing operations thereon at predetermined positions at which the printing or like devices come to rest in the course of the step-by-step advancing thereof and to enable selective set up of a storage means and selective operation of a printing means to be effected.

A further object of the present invention is to enable particularizing data or the like, as defined hereinabove, to be produced on sheets fed through a machine; to produce interrelated particularizations on sheets fed through the machine as by producing consecutive numbers or representations thereof on sheets fed through the machine; to so control operation of the means for producing particularizing or like data on sheets that automatic and predetermined operation thereof may be effected; and to control the production of such data on the sheets by the sheets or the passage thereof through the machine.

In instances where business instruments of the character that may be produced in the machine to which this invention pertains are being printed, it is frequently advantageous or necessary to effect sorting operations and, while such operations may be effected in a wide variety of ways, it is often advantageous to effect such sorting in accordance with the method disclosed in United States Letters Patent to Perkins, No. 1,544,172, patented June 30, 1925, which entails producing perforations in the margins of the instruments and selectively notching the instruments from the aforesaid perforations to the adjacent edge. It is to be understood, however, that while it is advantageous to produce the perforations in the margin and to selectively notch the instruments from such perforations to the adjacent edge, resort might be had to other arrangements for producing sorting indicia without departing from the purview of the present invention but for the purpose of describing the present invention, reference is made to the aforesaid Perkins patent and the method of sorting disclosed therein, for this will serve to illustrate the manner in which sorting indicia may be selectively produced on business instruments of the character to which this invention pertains.

In view of the foregoing, other objects of the present invention are to selectively produce formations or the like in business instruments that may be utilized to effect sorting thereof; to produce perforations in the margins of business instruments prepared in the machine of the present invention; to selectively produce notches in association with the aforesaid perforations to thereby

afford representations of classification data or the like in the instruments which may be used in sorting of the instruments; to selectively produce the notches or the like in the instruments from or under control of devices employed to produce other data on the instruments; and to print an identification on a particular business instrument passed through the machine from a printing or like device fed into the machine and to selectively produce notches in such particular instrument from or under control of the device from which identification data or the like was printed on the particular instrument.

Other objects are to enable means for producing notches or other sorting indicia in business instruments prepared in the machine of the present invention to be manually set up; to produce notches or other sorting indicia in business instruments passed through the machine from or under control of a consecutive numbering apparatus or the like; and to enable predetermined notching or other sorting indicia producing means to be normally rendered operative or inoperative as desired.

Other and further objects of the present invention will be apparent from the following description and claims and are illustrated in the accompanying drawings which, by way of illustration, show a preferred embodiment and the principle thereof and what I now consider to be the best mode in which I have contemplated applying that principle. Other embodiments of the invention embodying the same or equivalent principle may be used and structural changes may be made as desired by those skilled in the art without departing from the present invention and the purview of the appended claims.

In the drawings,

Figs. 1 and 1A, taken together, constitute a plan view of the complete machine;

Figs. 2 and 2A, taken together, constitute a front elevational view of the machine;

Figs. 3, 3A and 3B, taken together, constitute a more detailed plan view of the machine, certain parts being broken away for the sake of clarity;

Fig. 4 is a plan view of a portion of the perforating mechanism and associated parts;

Fig. 5 is a front elevational view of the perforating mechanism;

Fig. 6 is a vertical sectional view taken on the line 6—6 on Fig. 5;

Fig. 7 is a longitudinal sectional view taken on the line 7—7 on Fig. 4;

Fig. 8 is a vertical sectional view taken on the line 8—8 on Fig. 4;

Fig. 9 is a longitudinal sectional view taken on the line 9—9 on Fig. 4;

Fig. 10 is a plan sectional view taken on the line 10—10 on Fig. 5;

Fig. 11 is a vertical sectional view taken on the line 11—11 on Fig. 4;

Fig. 12 is a plan sectional view taken on the line 12—12 on Fig. 5;

Figs. 13 and 14 are sectional detail views taken on the lines 13—13 and 14—14, respectively, on Fig. 4;

Fig. 15 is an end elevation, with certain parts broken away, of a clutch employed in the machine and taken on the line 15—15 on Fig. 16;

Fig. 16 is a sectional view taken along the line 16—16 on Fig. 15;

Figs. 17 and 18 are sectional views taken on the lines 17—17 and 18—18, respectively, on Fig. 16;

Fig. 19 is a plan view of the slotting mechanism;

Fig. 20 is a front elevational view of a portion of the slotting mechanism;

Figs. 21 to 24, inclusive, are sectional views taken along the lines 21—21, 22—22, 23—23 and 24—24, respectively, on Fig. 19;

Figs. 25 and 26 are longitudinal sectional views, drawn to an enlarged scale, of certain parts shown in Fig. 24;

Fig. 27 is a plan sectional view taken along the line 27—27 on Fig. 24;

Figs. 28 to 30, inclusive, are vertical sectional views taken on the lines 28—28, 29—29, respectively, on Fig. 19;

Fig. 31 is a plan sectional view taken on the line 31—31 on Fig. 30;

Fig. 32 is a vertical sectional view taken on the line 32—32 on Fig. 19;

Fig. 33 is a sectional detail view taken on the line 33—33 on Fig. 3A;

Fig. 34 is a sectional view taken on the line 34—34 on Fig. 33;

Figs. 35 and 36 are side and front elevational views, respectively, of the counting apparatus of the consecutive numbering means, Fig. 35 being taken along the line 35—35 in Fig. 2;

Fig. 37 is a vertical sectional view taken substantially on the line 37—37 on Fig. 36;

Fig. 38 is a sectional view taken on the line 38—38 on Fig. 37;

Figs. 39 and 40 are diagrammatic views of the electrical circuits of the consecutive numbering means;

Fig. 41 is a plan view, with certain parts broken away, of a portion of the printing device guideway, sensing means and associated parts;

Fig. 42 is a sectional view taken on the line 42—42 on Fig. 41, showing the sensing and selecting devices;

Fig. 43 is a detail view of a part of the drive for the printing device feeding means;

Fig. 44 is a sectional detail view taken on the line 44—44 on Fig. 41;

Fig. 45 is a sectional detail view taken on the line 45—45 on Fig. 44;

Fig. 46 is a view of the means for sensing classification data and the electrical connections of the storage means;

Figs. 47 and 48 are plan and elevational views, respectively, of a sequence switch for controlling certain machine operations;

Fig. 49 comprises a series of perspective views of certain timing cams embodied in the sequence switch shown in Figs. 47 and 48;

Fig. 50 is a perspective detail view looking in a direction opposite to that of Fig. 49 and showing the opposite faces of the timing cams;

Figs. 51 and 52 are elevational views of opposite faces of a typical bill sheet or like business instrument produced by the present machine;

Fig. 53 is a front elevation of the platen, showing certain details of construction thereof;

Figs. 54 and 55 are sectional detail views of the platen, showing certain parts thereof in different operative positions;

Fig. 56 is a vertical sectional view taken substantially on the line 56—56 on Fig. 53; and

Figs. 57 and 58, taken together, constitute a chart diagrammatically representing the relative timing of various machine operations.

While the machine of the present invention may be utilized, as stated hereinabove, to prepare a wide variety of business instruments, the preparation of public utility bills is a typical utilization of the machine and it is for this reason that the machine, as it is arranged to enable the preparation of such instruments, is described hereinafter.

aration of such instruments, is described hereinafter.

The particular public utility bill that is prepared in the presently described machine is of the nature that is disclosed in the copending application of Harold M. Whittlesey, Serial No. 403,357, filed July 21, 1941, now issued as Patent No. 2,371,007, patented March 6, 1945. The machine of the present invention primarily enables the production of a public utility bill of the character that may be used in preparing public utility bills in the manner described in this copending application. It is to be understood that, in the form of the invention described herein, a complete public utility bill is not prepared for the reason that variable data, such as the meter readings and the difference therebetween, the consumption quantity, and the charges to be made to the customer of the utility for such consumption quantity, are not produced on the instruments in the present machine. However, the present machine does otherwise prepare the business instruments.

As described in the aforesaid Whittlesey application, it has been observed that in the course of preparation of public utility bills, a large number of different bills receive the same variable data and are otherwise in correspondence. This arises by reason of the fact that a large number of different customers will all be charged under the same rate schedule, and a large number of different customers will all utilize the commodity for the same purpose, wherefore such corresponding bills will bear the same revenue account number or a representation thereof. Furthermore, it has also been observed that a large number of customers who are to be charged under the same rate schedule will consume a corresponding quantity of the commodity. Thus, instead of performing individual computing operations or the like for each bill as it is being prepared, all those bills which are to receive like variable data, such as a corresponding charge in dollars and cents, are grouped together by sorting the bills which are being prepared concurrently into groups, each of which includes, for example, all bills that are to receive the corresponding amount in dollars and cents, and among the advantages of the present invention is that the public utility bills are prepared in such a way that such sorting thereof may be expeditiously effected.

As has been stated hereinabove, sorting of public utility bills or other business instruments may be expeditiously effected in the manner disclosed in Perkins Patent No. 1,544,172 and the machine of the present invention functions to produce perforations in the marginal edges of each bill and to selectively notch each bill from proper of the aforesaid perforations to the adjacent edge to thereby impart sorting characteristics to the particular bill.

Now while the herein described machine is utilized to print and cut public utility bills, a machine embodying the present invention may also operate on preprinted and cut bills. If resort is had to preprinted and cut bills, such bills, prior to being brought to the machine of the present invention, will have the reoccurring matter, as this is defined hereinabove, printed thereon and such bills may then be arranged in a sheet feeding means, associated with a machine of the present invention, which will function to pass such preprinted and cut bills to the machine one at a time. A sheet feeding means suitable for this purpose may be, for example, that disclosed

in Gollwitzer Patent No. 2,002,773, patented May 28, 1935.

However, preprinted and cut bills need not necessarily be utilized for the machine disclosed in the accompanying drawings is arranged to perform those printing and cutting operations which would normally be performed on preprinted and cut bills. To this end a roll of paper R, Fig. 2A, is so supported in a stand 70 that a web W may be withdrawn therefrom and fed to the machine. Preferably the roll R and the web W are of a width equal to the length of the bill or other sheet to be prepared by the machine so by severing the web W transversely thereof at uniformly spaced intervals, bills or the like of the desired width and length may be severed from the web.

As shown in the accompanying drawings, suitable web withdrawing and looping devices of the character disclosed in United States Letters Patent No. 2,041,183, patented to Emmett C. Hartley on May 19, 1936, are supported in a frame as 71, Figs. 2A, 3B and 5, which is mounted on one end of the frame as 72 of the machine above the paper stand 70. The web W is threaded through these devices to be advanced thereby so that the leading end portion of the web may be fed horizontally across a ledge 73, Fig. 6, and beneath a vertically reciprocable knife 74 mounted in the frame 71. When a predetermined length of web, equal to the desired width of a bill sheet as S, Figs. 51 and 52, that is to be prepared by the machine, has been advanced past the knife 74, movement of the web W is momentarily halted and the knife descends and severs such a sheet S from the web.

The means for driving the web feeding and severing means comprises a motor M1, Fig. 2A, supported on the frame 72 of the machine, the driving pulley of this motor being connected by a belt 75 to a large pulley 76 mounted on a shaft journaled in bearings on the frame 72. A smaller pulley 77, connected to the pulley 76, drives a flywheel 78 mounted near the top of the machine, Figs. 1A and 2A, by means of a belt 79. The flywheel 78 is connected by suitable coupling means to a drive shaft 80, Figs. 1A and 3B. A clutch 81, preferably of the type disclosed in United States Letters Patent No. 2,002,737, patented to Emmett C. Hartley, on May 28, 1935, affords a coupling between the drive shaft 80 and the train of mechanisms for driving the web advancing and severing means as well as other operative devices, presently referred to, that are mounted on the frame 71.

It will be noted in Fig. 51 that the bill sheet S has certain form or constantly reoccurring matter imprinted upon what is known as the "back" of the sheet. This form matter is printed upon the upper surface of the web W at predetermined spaced intervals thereon prior to feeding the web beneath the knife 74, Fig. 6, by a printing couple of the character disclosed in the referred to Hartley Patent No. 2,041,183, provision being made to properly orient the impressions on the respective portions of the web that are to be divided into sheets. Each sheet as S likewise has a pair of longitudinally spaced perforations 82, Figs. 51 and 52, therein, and preferably these openings are formed in the web W, prior to the severance of the sheet S therefrom, by a punching device as shown in the aforesaid Hartley Patent No. 2,002,737. If desired, means for scoring the web W along certain lines in the direction of its advancing movement can also be incorporated in the web feeding mechanism, as is disclosed in

Hartley Patent No. 2,041,183, such scoring enabling the bill sheet to be divided into sections such as are referred to, in the case of a public utility bill, as the main body and the stubs, of the latter of which there may be one or more, there being two in the present instance. The back printing, punching and scoring devices just referred to are all driven by the drive shaft 80 through the medium of clutch 81 and suitable gearing, Figs. 1A and 3B, as are the web feeding and severing means, so that properly timed interrelation in the operation of these parts is insured.

Thus, each time the knife 74 is depressed, it cooperates with a stationary blade 83, Fig. 6, mounted in the ledge 73 to shear a rectangular sheet, having the desired dimensions of the sheet S, Figs. 51 and 52, from the web W, this sheet having a blank "face" and having the form matter shown in Fig. 51 imprinted upon its back and also being provided with the perforations 82 as just described. The back of the sheet, Fig. 51, faces upwardly as the sheet is advanced through the machine.

Perforating mechanism PM

Where sorting of the bills is to be effected in the manner disclosed in the aforesaid Perkins Patent No. 1,544,172, each bill sheet as S must be provided with rows of perforations 84, Figs. 51 and 52, that may extend longitudinally or transversely, or both, of the sheet in the margins thereof or in the margins of sections thereof, as will be explained. Thus, the main body 85 of the sheet S is to have perforations 84 arranged along all four marginal portions thereof, while the stub 86 of the sheet S has a transverse column of perforations in the free end margin thereof. Preferably the upper free corner of the body portion 85 is bevelled as indicated at 87, Figs. 51 and 52, for purposes well understood in the art. The perforating and bevelling operations are performed by a perforating mechanism generally designated PM, Figs. 1A, 2A and 3B, that is carried by a triangular frame 88, Figs. 2A, 5, 6, and 7, mounted on one end of the machine frame 72 and in front of the frame 71 which supports the web withdrawing, back printing and severing unit, as viewed in Fig. 5. When the sheet S has been severed from the web W by the knife 74, it is moved away from the knife 74 in the direction of movement of the web, and is then advanced at right angles to the line of movement of the web by suitable means, to be presently described, to a predetermined position in the perforating mechanism PM to have the perforations 84 formed therein and the corner 87 bevelled. If preprinted and cut sheets were used, as described above, these would be first advanced into the perforating mechanism PM.

The frame 88 includes two spaced vertical gussets 89 and 90, Figs. 5, 6, 7 and 12, extending substantially parallel to the knife 74, the top edges of these gussets lying in a horizontal plane well below the level of the knife ledge 73. The die blocks 91 and 92, Figs. 6, 9 and 10, of the perforating mechanism PM are supported on top of the frame 88, being secured to the upper edges of the gussets 89 and 90 by screws as 93 (see also Fig. 10). The upper faces of these die blocks are coplanar and are disposed slightly below the level of the knife ledge 73. The die blocks 91 and 92 are provided with sets of openings 94 corresponding to the perforations 84 to be formed in the sheets as S, Fig. 62. Thus, in the present

instance, referring to Fig. 10, the die block 91 has four series of openings 94 arranged in a rectangular outline in the same manner and with the same relative spacing as are the perforations 84 to be produced in the body portion 85 of the sheet S, Fig. 51. Likewise, the die block 92 has a column of openings 94 identical in arrangement and relative spacing with the perforations 84 to be formed along the free end margin of the stub 86 of the sheet S, Fig. 51, these latter die openings 94 being properly spaced from the die openings 94 in the block 91 to thus locate the just described perforations 84 in the sheet S as the sheet is positioned on the die blocks 91 and 92 in the manner presently to be described. To bevel the corner of the sheet S as indicated at 87, Fig. 51, the die block 91 has a triangular opening 95, Fig. 10, properly located with respect to the die openings 94 to underlie the corner 87 of the sheet S when it has been positioned on the die blocks. It will be understood that the aforesaid arrangement of the openings as 94 and 95 is one predicated upon the requirements of the illustrated bill sheet S and that if these requirements were of a different nature that the disclosed arrangement of these openings would be accordingly varied and, further, the manner in which this would be done will be readily understood by those skilled in the art.

The frame 88 is reinforced by transverse ribs 96 and 97, Figs. 9 and 12, joining the gussets 89 and 90, and underlying the end portions of the die block 91 supported by these gussets. A rectangular opening 98 is defined in the frame 88 between the gussets 89 and 90 and the ribs 96 and 97, this opening 98 being slightly larger than the area encompassed by the die openings 94, Fig. 10, and coming substantially flush with two sides of the triangular opening 95 in the die block 91. A horizontal bed plate 99, consisting of several sections for convenience, is supported on the frame 88 in a conventional manner, the several sections of the bed plate 99 being fitted around the die blocks 91 and 92 and coming flush with the upper surfaces thereof to afford an even surface for supporting the bill sheets that are successively severed from the web W.

Castings 108 and 109, hereinafter referred to as punch heads, are supported directly above the die blocks 91 and 92, respectively, as shown in Figs. 4 to 9, inclusive, by the following means: As is best shown in Figs. 5 to 8, inclusive, the gusset 89 is provided at its upper end with a flange 100 that extends forwardly, or to the left as viewed in Fig. 8, of the gusset 89. A number of bearings 101 are secured to the under side of this flange and depend therefrom to afford a support for a shaft 102, Figs. 6 and 7, which is journaled therein, this shaft extending parallel with the gusset 89. Two eccentrics 106, Figs. 6 and 7, are fixed on the shaft 102 at positions opposite mid-portions of the die blocks 91 and 92, respectively, and each eccentric 106 is provided with a strap having an arm 107 extending upwardly therefrom into openings afforded in the flange 100. Connecting rods 110 extend downwardly from the punch heads through the aforesaid openings in the flange 100 and are pivotally connected to the eccentric arms 107 by wrist pins 112.

A clutch generally designated 103, the construction of which is described in greater detail hereinafter, is mounted on the left end of the shaft 102, Fig. 5, and serves to couple the shaft 102 with a flywheel 104 rotatably mounted there-

on which is driven by a motor M2, Fig. 2A, through the medium of a belt 105, Figs. 5, 6 and 12. Hence, when the clutch is engaged and the shaft 102 is rotated to thereby rotate the eccentrics 106, the punch heads 108 and 109 are reciprocated vertically for the purpose to be presently explained, being guided in such reciprocatory movement by guide pins 119, Figs. 4 and 7, which are secured in the punch heads 108 and 109 and depend downwardly through bearings 111, in the flange 100.

Punches 113, Figs. 6, 8 and 9, are mounted in retaining plates 114 that are secured to the under sides of the punch heads 108 and 109 by cap screws 115, Fig. 9. The punches 113 have enlarged heads which are clamped between the respective punch heads 108 and 109 and their retaining plates 114, and the shanks of the punches 113 extend downwardly through openings in the plates 114 in vertical alignment with the die openings 94 in the die blocks 91 and 92, there being a punch for each such die opening. A special mitering punch 113', Fig. 9, is mounted in the punch head 108 in position to cooperate with the die opening 95, Fig. 10, for bevelling the corners as 87 of the sheets as S, Fig. 51.

For the purpose of guiding the sheets S a thin plate or strip 116, Figs. 6 and 10, is secured by pins 117 to the upper face of each of the die blocks 91 and 92 in spaced relation with the knife 74, the rearwardly disposed edge of each plate 116 being parallel with the stationary knife blade 83, Fig. 6, and lying slightly outside the area in which the die openings 94 are enclosed, as shown in Fig. 10. Punch guide plates 118, Figs. 6, 8 and 9, are also secured to the die blocks 91 and 92 by the pins 117, these guide plates resting on the upper faces of the thin plates 116, to be thereby supported above the die blocks 91 and 92 in spaced relation therewith. Openings are provided in the punch guide plates 118 in alignment with the die openings 94 and 95, and the shanks of the punches 113 and 113' are disposed in these punch guide openings. When the punch heads 108 and 109 are in their upper positions as shown in Figs. 6 and 9, the lower ends of the punches 113 and 113' do not project downwardly beyond the lower faces of the punch guide plates 118 and hence when the punches 113 and 113' are in their upper positions, clearance is afforded to enable a sheet severed from the web W by the knife 74 to be advanced between the guide plates 118 and the die blocks 91 and 92. Curved guide strips 120, Figs. 6 and 8, anchored in suitable recesses in the under sides of the punch guide plates 118 adjacent the edges thereof disposed near the knife 74, cooperate with guide strips 121 attached to the rear face of the gusset 90, Figs. 6, 8, 10 and 12, to define a mouth into which the leading edge of the advancing web W is directed to be thereby guided into the space between the punch guide plates 118 and the die blocks 91 and 92. The web is arrested each time before its leading edge can engage the strips 116, and the knife 74 is thereupon depressed to sever the sheet from the web.

It is desirable that when the sheet is completely severed from the web it shall be rapidly advanced away from the knife 74 so that there will be no possibility of the sheet catching on the knife when the latter is retracted upwardly. To this end a roller 122, Figs. 8 to 10, and 12, is rotatably mounted on a shaft 123 that is carried by blocks 124 secured to the upper edge of

the gusset 90 of the frame 88, and a portion of the periphery of the roller 122 projects through an opening 125 in the bed plate 99 intermediate the die blocks 91 and 92 so that the sheet S which is severed from the web W will rest in part on the roller 122, as indicated in Fig. 8. A belt 126 is passed about a circumferential groove in the roller 122 and about a pulley 127 on a shaft 128, Figs. 8, 9 and 12, journaled in bearings provided in the ribs 95 and 97 of the frame 88. A gear 129 mounted on the shaft 128 to the left of the rib 96, Figs. 9 and 12, meshes with a gear 130 that is rotatable on a stub shaft 131 supported by the frame 88, and the gear 130 in turn meshes with a gear 130' Fig. 11, rotatably mounted on a bracket 135 which latter gear meshes with a gear 132 on a shaft 133 journaled in bearings in the brackets 134 and 135 that are supported by the frame 71 of the back printing and severing unit of the machine. The shaft 133 is interconnected by bevel gears 137 and 138, Figs. 9 and 12, with a shaft 136, Figs. 1A, 2A, 3B and 5, which is included among the devices driven by the drive shaft 80 through the intermediary of clutch 81, this shaft 136 being part of a sheet feeding means (of the character disclosed in United States Letters Patent No. 1,955,806, patented to Emmett C. Hartley on April 24, 1934) in the main section of the machine to the left of the perforating mechanism PM, as viewed in Fig. 1A. Thus the shaft 136 serves to drive the roller 122 constantly counterclockwise, as viewed in Fig. 8.

A pair of rollers 139, Figs. 4, 8 and 9, journaled in brackets 140 adjustably mounted on rods 141 extending outwardly at right angles from the movable frame that carries the knife 74, are positioned directly above the roller 122. As the knife 74 descends to sever a sheet S from the web W, the rollers 139 approach the roller 122, which is constantly rotated, and when the sheet is severed from the web, the rollers 139 clamp the sheet against the roller 122, whereupon the roller 122 rapidly moves the sheet S away from the knife 74 in the direction of advancing movement of the web. This movement of sheet S is limited by engagement of the leading edge of the sheet with the edges of the strips 116, Figs. 8 and 10.

After the sheet S has been so arrested by the strips 116, it then becomes necessary for the sheet S to be advanced a short distance at right angles to the line of movement of the web W, into the position shown in Fig. 3B whereat the punches 113 and 113' may be actuated to perforate the sheet S along the marginal portions of the body 85 and stub 86 thereof as indicated in Fig. 62, and to bevel the corner 87. To afford such additional advance of the sheet S, a feed roller 142, Figs. 8, 9, 10 and 12, is mounted on a stub shaft 143 carried by a block 144 secured to the upper face of the flange 100 of the gusset 89, a portion of the periphery of the roller 142 projecting through an opening 145 in the bed plate 99 intermediate the die blocks 91 and 92 and between the aforesaid roller 122 and the sheet stopping edges of the strips 116. The stub shaft 143 extends slightly diagonally with respect to the direction of movement imparted to the sheet S by the roller 122 so that the feed roller 142 is rotatable in a plane which intersects the sheet stopping edge of the strip 116 on the die block 91, Fig. 10. The roller 142 has a circumferential groove which receives a belt 146 that is also passed about a pulley 147 fixed

on a shaft 148 journaled in bearings in the gussets 89 and 90, as shown in Figs. 8, 10 and 12. A bevel gear 149 on the shaft 148 meshes with a bevel gear 150 on the end of the shaft 128, and hence as the shaft 128 is rotated in the manner previously explained, it drives both the feed rollers 122 and 142, the roller 142 being driven in a counterclockwise direction as viewed in Fig. 9.

A cam shaft 151, Figs. 4, 5 and 8, is journaled in brackets 152 and 153 on the upper face of the bed plate 99 and extends parallel with and in proximity to the front edge of the bed plate 99. Another shaft 154, extending parallel with the shaft 151, is fixedly mounted in the brackets 152 and 153 intermediate the shaft 151 and the punch head 108 and below the level of the shaft 151. As shown in Fig. 3B, a shaft 160 is included among the devices driven by the drive shaft 80 through the medium of clutch 81, the shaft 160 extending above the bed plate 99 and being journaled in the bracket 153 at right angles to the cam shaft 151, and bevel gears 161 and 162 interconnect the shafts 160 and 151; hence the cam shaft 151 is rotated in timed relation with the other mechanisms driven by the drive shaft 80.

A lever 155 pivotally mounted on the shaft 154 carries a gripping roller 156, Figs. 4 and 8, in vertical alignment with the feed roller 142, the roller 156 being rotatable in the same plane as the roller 142 and being urged into engagement with the roller 142 by a leaf spring 159 attached to the lever 155 and bearing on the bed plate 99. The forward or left end of the lever 155, Fig. 8, carries a roller 157 which cooperates with a cam 158 on the cam shaft 151. The cam 158 is of such configuration and is so positioned angularly on the shaft 151 that a high portion of the cam is in engagement with the roller 157, Fig. 8, on the lever 155 at the time when a sheet S severed from the web W by the knife 74 is being advanced toward the sheet stopping edges of the strips 116 by the roller 122 in the manner above described. The gripping roller 156 is therefore elevated to enable the leading edge of the sheet S to advance past the roller 142 and into engagement with the strips 116. When the sheet S is in this position a relief on the cam 158 moves into alignment with the roller 157 and the lever 155 is thereupon rocked by the spring 159 to bring the roller 156 into engagement with the upper surface of the sheet S, as shown in Fig. 8, to thereby clamp the sheet against the feed roller 142. As the knife 74 is elevated after severing the sheet S from the web W, the rollers 139 are lifted away from the roller 122, thereupon placing the sheet S under the sole control of the rollers 142 and 156. Because of the angularity of the axes of the rollers 142 and 156, Figs. 4 and 10, and the directions of rotation of these rollers, the sheet S is urged to the left, as viewed in Fig. 10, and is pressed firmly against the edges of the strips 116 to be guided thereby into proper transverse registration with the die openings 94 and 95 in the die blocks 91 and 92.

A sheet stopping finger 165 is carried on one end of a lever 161, Figs. 4 and 13, which is pivotally mounted on the shaft 154 to the left of the area defined by the die openings 94 and 95 in the die block 91, Fig. 10. The other end of the lever 161 extends beneath the cam shaft 151 and carries a roller 162 which cooperates with a cam 163 on the shaft 151, a leaf spring

164 acting upon the lever 161 to maintain the roller 162 in engagement with the periphery of the cam 163. The sheet stopping finger 165 extends downwardly through a recess in the punch guide plate 118 above the die block 91, as shown in Figs. 9 and 13, and seats in a slot 166 in the die block 91 in spaced relation with the most left-hand column of die openings 94, Fig. 10. The cam 163 is of such configuration and is so positioned on the shaft 151 that a relief portion of the cam 163 is opposite the roller 162 at the time when a sheet as S, Figs. 3B and 8, is being advanced by the rollers 142 and 156, and hence the stop finger 165 is maintained in its lower or sheet stopping position as shown in Figs. 9 and 13. Sheet S continues to be fed longitudinally by the rollers 142 and 156 until the leading edge engages the finger 165 whereupon the sheet S is arrested in the position shown in Fig. 3B. When the sheet has been so arrested, the gripping roller 156, Fig. 8, is elevated by the cam 158 and remains in an upper inoperative position while the perforating operation is performed by the punches as 113. When the sheet S has been thus positioned in engagement with the stop finger 165, as indicated in Fig. 3B, the perforating mechanism PM is operated to bring about the formation of the perforations 84, Fig. 51, and the beveled corner 87, and such operation of the perforating mechanism is initiated by tripping the clutch 103, Figs. 2A, 5, 6, 7 and 12.

The construction of the clutch 103 is shown in detail in Figs. 15 to 18, inclusive. As shown in Fig. 16, the driving member or flywheel 104 has a hub 167, and within this hub are positioned three arcuate friction shoes 168. Each of the shoes 168 has an outer gripping surface 169 which is adapted to bear against the inner periphery of the hub 167, while the inner face of each shoe 168 has a recess 170 therein. A strut 171, Figs. 17 and 18, is seated within each recess 170 and extends into a corresponding recess 172 in a cylindrically shaped member 173, mounted on the shaft 102 of the perforating mechanism. Each of the struts 171 has a circular pivot portion 174 which is seated in a socket provided in a ring 175, Fig. 16, that surrounds the member 173 and encloses the friction shoes 168 within the hub 167. A disc 176 is mounted on the shaft 102 in spaced relation with the ring 175 and abutting another disc 177 that is fixed to the shaft 102, the disc 176 being connected to the disc 177 as by a pin 178, Figs. 15 and 16. The disc 176 has a series of recesses 179 in its inner periphery, and the member 173 is provided with correspondingly shaped lugs 180. In assembling the clutch 103, the disc 176 is fitted against the end of the member 173, the lugs 180 interlocking with the recesses 179, so that the member 173 and the discs 176 and 177 rotate as a unit with the shaft 102.

The ring 175, Fig. 16, has a series of spring anchor pins 181 fastened therein (see also Fig. 17), these pins 181 being received in circumferentially extending slots 182 in the disc 176. Spring anchor pins 183 are attached to the disc 176 facing the ring 175 and springs 184, Fig. 17, are extended between pairs of anchor pins 181 and 183 in such a manner as to tend to rotate the ring 175 clockwise, as viewed in Fig. 15, relative to the member 173. It will be noted in Fig. 18 that the struts 171 are of such dimensions that when they are moved into positions substantially radial of the shaft 102, as indicated by the broken lines in Fig. 18, the shoes 168 are moved from their full line positions, in which they do not engage the

hub 167, into their broken line positions in which they are engaged with the inner periphery of said hub. Hence if the ring 175 is rotated relative to the disc 176 under the influence of the springs 184, the pivot centers 174 of the struts 171 are moved clockwise relative to the member 173, as viewed in Fig. 18, and the shoes 168 are pressed firmly against the hub 167, there being a sufficient amount of play in the sockets in ring 175 in which the pivots 174 are received to enable such radial movement of these pivots and the shoes 168. The direction of rotation of the flywheel 104 and hub 167 being clockwise as viewed in Fig. 18, such engagement of the shoes 168 with the hub 167, tends to impart additional clockwise movement to the pivot centers 174 to thereby bring the struts 171 into positions more nearly radial with respect to the shaft 102, thereby further increasing the grip of the shoes 168 on the hub 167. Thus, the clutch 103 has a self-energizing action when the shoes 168 are released to the action of the springs 184, and this insures against any undue slippage or intermittent grabbing action of the clutch parts.

As shown in Figs. 5 and 6, a lever 186 is pivotally mounted on a sleeve 189 on a stub shaft 187 fixed in a bracket 188 that is attached to the machine frame 72 below the shaft 102. An arm 190 of the lever 186 extends from the pivot point thereof upwardly at a tangent to the hub 167 of the flywheel 104, and as shown in Figs. 15 and 17, a plate 191 is shiftably supported on the arm 190 by headed retaining pins 192 secured to the plate 191 which are received in slots 193 in the arm 190. A spring 194 anchored at one end to the arm 190 is attached at its other end to one of the pins 192 and tends to draw the plate 191 downwardly, as viewed in Figs. 15 and 17, toward the shaft 187 until the pins 192 seat in the lower ends of the slots 193. The end of the plate 191 is bent at right angles to form a lug 195, Figs. 15 and 17, which is adapted to engage the periphery of the ring 175 of the clutch 103. A spring 197, Fig. 6, anchored in the bracket 188 acts upon the arm 196 of the lever 186 to urge the lug 195 against the periphery of the ring 175.

A crank arm 185, Figs. 15 and 17, is secured to the pivot 174 of one of the struts 171, this arm 185 being disposed intermediate the ring 175 and disc 176 and having a slightly hooked end portion which projects outwardly of the hub 167 and ring 175. When the parts are in their normal positions as shown in Figs. 6 and 17, the lug 195 of the lever 186 is in position to engage the tail of the crank arm 185 of the clutch 103, and inasmuch as the direction of rotation of the flywheel 104 is clockwise, as viewed in Fig. 17, the engagement of the arm 185 with the lug 195, assuming that these parts have been previously disengaged, causes the arm 185 to be pivoted about its center 174 counterclockwise, Fig. 17. Such pivoting of the arm 185 causes the strut 171 connected therewith to be pivoted in the same angular direction about the center 174 to thereby produce relative angular movement between the connected friction shoe 168 and the member 173. This increases the angularity of the strut 171 with respect to the center of the shaft 102 and thereby causes the shoe 168 to be retracted from engagement with the hub 167. Since the pivots 174 of the various struts 171 are all maintained in fixed relative positions by the ring 175, each of the other struts 171 will likewise increase its angularity with respect to radii of the shaft 102 and each of the shoes 168 is thus retracted from engagement with the hub 167. So long as the lever

arm 190 is so positioned that the lug 195 remains in engagement with the arm 185 of the clutch 103, the driving clutch member or flywheel 104 remains uncoupled from the shaft 102 so that no power can be transmitted to the shaft 102 for operating the punch heads 108 and 109, Fig. 5.

The arm 196 of the lever 186 is pivotally connected to a link 198, as shown in Fig. 6, which extends upwardly through an opening in the bed plate 99, as shown in Fig. 14, and is pivotally connected to a lever 199 mounted on the shaft 154, shown also in Fig. 4. The opposite end of the lever 199 carries a roller 200 that cooperates with a cam 201 on the cam shaft 151. A leaf spring 202 acts upon the lever 199 to urge the roller 200 into engagement with the periphery of the cam 201, and at predetermined times in each cycle of rotation of the cam shaft 151, a lobe on the cam 201 engages the roller 200 and rocks the lever 199 to raise the link 198. This in turn rocks the lever 186 counterclockwise, as viewed in Figs. 6 and 17, to withdraw the lug 195 from engagement with the crank arm 185. The springs 184 are thereupon free to act upon the friction shoes 168 of the clutch 103 and to urge these shoes into engagement with the hub 167, thereby clutching the shaft 102 to the flywheel 104. As the shaft 102 commences rotation with the flywheel 104, it rotates the eccentrics 106, Figs. 5 and 6, and depresses the punch heads 108 and 109 and thereby forces the perforating punches 113 and the corner bevelling punch 113', Figs. 5, 6, 8 and 9, through the sheet S positioned therebelow. When this punching operation has been effected, the sheet S will appear as shown in Fig. 3B, having the perforations 84 and the bevelled corner 87 formed therein, as shown in Fig. 51.

As the roller 200, Fig. 14, of the lever 199 rides off the lobe of the cam 201, the spring 202 restores the lever 199 and lowers the link 198 to restore the rock arm 185 of the lever 186 into engagement with the periphery of the ring 175. Continued rotation of the shaft 102 causes the punch heads 108 and 109 to be restored to their upper positions, as shown in Figs. 5 and 6, the punch guide plates 118 stripping the sheet S from the punches 113. Toward the end of the cycle of rotation of the shaft 102, the tail of the rock arm 185 engages the lug 195 so that the crank arm 185 is swung counterclockwise, as viewed in Fig. 17, relative to the member 173, thereby effecting the release of the friction shoes 168, as previously described. Inasmuch as there may be a considerable force of impact as the arm 185 strikes the lug 195, a flexible connection between the plate 191 and the lever arm 190 has been afforded by the spring 194 as aforesaid to cushion the shock. To insure that the tension of the springs 184 acting upon the discs 176 and 177 and member 183 will not cause these driven clutch parts to be pulled back and thereby take up the angular displacement of the disc 175 relative to the member 183, thus causing the shaft 102 to be again clutched to the flywheel 104, a spring-urged pawl 203, Figs. 6 and 15, pivotally mounted on the sleeve 189 of the stub shaft 187 cooperates with a notch 204 in the disc 176 to prevent any reverse rotation of the driven clutch parts under influence of the springs 184, and thus prevents any such undesired re-engagement of the driving and driven clutch parts.

When the above described perforating operation has been performed by the perforating mechanism PM, the roller 162 of the sheet stop lever 161, Fig. 13, rides onto the high portion of

the cam 163 and the lever 161 is thereupon rocked to elevate the stop finger 165, Figs. 9, 10 and 13, out of sheet stopping position. Likewise, the roller 157 of the lever 155, Fig. 8, rides onto a relieved portion of the cam 158 to enable the gripping roller 156 to descend and clamp the sheet S in the bite between the rollers 156 and 142. The sheet S is thereupon advanced by the roller 142 longitudinally to the left, as viewed in Fig. 3B. As shown in Figs. 9 to 12, inclusive, a roller 205 is mounted on a shaft 206 that extends transversely of the direction of movement of the sheets as S and is journaled below the bed plate 99 in bearing blocks 207 secured to the upper edges of the gusset 90 and flange 100 of the frame 88 to the left of the die block 91, Fig. 10. The roller 205 projects through an opening 208 in the bed plate 99 to engage the under surface of the sheet S as it is moved to the left away from the position shown in 3B. A pulley 209 is also mounted upon the shaft 206, and a belt 210 is passed about this pulley and a pulley 211, Figs. 9, 11 and 12, on the aforementioned shaft 136. Hence, the pulley 209 and shaft 206 are driven in a counterclockwise direction, Fig. 9, as is also the roller 205. A lever 213 pivotally mounted on the shaft 154 carries a gripping roller 212, Figs. 9 and 11, which cooperates with the roller 208, a spring 214 acting upon the lever 213 maintain the rollers 212 and 205 yieldingly in engagement at all times. When the stop finger 165 has been raised to release the sheet S, the rollers 142 and 156, Figs. 4 and 8, advance the sheet into the bite between the rollers 205 and 212, whereupon the roller 156 is elevated by the cam 158 and is maintained in such raised position until the next succeeding sheet has been severed from the web W and advanced beneath the roller 156. The rollers 212 and 205 advance the sheet S to the left, as viewed in Figs. 3B and 1A, into a sheet guideway SG in the main section of the printing machine.

Inasmuch as the cam shaft 151 which controls the operation of the clutch 103 of the perforating mechanism PM, and of the stop finger 165 and roller 156, is driven in timed relation with the web feeding, back printing and web severing mechanisms and also with the remaining operative devices of the machine, as will be explained, accurate timing in the operation of the various parts of the perforating mechanism PM with respect to the other operative functions of the machine is insured. Thus, as soon as the sheet is severed from the web, it is advanced away from the knife and into position to be operated upon by the punches of the perforating mechanism PM, being accurately oriented relative thereto in the manner set forth hereinabove. Thereupon the punching operation is performed by the mechanism PM and the sheet S is then discharged into the guideway SG, Fig. 1A, where conventional sheet feeding means operates to continue the advancing movement of the sheet through the main section of the machine.

Printing identification data on face of sheet

Each bill sheet S is adapted to receive impressions of identification data, such as an address A and kindred data A', Fig. 63, upon its face from a corresponding printing device D, Figs. 1A, 41 and 44, in the course of its passage through the machine. Such impressions are effected by a platen P, Figs. 1A, 2A, 3A and 56, which is embodied in the main section of the machine to the left of the perforating mechanism PM, as

viewed in Fig. 2A. As the sheets are discharged from the perforating mechanism PM, they are successively advanced along a sheet guideway SG by sheet feeding and positioning means of the character disclosed in the aforesaid Hartley patent, No. 1,955,806, and which will be particularly described hereinafter, to receive the impressions of data as A and A' upon their faces. The printing devices D from which such impressions are to be made upon the sheets S by the platen P are stacked in a magazine 229, Figs. 41, 42 and 44, prior to the start of operation of the machine, and during operation of the machine they are sequentially withdrawn from the bottom of this magazine and are advanced in a step-by-step manner along a printing device guideway toward the platen P, by means presently to be described. As each printing device D is presented to the platen P, the platen is operated a plurality of times, in the present instance, to make a plurality of impressions of identification data A and A' upon the sheet S which is disposed in printing position between the platen P and the printing device D, the sheet S and printing device D being held stationary while each impression is made. Intermediate these impression-making operations, the sheet S is shifted by the sheet feeding and positioning means to properly space the various impressions on the sheet S, as will be subsequently explained.

The means for operating the platen P and associated parts is substantially the same as disclosed in United States Letters Patent, No. 2,002,771, patented to Walter T. Gollwitzer on May 28, 1935. Thus, referring to Fig. 3B, the main drive shaft 80 is interconnected by bevel gears 220 and 221 with a platen operating shaft 222 that extends lengthwise of the machine and is journaled in suitable standards on the frame 72. The platen P is carried by a rocker that is mounted on the frame 72 and includes arms carrying rolls 600a and 600b, Figs. 3A and 67, which respectively cooperate with conjugated cams 600 and a cam 600c fast on a sleeve 223 disposed about the shaft 222. The sleeve 223 has a lug 224, Fig. 42, which is engaged by the nose of a pawl 225 pivotally mounted at 226 on a disc 227 fast on the shaft 222, a spring 228 normally acting on the tail of the pawl 225 to hold the nose thereof engaged with the lug 224. So long as the pawl 225 and lug 224 are so engaged, the platen P is operated each time the shaft 222 goes through a cycle of rotation. However, if the pawl 225 should be disengaged from the lug 224, in a manner presently to be explained, the platen P and certain other mechanisms in the machine are rendered inoperative.

It will be noted that in the particular bill sheet illustrated in Fig. 52 the stub 86 is subdivided into two smaller stub portions 86a and 86b. The identification or address data A are printed at two places on the sheet S, namely, the body 85 and the stub 86b, and the identification data A' are likewise printed on both the body 85 and stub 86a. However, on the body 85 of the sheet S the data A' are located relatively near and to the left of the data A, Fig. 52, whereas on the stub 86 the data A' are located in substantial spaced relation to the right of the data A, Fig. 52. Since both the data A and A' are printed from the same printing device D, means have been included in the present invention to enable the data A and A' to be printed on the body 85 of the sheet S in a single operation of the platen P, a second impres-

sion of the data A' to be made upon the stub 86a in a second operation of the platen P, and a second impression of the data A to be made upon the stub 86b in a third operation of the platen P. The printing device D remains stationary during these three successive printing operations and the sheet S is shifted in the proper amounts intermediate the successive impression-making operations to properly locate the data A and A' on the sheet S in the manner shown in Fig. 52, as will be described in greater detail hereinafter. It will be understood, of course, that such means can be adapted to provide various arrangements of impressions of the identification data upon the bill sheets as S depending upon the particular use to which the machine is to be put.

Thus, in order to enable the platen P to make separate impressions of the data A and A' at different times from the same printing device D upon the stub 86 of the sheet S, the impression-making surface of the platen is divided into two parts. Referring to Figs. 53 to 56, inclusive, the platen P includes a block 601 which is rigidly attached to the rocker arms of the platen, and two impression members 602 and 603 which are yieldingly secured to the lower face of the block 601 by springs 604', as shown in Figs. 54 and 55. The member 602 is provided with a face 604, Fig. 53, that is of such a size and location that it is aligned with the type characters representing the data A, Fig. 52, on each printing device D positioned for cooperation therewith. The member 603 is provided with a face 605 that cooperates with the type characters representing the data A' on each printing device D.

Each of the impression members, for example, the member 603, is capable of being positioned in spaced relation with respect to the block 601, against the action of the springs 604', independently of the other impression member 602. To effect such adjustment of the impression members 602 and 603, shafts 606 are pivotally mounted in suitable sockets formed in the lower face of the block 601 to bear against the upper faces of the impression members 602 and 603. Each shaft 606 has a flat 607, Fig. 54, and when the shafts 606 are engaged with an impression member as 603 are so positioned angularly that the flats 607 thereof are parallel with the upper face of the impression member, the springs 604' maintain the impression member as 603 in contact with the block 601, as shown in Fig. 55. However, when the shafts 606 are so positioned angularly that the circular portions of their peripheries bear on the impression member as 603, this member is maintained in spaced relation with the block 601 as shown in Fig. 54. Depending upon whether or not the impression member as 603 is or is not maintained in spaced relation with the block 601, an impression is or is not effected from the corresponding portion of the printing device D positioned beneath the platen P.

Means have been provided to enable the machine to alternately adjust the shafts 606 for enabling or suppressing the printing operations that are ordinarily effected by the respective impression members 602 and 603. For example, in the case of the impression member 603, there are two shafts 606, and the one located nearer the center of the platen P has a rock arm 608 which is pivotally connected by a link 609 to a plate 610 secured to the other shaft 606 which is nearer the outer edge of the platen P. A spring 611 anchored at one end to the block 601 is attached

at its other end to the plate 610 in such a manner that whenever the plate 610 is in either of its extreme angular positions, Figs. 54 and 55, the spring 611 is disposed on one or the other side of a dead center point. When the platen P is raised, Fig. 54, a bar 612, Figs. 53 and 56, stationarily supported by a bracket 618 on the frame 72 of the machine, engages a roller 613 mounted on the plate 610 and causes the plate 610 and connected rock arm 601 to assume their extreme clockwise positions, as viewed in Fig. 54, whereby the spring 611 is carried past dead center and maintains the parts in these positions to thereby so position the shafts 606 that the impression member as 603 is maintained in spaced relation with the block 601. A tail 614 on the plate 610 engages a lug 615 on the block 601 to limit movement of the plate 610 and connected parts under the influence of the spring 611 in the operation as just described.

For the purpose of adjusting each impression member as 603 to its inactive position as shown in Fig. 55, there have been provided levers 616, Figs. 53 to 56, which are pivotally mounted as at 617 on a bracket 618 secured to the machine frame 72, these levers 616 having lugs 619 that are adapted to cooperate with lugs 620 formed on the respective pivoted plates 610 carried by the impression members 602 and 603. Each lever 616 also has an arm 620, Fig. 56, carrying a roller 621 which cooperates with a cam 622 on a cam shaft 623, Figs. 3A, 3B, 53 and 56, that is journaled in the frame of the machine and extends parallel to the sheet guideway SG.

The cam shaft 623 is among the devices that are driven rotatively by the main drive shaft 80 through the medium of the clutch 81, Figs. 1A and 3B, and hence it is operated in timed relation with the web feeding, back printing and severing means and also with the platen operating shaft 222 so long as the clutch 81 remains engaged. Hence at predetermined times in the operation of the machine, each of the levers 616, Figs. 53 and 56, is actuated by its cam 622 and assumes a position in which the lug 619 thereof may cooperate with the lug 620 of the associated plate 610. When this occurs and the lug 620 engages the lug 619 in the course of downward movement of the platen P, the plate 610 is swung counterclockwise, as viewed in Fig. 54, into the position shown in Fig. 55, the spring 611 tending to maintain it in such position when this spring has been carried past its dead center. This causes the shafts 606 associated with the corresponding impression member as 603 to be rocked into such angular position that their flats are parallel with the face of the impression member as 603. The springs 604' thereupon operate to draw the impression member upwardly into its inoperative position as shown in Fig. 55 so that the impression face as 605 thereon does not engage the surface of the sheet S when the platen P has reached the limit of its downward stroke.

In the present instance where triplicate printing is performed, that is to say, where the platen P makes three impressions from each printing device D onto a sheet S, the cam shaft 623 is arranged to be driven at a one-to-three ratio with respect to the platen operating shaft 222. In the first revolution of the shaft 222, when the platen P makes the first impression from a printing device D on the body 85 of the bill sheet S, Fig. 52, neither of the impression members 602 and 603 of the platen P is rendered ineffective, so that the data A and A' are printed on the body

85 of the sheet S. However, during the next revolution of the shaft 222, when the platen P is to make an impression of the data A' upon the stub 86 of the sheet S, the lever 616, Fig. 53, associated with the impression member 602 is operated by its cam as 622, Fig. 56, to trip the above described mechanism for disabling the impression member 602, thereby suppressing the printing of any data A, Fig. 52, in the second printing operation of the platen P. In the third revolution of the platen operating shaft 222, when the data A are to be printed on the stub 86 of the sheet S, the lever 616 associated with the impression member 603 is actuated by its cam 622 to disable the impression member 603 and thereby suppress the printing of any data A' in this third impression-making operation of the platen P.

Each time the platen P is restored to its upper position, as shown in Figs. 53, 54 and 56, the rollers 613 on the pivoted plates 610 strike the bottoms of the aligned stationary bars 612 and the plates 610 are thereupon pivoted downwardly, rocking the shafts 606 and restoring the impression members 602 and 603 to their normal operative positions in spaced relation with the block 601. Such restoring movement of the impression members is limited, as aforesaid, by the tails 614 on the plates 610 engaging the lugs 615 on the block 601, the spring 611 aiding to maintain the parts in their operative positions to which they have just been adjusted. Each of the impression members 602 and 603 is maintained against lateral displacement relative to the block 601 by a dog 625 mounted on each end of the block 601 and extending into a recess 625 in the end of the impression member 602 or 603.

As disclosed in the aforesaid Gollwitzer patent, No. 2,602,771 (modified in accordance with Hartley patent, No. 2,002,737), the means for advancing the printing devices is actuated by the platen operating shaft 222 through the medium of a mechanism including an eccentric 230 that is fixed on the shaft 222 and which has a strap 231 carrying a plunger 232, Fig. 43, having a collar 233 affixed thereto. The plunger 232 is extended through a sleeve 234 pivotally supported on an arm 235 of the printing device feed rocker, the arm 235 being connected to a rock shaft 236 journaled in the frame 72 of the machine as shown in Fig. 42. As the shaft 222 rotates the eccentric 230, the plunger 232 is reciprocated, and on its downward movement the collar 233 thereon engages the end of the sleeve 234 (assuming this sleeve to have been in a raised position initially) and rocks the arm 235 and shaft 236 counterclockwise as viewed in Fig. 42. A spring-urged latch 237 pivotally mounted on the sleeve 234 normally engages the collar 233 to enable the sleeve 234 and rock arm 235 to be drawn upwardly as the plunger 232 ascends, thereby rocking the shaft 236 clockwise, as viewed in Fig. 42, and thence downwardly as the plunger 232 descends, thereby rocking the shaft 237 counterclockwise, Fig. 42. On each such downward movement of the sleeve 234 and rocker arm 235, the printing device feeding means is actuated to advance the printing device or devices along the guideway toward the platen P, Fig. 3A. However, during the upward movement of the plunger 232 the device feeding means is inactive and it is during this interval that the platen P is operated to make an impression from the printing device, if any, disposed therebelow.

Inasmuch as a plurality (in the present instance, three) impressions of identification data

A and A' are made on each bill sheet as S, Fig. 52, by the platen P from a printing device as D, Fig. 41, means have been provided for suspending the printing device feed until the last impression-making operation of each series has been performed. Such means includes a rocker 240, Fig. 42, which has a cam surface that cooperates with a pin 244 on the latch 237, Fig. 43. If the rocker 240 is in the position shown in Figs. 42 and 43 at a time when the plunger 232 and sleeve 234 are descending together to actuate the printing device feeding means, the pin 244 on the latch 237 engages the cam surface of the rocker 240 toward the end of the downward stroke of the plunger, at which time a new printing device D will have been advanced beneath the platen P, and the latch 237 is thereupon cammed out of engagement with the collar 233. Thus, during the first succeeding cycle of the platen operating shaft 222, the sleeve 234 is disconnected from the plunger 232 and hence the printing device D remains beneath the platen P after the first impression has been taken from it, to enable second and third impressions to be made in the second and third cycles. A cam 238, Fig. 42, is mounted on a shaft 241 that is driven by the platen operating shaft 222 through the medium of reduction gearing 243 and a universal connection 242, Fig. 1A, the shaft 241 being driven at a one-to-three ratio with respect to the shaft 222. Shortly prior to the initiation of every third cycle of the shaft 222, the cam 238 actuates a bell crank 239, Fig. 42, that is connected to the rocker 240, to thereby momentarily move the rocker 240 out of engagement with the pin 244 on the latch 237 and thus cause the sleeve 234 to be latched to the plunger collar 233 during the ensuing cycle. Hence, the printing device feeding means is rendered operative during every third cycle of the platen operating shaft 222 inasmuch as three impressions are to be taken from each printing device D that is to be effective.

A selector device is employed to control operation of the platen P without interrupting the printing device feed, for purposes understood in the art. This selector device includes a selector bar 245 in which sensing pins as 246, Fig. 49, are adapted to be mounted for cooperation with identifying means such as the tab T, Fig. 41, of the printing devices D. In the printing devices utilized in the present machine there are twenty-four available index positions or tab areas, but only one of these, namely, the twenty-fourth or top-most position, as viewed in Fig. 41, is utilized to effect operation of the selector bar 245. It will be noted that the tabs as T may be in the form of half-tabs so that although there is only provision for twelve such tabs in the frame of the printing device D, twenty-four index positions are actually available. Inasmuch as the twenty-fourth index position alone is to be utilized to determine operation of the selector, the bar 245 has but a single sensing pin 246 mounted therein at the twenty-fourth position for cooperation with the twenty-fourth index position on each printing device D advanced into sensing relation with such pin.

The selector bar 245 is mounted for yielding pivotal movement in a rocker 247 pivotally mounted at 248 on the frame 72 of the machine. A spring 249 connected to an arm of the rocker 247 and anchored to a stop pin 250 tends to maintain the rocker 247 in an upper position in which an adjusting screw 251 on this rocker engages the stop pin 250, thus maintaining the selector bar

245 and the sensing pin 246 in their upper inoperative positions. An arm 252 secured to the rock shaft 236 carries a roller 253, Figs. 41 and 42, which is adapted to cooperate with a plate 254 attached to the rocker 247. Assuming that the sleeve 234, Fig. 43, is latched to the plunger 232 and is drawn upwardly as the plunger ascends, the shaft 236 is rocked clockwise as viewed in Fig. 42, and the rocker 253 engages the plate 254 and cams the rocker 247 downwardly to bring the sensing pin 246 into engagement with the aligned tab, if any, on the printing device D disposed in sensing relation therewith.

The selector bar 245 is part of a mechanism 15 which also includes a link 255 and a lever 256 having a lip 257 provided with a notch 258. A dog 259 normally seats in the notch 258, this dog being supported by a leaf spring 260 attached at one end to a lever 261 having a notch 262 therein. Depending upon the presence or absence of a tab beneath the sensing pin 246, the lever 256 is so positioned, when the rocker 247 is lowered in the manner above described, that the dog 259 is either seated in the notch 258 or rides on the lip 257, and the lever 261 is correspondingly either retained in its lower position as shown in Fig. 42 or is rocked to bring the notch 262 into position to cooperate with a lug 263 on a rocker generally designated 264 that is pivotally mounted in the same plane as is the pawl 225 on the disc 227. A rod 265 pivotally connected to the rocker 264 is passed about an opening in a boss 266, Fig. 43, on the sleeve 234. A nut 267 on the rod 265 bears on the top of the boss 266 and hence each time the sleeve 234 is elevated the rod 265 may likewise be elevated to swing the rocker 264 clockwise, as viewed in Fig. 42. Such swinging of the rocker 264 occurs prior to the actuation of the selector bar 245 so that the lug 263 is in vertical alignment with the notch 262 at the time the selector bar 245 is lowered.

As explained in the aforesaid Gollwitzer and Hartley patents, Nos. 2,002,737 and 2,002,771, respectively, the selector mechanism may be adjusted to either a "skip" or "print" condition by adjustment of a knob 268, Fig. 42. In the present instance the knob 268 is adjusted to its "skip" position so that if the sensing pin 246 should contact the tab T (which would be a tab in the position indicated by dotted lines in Fig. 41 on the printing device D) the lever 256 is swung to move the dog 259 out of the notch 258 and thereby position the lever 261 so that the lug 263 of the rocker 264 is hooked by the notch 262. The rocker 264 is therefore retained in its lower position until the sleeve 234 is again elevated to push the rod 265 and free the lug 263 from locking engagement with the notch 262. During the interval when the rocker 264 is locked in its lower position, it will be in the path of movement of the tail of the pawl 225 and as the tail of the pawl 225 moves into engagement therewith the pawl 225 is pivoted and disengaged from the lug 224 on the sleeve 223. Thereupon the sleeve 223 is uncoupled from the shaft 222 and since the machine is adjusted for triplicate printing in the present instance, the rocker 264 is effective to uncouple the sleeve 223 during three successive cycles of the shaft 222. As explained in detail in the aforesaid patents, the arrangement is such that when two or more impressions are being effected from each printing device as D, the selecting means is rendered inoperative during all save the last impression-making operation of each series, inasmuch as the selector rocker 247 remains in-

active so long as the sleeve 234, Fig. 43, is unlatched from the plunger 232.

When the sleeve 223 is uncoupled from the shaft 222, the platen P, of course, is rendered inoperative. Likewise, a bar 69, Figs. 49, 1A, 3A and 3B, which is a part of the rocker 264, has a portion 270 which effects the release of the clutch 81, Fig. 3B, whenever the rocker 264, Fig. 42, is locked in its lower or skipping position as just described. Hence, concurrently with the disabling of the platen P, the web feeding, back printing, severing and other devices carried by the frame 71, as well as the sheet feeding means of the machine and certain other devices as will be described herein-after, are likewise disabled whenever a printing device D bearing a tab in the twenty-fourth position is sensed. The printing device feeding means, however, is unaffected and continues to advance printing devices through the guideway in the usual manner.

If a printing device D is to be utilized in the printing operation, the twenty-fourth position tab is omitted and therefore when the selector bar 245, Fig. 42, is depressed the sensing pin 246 will not encounter a tab and the rocker 264 and bar 269 are restored to their upper positions when the sleeve 234, Fig. 43, is lowered. The pawl 225, therefore, remains in engagement with the lug 224 to maintain the sleeve 223 coupled to the shaft 222 for operating the platen P. The clutch 81, Fig. 3B, is also unaffected so that the drive shaft 80 remains coupled to the gear trains which drive the web feeding, back printing and severing devices, and the sheet feeding means.

Sheet conveying and positioning means are provided in the main section of the machine and such means include a feed tape 625, Figs. 1A, 3A and 3B, which extends along the sheet guideway SG and is trained around pulleys on the pulley shafts as 136, Figs. 2A and 3B, located at the ends of the guideway. Gripping rollers 626 carried by roller supports 627, pivotally mounted in brackets on the bed plate 99, bear on the tape 625. As the sheet S is discharged from the perforating mechanism PM in the manner hereinabove explained, its leading edge passes onto the tape 625 and is gripped by the most right-hand roller 626, Figs. 1A, 3A and 3B, being thus held in firm contact with the tape 625 to be advanced thereby along the sheet guideway SG toward the platen P.

The sheets are timed in entering printing position with respect to the platen P by a stop finger 628 which is pivotally mounted on a rod 629 extending longitudinally of the sheet guideway, and which has a rearwardly extending portion co-operating with a cam 630 on the cam shaft 623, Fig. 3B. The cam shaft 623 is driven in timed relation with the sheet advancing means so that the cam 630 operates the stop finger 628 to momentarily delay the movement of each sheet S before it reaches printing position beneath the platen P until the preceding sheet has been printed and moved away from such position. The stop finger 628 is thereupon elevated to release the sheet S, which is then carried by the tape 625 toward the platen P.

It will be recalled that each sheet S receives three separate impressions of identification data A and A', Fig. 52, from a printing device D positioned beneath the platen P, and that intermediate the successive impression-making operations the sheet S must be shifted longitudinally to enable the impressions to be properly spaced thereon. To this end three sheet stopping fingers

631, 632 and 633, Figs. 1A and 3A, are provided for successively arresting the sheet S at each of the three different positions which it is to occupy while the printing operations are being performed by the platen P. The stop fingers 631, 632 and 633 are pivotally mounted on the rod 629 and are respectively controlled by cams on the cam shaft 623 in a manner similar to that explained hereinabove with respect to the stop finger 628.

When the stop finger 628 releases the sheet S to enable it to advance into printing position beneath the platen P, the leading edge of the sheet is first inserted into the bite between the second gripping roller 626 and the tape 625, and the sheet continues to advance until its leading edge engages the stop finger 631 which is then in sheet stopping position. The platen P descends to make the first impression of data A and A', Fig. 52, on the body 85 of the sheet S while the sheet is maintained stationary by the finger 631. As the platen P is raised following the printing of such data on the body of the sheet, the stop finger 631 is elevated and the sheet S is advanced by the tape 625 until its leading edge engages the stop finger 632, then in sheet stopping position. The platen P again descends and prints the identification data A', Fig. 52, on the stub 86 of the sheet S, that portion of the platen P which normally effects printing of the data A being in the present instance rendered ineffective in the manner described hereinabove. Following this, the stop finger 632 is elevated to release the sheet S, which is thereupon advanced into engagement with the stop finger 633. The plate P descends a third time to print the identification data A on the stub 86 of the sheet S, that portion of the platen P which normally effects printing of the data A' being in this instance rendered ineffective.

When the three impressions of identification data have been thus made on the sheet S, the sheet is freed from engagement with the stop finger 633 and is advanced by the tape 625 toward the left end of the sheet guideway SG, Figs. 1A and 3A, to have further printing operations performed upon it in a manner presently to be explained, another of the gripping rollers 626 serving to clamp the sheet S against the tape 625 in this instance to insure its passage out of printing relation with respect to the platen P.

In the event there is a skip operation of the machine, it is desirable that the sheet feed be interrupted so that there will be no incomplete bill sheets produced. Hence if an inactive printing device D, that is, one bearing a tab T in its twenty-fourth index position as indicated in dot-dash outline in Fig. 41, is disposed beneath the platen P (under which condition the platen P is disabled so long as the inactive printing device D remains beneath it) the sheet S then in printing position beneath the platen P should remain in such position until it has received impressions of identification data from the first succeeding active printing device to be brought into printing position. It will be recalled that whenever an inactive printing device has been sensed, the clutch 81, Fig. 3B, is thrown out, thereby interrupting operation of all mechanisms under its control. The stop finger cam shaft 623 and the feed tape pulley shafts as 136 are among these devices, and hence they are disabled and remain stationary concurrently with the disabling of the platen P. Thus the sheet stopping finger 631, Fig. 3A, is maintained in its sheet stopping position throughout the idle cycles occasioned by the sensing of an inactive printing device, so that the

sheet S is maintained in printing position. Such interruption of the sheet feed, however, does not affect those sheets S which have already received impressions of identification data A and A', Fig. 52, and these sheets continue to advance through the machine, as will be shown hereinafter, leaving a hiatus in the successive feeding of the sheets.

Printing form on face of sheet

After having the identification data A and A' imprinted on its face, each sheet S is advanced into a face printing unit FP, Figs. 1, 1A, 2, 2A and 3A, to have the reoccurring data or form F, Fig. 52, imprinted on the face of such a sheet. This face printing unit is identical in construction and mode of operation with the printing mechanism disclosed in the United States Letters Patent No. 1,955,814, patented to Curtis George Kranz on April 2, 1934, and a reference may be had to this patent for further details of construction.

In order to time the advance of sheets into the face printing unit FP, a stop finger 637 is disposed in the sheet guideway SG intermediate the face printer FP and the stop finger 633, it being recalled that the latter stop finger serves to position the sheet S to receive the third and last impression of identification data from the printing device D at the platen P. The stop finger 637 is pivotally mounted on the rod 629 and has a lever arm which is controlled by a cam on the cam shaft 623. As each sheet is freed from the stop finger 633 it advances to the left as viewed in Fig. 3A into momentary engagement with the stop finger 637, and is then released to be advanced into the face printer FP.

For a reason which will appear hereinafter, it is desirable that each sheet S be advanced into the face printer FP prior to the time when the platen P has been fully restored to its upper inoperative position following the printing of the last impression of identification data A or A' on such sheet. To this end the stop finger 637 is so operated that it is in its sheet stopping position only momentarily and returns to its upper position at the end of each cycle of rotation of the cam shaft 623. To further insure that the sheet S is advanced into the printer FP when freed by the stop finger 637 a means operating independently of the feed tape 625 is arranged to positively advance the sheet toward the end of the guideway SG leading to the printer FP. Such means comprises a feed roller 634, Fig. 2A, which is rotatably mounted on the machine frame beneath the bed plate 99 and which extends upwardly for a slight distance through a suitable opening in the bed plate to contact the lower surfaces of the sheets S. This roller 634 is preferably located intermediate the sheet stopping fingers 633 and 637 and in such spaced relation with the face printer FP that the trailing edge of a sheet S does not move out of engagement with the feed roller 634 until the leading edge of this sheet has been advanced to the sheet feeding means of the face printer FP.

A shaft 359, Fig. 2A, more specifically referred to hereinafter, is included in the face printer FP and is continuously rotated while the machine is in operation. This shaft is utilized to continuously drive the feed roller 634 through the medium of a silent chain 635. A gripping roller 636, Figs. 2A and 3A, is pivotally mounted directly above the roller 634 on a spring urged arm that is rotatably mounted on the rod 629, so that the roller 636 is yieldingly urged toward the roller 634. Thus, when the leading edge of a sheet is ad-

vanced by the feed tape 625 and gripping roller 626, Fig. 3A, into the bite of the rollers 634 and 636, the latter rollers thereupon function to supplement the feeding action of the tape 625 for continuing the advancing movement of the sheet after its trailing edge has moved from beneath the gripping roller 626.

As is disclosed in the aforesaid Kranz Patent No. 1,955,814, the face printer FP is constantly driven by a shaft 380, Fig. 3A, which is geared to the platen operating shaft 222 through the medium of step-down gearing 243. The printing drum of this unit, therefore, is normally rotated in timed relation with the advancing movement of the sheets along the guideway SG. This face printing unit has its own sheet feeding and positioning means which are likewise constantly driven so long as the machine is in operation, and as each sheet S is delivered to the face printer FP by the above described sheet feeding means in the main section of the machine, it is picked up by the printing drum of the unit FP at the proper instant and is rapidly advanced through this unit, receiving an imprint of the form or re-occurring data F, Fig. 52, on its face.

It has been explained hereinabove that whenever a skip operation of the machine is brought about by the sensing of a printing device which bears a tab in its "Skip" or twenty-fourth index position, the feed tape 625 stops moving and the operation of the cam shaft 623, Figs. 3A and 3B, is suspended at the end of the cycle of this cam shaft in which the sheet S allocated to the preceding active printing device receives its impression of identification data from such device. The last stop finger 637 is so arranged that it comes to rest in a raised position when the cam shaft 623 is arrested, so that the aforesaid sheet S bearing the impressions of identification data is advanced by the continuously rotating feed rollers 634 and 636 into the face printer FP notwithstanding that the operation of the feed tape and associated sheet stop fingers is interrupted at the initiation of the skipping operation of the machine. Hence, although the following sheet S is maintained in printing position beneath the platen P until the next active printing device reaches printing position and makes the impressions of identification data A and A', Fig. 52, on this sheet, the sheet S which has already received the impressions of identification data A and A', is advanced through the face printer FP and is discharged therefrom to be fed by means hereinafter described to the slotting mechanism SL, Figs. 2 and 3. The face printer FP has its own safety device to prevent the formation of offset impressions on the impression roll thereof when for any reason, such as in the event of a skipping operation, the sheet feeding means fails to feed sheets at the usual intervals to this printer.

Slotting mechanism

It has been explained that the present invention may be adapted to the production of a wide variety of business instruments and the like, and that it is particularly susceptible of use in connection with the preparation of cards, sheets and the like which may be sorted according to the method disclosed, for example, in the aforesaid Perkins Patent 1,544,172. Such sorting methods require that the cards or sheets to be sorted shall be provided with what are referred to herein as particularizing and classification data representations formed by notching or slotting out the

material disposed between perforations at selected positions and the margins of the document.

Thus, referring to Fig. 52 in which a public utility bill which is typical of instruments of the above mentioned character is illustrated, it will be noted that each sheet as S has a column of perforations 84 along the margin of the body 85 near the center of the sheet S, and another column of perforations 84 at the left end of the stub 86 of the sheet S, as viewed in Fig. 52, both of which columns of perforations are allocated to the "book number" of the person to whom the bill or other sheet S is to be sent. Twelve of the index positions represented by the perforations 84 in each of these two columns are actually utilized, there being four index positions for each of the orders of the book number inasmuch as a four-unit code is to be utilized in representing the digits of the book number. Similarly, the right-hand margin of the sheet S, Fig. 52, has a column of perforations 84 which pertain to the "consecutive number" of the sheet S. In this instance only eleven of the index positions represented by these perforations are utilized, there being but three index positions allocated to the hundreds order since it is not contemplated that the hundreds order digit of the consecutive number will exceed a predetermined digital value less than nine. A row of perforations 84 is also located along the top marginal portion of the body 85, Fig. 52, as well as another row of perforations 84 along the bottom marginal portion of the body 85.

As mentioned hereinabove, the various items of particularizing and classification data are represented on the sheet S by slotting the sheet at the index positions in the vicinity of selected perforations 84 therein. For example, in representing the book number 80, the left-hand margin of the sheet S, Fig. 52, would be slotted as indicated, trapezoidal openings being formed in the edge of the sheet in the vicinity of the perforations 84 normally disposed at the positions designated 7 and 1 in the tens order. Of course, in thus forming a slot in each of such positions, the perforation is obliterated and the slot appears in its stead. The representation of the book number is duplicated along the marginal portion of the body 85 of the sheet S near the middle of the sheet, trapezoidal openings or slots being formed in the positions designated 7 and 1 in the tens order, and these openings or slots extend to the line along which the stub 86 is to be separated from the body 85 of the sheet S. The consecutive or serial number is represented by slotting the right-hand edge of the sheet S, Fig. 52, at the appropriate index positions therein. In the illustrated example, the consecutive number 291 is represented by slots in the positions designated 2 in the hundreds order, 7 and 2 in the tens order, and 1 in the units order. In the present machine no provision has been made for slotting the bottom marginal portion of the sheet, although the index positions represented by the perforations 84 therein are allocated to certain items which are printed upon the back of the sheet S, as shown in Fig. 51.

The index positions denoted by the top row of perforations 84, Fig. 52, pertain to certain items of classification data which are identified on the face of the sheet. Thus, the first eleven index positions from the right along the top of the sheet S, Fig. 52, are allocated to the rate schedule number, there being three index positions for the hundreds order and four index posi-

tions for each of the tens and units orders thereof. The twelfth index position from the right, designated "K," Fig. 52, relates to a predetermined factor known as a meter constant which is applied only where the bill is being computed for an industrial consumer. Thus, bills which are to be sent to residential consumers will not be provided with slots at the position "K." The next seven index positions 84 pertain to the tens and units orders of the revenue account number. The twentieth to the twenty-third index positions, inclusive, from the right along the top of the sheet S, Fig. 52, respectively pertain to various miscellaneous items. Thus, provision is made for indicating whether or not the bill S is a "Clear bill," that is, whether or not it is to be sent to the customer's bank or other paying agent. Likewise, a "Farm" customer may be denoted by a slot in the appropriate position, and similarly a slot in still another position (Tax) may be used to indicate that the customer is tax-free. The presence of a slot in the position designated "Dup. trip." signifies that this bill is the last one of a series of identical bills that are being prepared for the same customer, an instance of this being where the customer is a governmental agency. The twenty-fourth index position, designated "Reg.," is not provided with a slot if the bill being sent to the customer is a final bill. However, in most instances there will be a slot in this position.

As will be described in greater detail hereinafter, the means for slotting the sheet S to represent the book number is manually controlled, as is also the means which slots the sheet S in the position "Reg." The means for slotting the consecutive number in the sheet S is controlled by a consecutive numbering device which is, in effect, a counter for serially numbering the sheets. The slotting means which forms representations of classification data along the top of the sheet S, Fig. 52, in the first twenty-three index positions from the right therein is controlled by a means responsive to indicia such as tabs T, Fig. 41, on the printing devices D. Where duplicate or triplicate bills are to be prepared, a separate printing device D is utilized for each bill, but only the last printing device of this series is provided with a tab T in the "Dup. Trip." position.

The mechanism for slotting the sheets S is generally designated SL and is located at the left of the face printing unit FP, Figs. 1 to 3A, inclusive, where it is supported in a frame or stand generally designated 271, Fig. 2. The slotting mechanism SL includes die assemblies generally designated 272 and 273, Figs. 3 and 24 to 28, inclusive, which are secured to a horizontal table at the top of the stand 271. As shown in these figures, the die assembly 272 comprises a central rectangular die block 274 having trapezoidal die openings 275 formed in three of its sides, these die openings having the same relative positions as the perforations 84 in the index positions along the three marginal portions of the body 85, Fig. 51, of the sheet S, which may be slotted out in representing the various items of data in the sheet S, although of course this arrangement can be varied in dependence upon the character of the instrument to be prepared. As shown in Figs. 24 to 28, inclusive, the die block 274 is surrounded on three sides by blocks 276 which are fitted against the block 274 to close the die openings 275 therein. The portion of the die block 274 along the edge which does not have any die openings 275 therein is of less thickness than the remainder

of the block 274, as shown in Fig. 28, and the block 276 along the opposite side of the die block 274 is likewise of less thickness than the abutting side of the block 274. The other two blocks 275, Figs. 25, 26 and 27, however, are coplanar with the main portion of the block 274.

A punch guide block 277 is supported on the die block 274 for the purpose of guiding the slotting punches 301, to be described hereinafter, and as shown in Fig. 28, the guide block 277 has a leg 278 which bears on the thin portion of the die block 274, being accurately interfitted with the die block 274. The remaining portion of the block 277 is offset upwardly to afford a clearance between itself and the upper surface of the die block 274, thereby providing space for the admission of a sheet as S, Fig. 51, into the punch guide and die block assembly. The guide block 277 has the same rectangular shape as the die block 274 and is provided with marginal openings identical and vertically aligned with the die openings 275. These openings are closed by blocks 279, Figs. 24 to 28, which are secured to the edges of the guide block 277 and to the block 276 shown in Fig. 28.

The die assembly 273 is constructed in a manner somewhat similar to that of the die assembly 272. Thus, the die assembly 273 includes a block 280 having die openings 275, Fig. 27, along one edge thereof, these openings being positioned with respect to each other and also with respect to the die openings 275 in the die assembly 272 in an arrangement identical with that of the perforations 84 in the positions along the right-hand margin of the stub 86, Fig. 51, which may be slotted to represent the book number as indicated in Fig. 52. The die openings 275 are closed by a block 281, as shown in Figs. 26 and 27, which is accurately fitted against and is coplanar with the die block 280. As shown in Fig. 29, the die block 280 is thinner at its end portions than it is at its center and a punch guide block 282 having depending legs which seat on these thin portions is accurately interfitted with the die block 280, the guide block 282 having punch guide openings which are aligned with the die openings 275. Another block 283 is similarly supported on the block 281 and closes the punch guide openings along the edge of the block 282. The middle portions of the blocks 282 and 283 are offset upwardly with respect to the upper faces of the blocks 280 and 281 to provide a passageway for the sheets as S, Fig. 51.

A bed plate 284, Figs. 24 to 27, inclusive, is supported on the frame 271, being screwed to flanges 285, Fig. 28, extending along the top of the frame 271. The upper surface of the bed plate 284 is coplanar with the upper surfaces of the die blocks as 274 and 280 of the die assemblies 272 and 273, and guide strips 286, Figs. 3, 19 and 27, are secured on the bed plate 284 to define a sheet guideway SG through which sheets may be successively advanced to and from the die assemblies by means to be described hereinafter.

Punch heads 292 and 293, Figs. 19, 20, 23, 28, and 29, are supported above the die assemblies 272 and 273, respectively, in the following manner. A shaft 287, Figs. 2, 23, 28, 29 and 32, is journaled in bearings 288 secured to the under side of the table of the frame 271, in much the same manner as the shaft 102, Figs. 2A and 7, is supported in the frame 88 of the punching mechanism PM. The shaft 287 has eccentrics 289, Figs. 23 and 28, thereon at points opposite the die assemblies 272 and 273. The straps 290 of the eccentrics 289 extend upwardly through openings

in the table of the stand 271 and are pivotally connected to connecting rods 291 of the punch heads 292 and 293, thus supporting the punch heads above the die assemblies 272 and 273, as shown in Fig. 19. Guide pins 291a fastened to the punch heads 292 and 293 extend downwardly through bearings 291b mounted in the table, as shown in Figs. 23 and 27.

The shaft 287 has a clutch 103a, Fig. 23, identical in construction with the clutch 103 of the perforating mechanism described hereinabove, that is adapted to couple the shaft 287 to a fly-wheel 104a which is connected by a belt 105a to a pulley on a motor M3, Fig. 2, supported in the stand 271, for thereby operating the punch heads 292 and 293. The means for controlling the clutch 103a is associated with the sheet feeding means of the slotting mechanism SL and will be described hereinafter in connection therewith.

The slotting punches 301, Figs. 24, 25, 26, 28 and 29, are mounted in the guide openings in the punch guide blocks 277 and 282 and each of these punches 301 has a notch 302 therein, Figs. 25 and 26, such notch being located in that portion of the punch 301 which normally projects above the punch guide block 277 or 282. Each of the punch heads 292 and 293 has a plate as 294, Fig. 28, secured to the under side thereof by screws 295, and blocks as 296 are secured against the under sides of the plates as 294 by studs as 297 that extend through the punch heads and plates 294 and are threaded into tapped openings in the blocks 296, these studs having nuts 298 threaded on the other ends thereof and bearing on the tops of the punch heads 292 and 293. A punch retaining plate 299 is secured to the bottom of each block 296 by screws 300 which pass freely through holes in the block 296 and are threaded into tapped openings in the plate 299. A shoulder is defined at the upper end of the notch 302 in each slotting punch 301, and this shoulder normally rests on the edge of the retaining plate 299, and when the punch heads 292 and 293 are in their upper positions, as shown, the bottoms of the punches 301 do not extend downwardly beyond the bottom faces of the guide blocks 277 and 282.

Punch interponents 305 are mounted for lateral sliding movement in combs 304, Figs. 25, 26, 28 and 30, which are secured to the bottom faces of the blocks 294 in the punch heads 292 and 293 near the edges thereof adjacent the punches 301, the slots of these combs 304 registering with the tops of the punches. Legs 306 and 307 depend from each interponent 305 on either side of the comb 304, the spacing between the legs 306 and 307 being slightly greater than the width of the comb 304 to limit retracting or advancing movement of the interponent 305, the means for bringing about such actuation of the interponents 305 being described presently. Each interponent 305 mounted in the punch head 292 has a pair of V-notches 308 in its upper edge which is in contact with the lower face of the plate 294, and the notches 308 of each interponent 305 cooperate with a respective one of a series of spring-pressed dogs 308 that are mounted in the punch head 292 and plate 294 to afford detents for yieldingly retaining each of the interponents 305 in either of two alternative positions in the comb 304. When the interponents 305 are in what will be referred to hereinafter as their inactive positions, the legs 306 thereof about the comb 304 and are out of vertical alignment with the punches 301. However, when the interponents 305 are moved

inwardly to what will be referred to as their active positions, in which the legs 307 abut the comb 304, the legs 306 of the interponents are positioned over the tops of the respective punches 301. The interponents 305 mounted in the punch head 292, Fig. 26, are similar to the interponents 305 in the punch head 292 except that they are not provided with the notches 308 or detents 309.

When the sheet S is positioned in the slotting mechanism SL, as shown in Fig. 3, to be operated upon by the punches 301, it is face down on the dies 272 and 273, and those punches 301 that are disposed above the first transverse column of die openings 275 to the left, Fig. 27, are therefore adapted to slot the consecutive number in the left-hand edge of the sheet S, as viewed in Fig. 51 (or the right-hand edge, as viewed in Fig. 52). As shown in Fig. 25, a bracket 310 is secured to the table of the frame 271 to the left of the die assembly 272, this bracket having an opening 311 therein to permit the exit of sheets from the die assembly. A comb 311 is secured to the top of the bracket 310, this comb having a square hole 312 extending through the partitions of the slotted portion thereof and being open on the side of the comb 311 facing the punch head 292. A rod 313 fitted in the opening 312 serves as a pivot for a series of bell cranks 314, Figs. 19 and 25, which are mounted in the comb 311 and have depending legs that are respectively aligned with and abut the outer ends of the interponents 305 for the consecutive numbering punches 301, Fig. 25. An angle plate 315 having slots for receiving the bell cranks 314 is secured to the comb 311 and closes the opening 312 to thereby retain the rod 313 therein. Laterally extending arms of the bell cranks 314 are of graduated lengths, as shown in Fig. 19, and are pivotally connected to the ends of levers 316 of graduated lengths which extend at right angles to the bell cranks 314 and are pivoted at their other ends on a shaft 317 supported by a bracket 318, Figs. 19 and 32, on the frame 271 of the slotting mechanism SL. Vertical links 319, Figs. 23, 25 and 32, are pivotally connected at their upper ends to the levers 316 intermediate the ends thereof and extend downwardly through openings in the bed plate 284 and table of the frame 271 to be pivotally connected at their lower ends to bell cranks 320 that are supported in staggered relation on a bracket 321 in the frame 271.

A group of solenoids 322 of conventional construction is mounted on the bracket 321, as shown in Figs. 24 and 32, and the cores of these solenoids extend through suitable openings in the bracket 321 to be pivotally connected to the bell cranks 320. The solenoids 322 are controlled by the consecutive numbering devices, as will be explained subsequently, and when any of these solenoids is energized it actuates its bell crank 320 and pulls the connected link 319 and lever 316 downwardly, thereby rocking the connected bell crank 314 counterclockwise, as viewed in Fig. 25, and moving the associated punch interponent 305 from its inactive position inwardly to its active position in which the leg 307 abuts the comb 304 and the leg 306 is disposed above the top of the corresponding punch 301.

Hence, when the shaft 287, Fig. 23, is driven rotatively in the manner explained hereinafter and causes the punch head 292 to descend, those punches as 301, Fig. 25, in the consecutive numbering group above which the legs 306 of the corresponding interponents 305 are positioned

are forced downwardly to remove the material in the sheet S directly above the aligned die openings 275, thereby forming trapezoidal slots in the sheet S at selected of the positions above the die openings 275. However, in the case of those interponents 305 which are in their inactive positions, as shown in Fig. 27, the legs 306 of these interponents merely travel downwardly to one side of the corresponding punches 301 and these punches are either held frictionally in their upper inoperative positions in the guide openings in the punch guide block 277, or they bear lightly on the sheet S without penetrating it, the retaining plate 299 working idly through the slots 302 of such punches.

In the case of the consecutive numbering punches, it is desirable that the punch interponents 305 be restored to their inactive positions when the slotting operation has been performed. To this end a stationary cam 323, Fig. 25, is secured to the punch guide block 277 and extends upwardly through an opening in the retaining plate 299 to a point near the position occupied by the plate 294 on the punch head 292 when it is in its lowermost position. Each of the interponents 305 in the consecutive numbering group has a lug 324 which extends laterally to a point above the cam 323. The lugs 324 and the cam 323 have complementary cam surfaces thereon, and when the punch head 292 approaches its lowermost position, these cam surfaces are engaged and those interponents 305 which were previously adjusted to their active positions are cammed back into their inactive positions, being held by the spring-pressed detents 309 cooperating with the notches 308 when the punch head 292 is restored.

The punches 301 which are to slot the book number, Fig. 52, in the sheet S as shown in Fig. 51, are shown in elevation in Fig. 26 and are positioned in the punch heads 292 and 293 above the middle and right-hand transverse columns of die openings 275, Fig. 27. A bracket 325 is secured to the table of the frame 271 to the right of the die assembly 272, as viewed in Fig. 26, this bracket having an opening 326 at the level of the sheet guideway SG to enable sheets to be passed into the die assembly 272. A comb 327 is secured to the top of the bracket 325 and a rod 328 is mounted therein in the same manner as the rod 313 is mounted in the comb 311, Fig. 25. A series of levers 329 is pivoted on the rod 328 respectively in alignment with the interponents 305, Fig. 26, in the book number group on the punch head 292, the lower ends of the levers 329 abutting the respective interponents 305. A link 330, Figs. 19 and 26, connects the upper end of each lever 329 to the upper end of a respective one of a series of three-armed levers 331 pivotally supported in a comb 332 carried by a bracket 333 to the right of the die assembly 273, Fig. 26. The bracket 333, like the bracket 325, is secured to the table of the frame 271 and has an opening 334 through which sheets may be advanced into the die assembly 273. The lower arms of the levers 331 abut the punch interponents 305 in the book number group on the punch head 293, and the middle arms of the members 331 extend laterally through the comb 332 and are rigidly connected to the shanks 335 of the keys 337. The key shanks 335 project through suitable openings in a cover plate 336 secured to the top edge of the comb 332, and the keys 337 provided thereon facilitate manipulation of the levers 331.

The keys 337 bear numerals as shown in Fig. 19 and it will be noted that there are twelve such keys of which four are allocated to each of the hundreds, tens and units orders of the book number, Fig. 52, the digits of which, it will be recalled, are represented according to a four-unit code. Thus, counting from the top as viewed in Fig. 19, the three keys 337 in the first row and the first key in the second row pertain to the hundreds order; the second and third keys 337 in the second row and the first two keys in the third row pertain to the tens order; and the last key 337 in the third row and the three keys 337 in the bottom row pertain to the units order.

When it is desired to condition the punch interponents 305, Fig. 26, of the book number groups in the punch heads 292 and 293, for slotting the book number in the body and stub of the sheet S, Fig. 52, as shown in Fig. 51, the proper keys 337 are manually depressed for this purpose. Normally the interponents 305 in the book number group on the punch head 292 are retained in their inactive positions by the detents 309. The interponents 305 in the punch head 293 have no detents but are initially adjusted to their inactive positions in the manner to be explained presently, and since the interponents 305 in the punch head 292 bear against the levers 329 which are connected by the links 330 to the levers 331, the levers 331 normally do not exert any force on the ends of the interponents 305 in the punch head 293. Likewise, the keys 337 and key levers 335 are normally retained in their upper positions as shown by the detents 309 acting on the interponents 305 in the punch head 292. However, when a key 337 is depressed, it rocks its lever 331 clockwise, as viewed in Fig. 26, to adjust the corresponding interponent 305 to its active position, and through link 330 the associated lever 329 is rocked clockwise, Fig. 26, to adjust its interponent 305 to an active position, in which position it is held by the detent 309. The weight of the key shanks 335 acting on the levers 331 is sufficient to maintain these shanks 335 and their connected keys 337 in their lower positions once they have been depressed, thereby affording to the observer an indication of which keys and interponents have been actuated.

A series of restoring levers 341 for the interponents 305 is pivoted on a shaft 339 disposed in an opening 338, Figs. 34 and 37, which is formed in the punch head 293 and extends transversely of the sheet guideway SG, Fig. 19, the shaft 339 being supported in this opening by small brackets 340 screwed to the punch head 293 and the levers 341 being maintained in spaced relation by suitable spacers disposed on said shaft. It will be noted, Fig. 29, that there are twelve interponents 305 in the book number group on the punch head 293; however, there are only six of the levers 341. The lower ends of these levers extend downwardly through an opening in the plate 294 and are horizontally aligned with the lugs 324 on the interponents 325, and each such lever is bent at its lower end for cooperation with the lugs 324 of two adjacent interponents 305. The levers 341 also extend upwardly from the shaft 339 above the surface of the punch head 293, and the shanks 342 of keys 343 are rigidly connected to the upper ends of the levers 341. The key shanks 342 are bent at right angles and the laterally extending portion of each shank bears on a spring-supported pin 344 mounted in the punch head 293. Thus the keys 343 are maintained in their upper positions at all times except when they are held down

manually, and when they are in such upper positions the lower ends of the connected levers 341 are held clear of the lugs 324 of the interponents 305.

When a key 343 is depressed, however, the connected lever 341 pushes against the lugs 324 of the two interponents 305 controlled thereby and forces these interponents into their inactive positions, shown in Fig. 26. Such restoration of the interponents 305 in the punch head 293 is effective to restore the associated levers 331, keys 337, links 330 and levers 329. The upper end of each lever 341 is connected by a link 345 to a respective one of a series of levers 346 which are mounted in the punch at 292 in a manner similar to that in which the levers 341 are mounted in the punch head 293. The lower end of each of the levers 346 is adapted to cooperate with two adjacent interponents 305 in the book number group in the punch head 292, so that these interponents are restored along with the restoration of the corresponding two interponents 305 in the punch head 293, and are retained in their inactive positions by their detents 309. When all of the punch interponents 305 in the book number groups are to be restored, all six of the keys 343 are momentarily depressed and the key board 336, Fig. 19 is thus cleared to enable the setting up of a new book number.

The slotting punch 301 which is allocated to the twenty-fourth index position from the right along the top of the body 85 of the sheet S, Fig. 52, which position is designated "Reg.," is shown in elevation in Fig. 30 and is aligned with the first die opening 275 from the right, Fig. 27, along the top of the die block 274, as viewed in this figure (it being recalled that the sheet S is fed face downwardly, Figs. 3 and 51, to the punch and die assembly). The interponent 305 for this particular punch 301 is supported in a comb bar 304 attached to the plate 294 of the punch head 292 in the same manner as are the other interponents 305 described hereinabove. However, the outer leg 307 of this interponent is somewhat wider than are the legs 307 of the other interponents 305, and a recess 347, Fig. 30, is formed in its upper edge. A small bracket 348, Figs. 19 and 30, is secured to the upper face of the punch head 292 above the just described interponent 305 and supports a vertical lever 349 pivotally mounted thereon. The lower end of the lever 349 is ball-shaped as indicated at 350, Fig. 30, and is seated in the recess 347 in the interponent 305, thereby affording a ball and socket connection between this interponent and the lever 349. The interponent 305 is provided with the usual detent 309, so that by manually manipulating the lever 349 the connected interponent 305 can be adjusted to an active or inactive position with respect to the aligned punch 301.

As indicated in Fig. 31, the comb 304 which carries the interponent 305 that is controlled by the lever 349, Fig. 30, also supports a series of other interponents 305 shown in elevation in Fig. 28, there being twenty-three of these other interponents 305 corresponding to the punches 301 aligned with the first twenty-three die openings 275 from the left, Fig. 27, along the upper edge of the die block 274, as viewed in this figure. A bracket 351 is mounted on the table of the frame 271 at the rear, or to the right as viewed in Fig. 28, of the punch head 292. A comb 352 secured to the top of the bracket 351 carries a rod 353 on which a series of twenty-three bell cranks 354, Figs. 19 and 28, are pivotally mounted in the slots

of the comb 352, opposite the interponents 305 along the rear or right-hand edge, Fig. 28, of the punch head 292. The depending arms of the bell cranks 354 about the outer ends of the aligned interponents 305, and the other arms of these bell cranks are pivotally connected to links 355, Figs. 24 and 28, which extend downwardly through openings in the bed plate 284 and the table of the frame 271 and are pivotally connected at their lower ends to bell cranks 356, mounted in staggered relation on a bracket 357 on the frame 271.

Each bell crank 356 is pivotally connected to the core of a solenoid 358 that is mounted on the bracket 357, there being twenty-three of the solenoids 358 for controlling the interponents 305 associated with the slotting punches 301 which are allocated to the first twenty-three index positions from the right, Fig. 51, along the upper edge of the sheet S. Energization of the solenoids 358 is controlled by a detecting means that is responsive to the positions of tabs as T, Fig. 41, at certain index positions on the printing devices D, this means being fully described hereinafter. Each solenoid 358 need only be momentarily energized in order to set its interponent 305 to an active position, the detent 309 functioning to hold the interponent in such active position until it is positively restored. Restoration of the interponents controlled by the solenoids 358 is effected by a stationary cam 323, Figs. 28 and 30, similar to the cam 323, Fig. 25, which is so positioned that it cooperates with cam surfaces on the lugs 324 of the interponents 305 to restore the interponents 305 to their inactive positions on completion of the downward stroke of the punch head 292 during a slotting operation. It will be noted in Fig. 31 that the cam 323 does not extend beneath the interponent 305 controlled by the hand lever 349, Fig. 30, and hence this latter interponent remains in the position to which it has been manually adjusted until the setting thereof has been changed by hand.

The means for advancing the sheets S into the face printer FP as they are received from the sheet conveying means in the guideway SG includes the shaft 359, Fig. 2A, on which certain feed rollers are mounted, as disclosed in the aforesaid Kranz patent, No. 1,955,814. This shaft 359 is driven continuously so long as the machine is in operation and it is utilized in the present instance to drive the sheet feeding means of the slotting mechanism SL. Thus, a sprocket wheel 360, Fig. 3A, is fast on the shaft 359 and is connected by a sprocket chain 361, Figs. 3A and 27, to a sprocket wheel 362 formed on a sleeve 363 rotatably mounted on a shaft 364 that is journaled in bearings on the frame 271 of the slotting mechanism SL to the right of the die assembly 273, Fig. 27, and below the bed plate 284. A sprocket wheel 365, considerably larger in diameter than the wheel 362, is also formed on the sleeve 363 and is connected by a sprocket chain 366 to a sprocket wheel 367 fixed on a shaft 368 journaled in bearings on the frame 271, to the right of the die assembly 272, Fig. 27. The diameter of the wheel 367 is less than that of the wheel 365 and hence the wheel 367 is rotated more rapidly than is the sprocket wheel 362 because of the step-up ratios afforded between the wheels 362 and 365, and 365 and 367, so that even though there is little or no step-up ratio between the first two sprocket wheels 360 and 362, Fig. 3A, the shaft 368 is driven considerably more rapidly than is the shaft 359, Fig. 3A. The just

described arrangement of sprocket wheels and chains affords a high step-up ratio without resorting to gear systems, which would be likely to take up an undue amount of space and would, therefore, be impractical in the present instance. A sprocket wheel 369, Fig. 27, is fixed on the shaft 368 and through a sprocket chain 370 drives a sprocket wheel 371 fast on the shaft 364, and inasmuch as the sprocket wheels 369 and 371 are of the same diameter, shafts 364 and 368 are rotated at the same rate. A third sprocket wheel 372 is fixed on the shaft 368 and through a sprocket chain 373 drives a sprocket wheel 374 on a shaft 375 journaled in the frame 271 to the left of the die assembly 272, Fig. 27, the wheels 372 and 374 having the same diameter so that the shaft 375 is driven at the same rate as are the shafts 368 and 364.

As shown in Fig. 27, openings 376 are formed in the bed plate 284 in the sheet guideway SG of the slotting mechanism SL directly above the shafts 364, 368 and 375, and feed rollers 377, 378 and 379 respectively mounted on these shafts project slightly through the openings 376 into the sheet guideway, as shown in Figs. 24, 25, 26 and 32, and because of the above described sprocket chain interconnections, these rollers 377, 378 and 379 are driven rapidly counterclockwise, as viewed in Figs. 33 and 34 for feeding the sheets into and out of the slotting mechanism SL. A shaft 396 is stationarily mounted parallel to the front edge of the bed plate 284 in brackets 390, 392 and 393 secured thereto, as shown in Figs. 3, 3A, 19, 20 and 27, and levers 397, 398 and 399 are rockably mounted on the shaft 396 at points opposite the rollers 377, 378 and 379 projecting through the bed of the sheet guideway SG. These levers carry gripping rollers respectively designated 400, 401 and 402 which are positioned directly above the rollers 377, 378 and 379, respectively, Figs. 19 and 24. Leaf springs as 400a, Fig. 32, act upon the levers 397, 398 and 399 to urge the rollers 400, 401 and 402 into engagement with the rollers 377, 378 and 379 respectively positioned therebelow.

As the sheet S is ejected from the face printing unit FP, Figs. 2, 2A and 3A, it is deposited in the sheet guideway SG of the slotting mechanism SL and is advanced by the printer FP until its leading edge enters the bite between the rollers 377 and 400, Fig. 24, whereupon the roller 377 acts to impel the sheet to the left, as viewed in Fig. 32, toward the die assembly 273. The leading edge of the sheet is advanced by the roller 377, Figs. 24 and 27, through the opening 334 in the bracket 333, Fig. 26, and into the space between the die blocks 280 and 281 and the punch guide blocks 282 and 283, respectively, of the die assembly 273. The trailing end portion of the sheet being still in the bite of the rollers 377 and 400, the leading edge emerges from the die assembly 273 and advances into the bite between the rollers 378 and 401, and these rollers continue to advance the sheet through the opening 326 in the bracket 325 and into the die assembly 272 where it passes between the die block 274 and punch guide block 277.

Sheet stop fingers 420, Figs. 3, 19, 27 and 28, are positioned in suitable recesses in the punch guide block 279, Fig. 25, to the left of the die block 274, Fig. 27, the fingers 420 being formed on an arm of a lever 421, as shown in Fig. 28, that is pivotally mounted on the shaft 396. A leaf spring 422 acting on the lever 421 normally maintains the stop fingers 420 seated against the die

block 276 in position to arrest the leading edge of a sheet S, as shown in Fig. 3, as the sheet is advanced by the rollers 378 and 401 into the die assembly 272.

Means have been provided for controlling the operation of the sheet positioning and punching devices, and the construction of and drive for such means will now be described. In the main section of the machine, shown in Fig. 3A, a shaft 380 is driven by the platen operating shaft 222 through the medium of the reduction gearing 243, and this shaft 380 carries a pinion 381, Figs. 3A, 33 and 34, which meshes with a pinion 382 rotatably mounted on a housing 383 carried by the frame of the machine. The pinion 382 in turn meshes with a pinion 384 on a shaft 385 that is journaled in the housing 383 and extends into a housing 386 secured thereto. A bevel gear 387 fast on the shaft 385 meshes with a bevel gear 388 on the end of a shaft 389 which, as shown in Fig. 3A, is journaled in the housing 387 and in a bracket 390 on the bed plate 284 of the slotting mechanism SL, the shaft 389 extending across the bed plate 284 transversely of the sheet guideway SG thereon. A cam shaft 391, Figs. 3, 3A, 19 and 20, is journaled at one end in the bracket 390 on the bed plate 284 and extends at right angles to the shaft 389 and parallel to the shaft 396 through bearings in the brackets 392 and 393 on this bed plate. Bevel gears 394 and 395 interconnect the shaft 389 and cam shaft 391 so that the cam shaft 391, in effect, is driven by the shaft 380, Fig. 3A, which is to say, constantly so long as the printing machine is in operation.

As the sheet S is advanced into the slotting mechanism in the manner previously explained, the trailing edge of the sheet S is freed from the rollers 377 and 400, Fig. 24, by the time its leading edge has engaged the stop fingers 420. However, the roller 378 is still in contact with the sheet S when it is in the position shown in Fig. 3, and hence means is provided to elevate the roller 401, Fig. 24, away from the sheet S after the sheet has engaged the stop fingers 420. Thus, the lever 398 that carries the roller 401, Fig. 27, has a roller 423, Fig. 20, that rides on the periphery of a cam 424 on the cam shaft 391, and at a time in the operation of the slotting mechanism SL shortly after the sheet S has engaged the stop fingers 420, the cam 424 elevates the roller 401 out of engagement with the surface of the sheet S.

The punch heads 292 and 293, Figs. 19 and 20, are depressed to effect the slotting operation on the sheet S while the stop fingers 420 are in their lower or sheet stopping positions shown in Fig. 36. Such actuation of the punch heads is brought about by clutching the shaft 287, Figs. 23 and 32, to the flywheel 104a. Thus a lever 427, Figs. 3, 19 and 32 is pivotally mounted on the shaft 396 and carries a roller 428 which is engaged with a cam 429 on the shaft 391, and this lever is connected by a link 430 to the arm 196a of a lever 186a associated with the clutch 103a. As explained hereinabove, the construction and operation of the clutch 103a is identical with the clutch 103, Fig. 6, and hence when a rise on the cam 429, Fig. 32, engages the roller 428 and elevates the lever 427 and link 430, the clutch 103a is tripped and clutches the shaft 287 to the flywheel 104a for one complete revolution of the shaft 287 and this, through the medium of the eccentrics 289, Fig. 23, is effective to cause a reciprocation of the punch heads 292 and 293. When the slotting operation has been performed and the punch heads 292 and 293 restored to their upper posi-

tions, the cam 424, Fig. 19, lowers the roller 401 into engagement with the sheet S.

The lever 421 which carries the stop fingers 420 has a roller 425, Figs. 20 and 28, which rides on the periphery of a cam 426 on the cam shaft 391, and when the slotting operation has been performed, as just described, the high portion on the cam 426 engages the roller 425 and rocks the lever 421 to elevate the stop fingers 420 out of sheet stopping position. Such elevation of the stop fingers 420 releases the sheet to the action of the rollers 378 and 401, Fig. 24, which thereupon advance the sheet to the left as viewed therein, into the bite of the rollers 379 and 402. These latter rollers advance the sheet S to an ejector generally designated 431 at the left end of the sheet guideway SG, Figs. 2 and 3.

The ejector 431, Figs. 1, 2 and 3, is supported on a bracket 432 secured to the frame 271 of the slotting mechanism SL, and includes a shaft 433 which is journaled in the bracket 432 and carries a pair of friction rollers 434 which are positioned to receive the sheet S as it is delivered from the guideway SG by the roller 379. A pulley 435 on the shaft 433 is connected to a pulley 436 on the shaft 375 by a belt 437 so that the rollers 434 are rotated counterclockwise as viewed in Fig. 2. Discs 438 rotatably mounted in the frame 439 pivotally suspended from a rod 440 are positioned to bear upon the rollers 434 for gripping each sheet as it is delivered to these rollers. A sheet collector K, Figs. 2 and 3, adjustably supported on the bracket 432 receives the sheets as they are successively ejected by the rollers 434.

A sheet detecting means has been provided for controlling the operation of the consecutive numbering device so that the sheets are numbered consecutively as they are advanced through the slotting mechanism even though there may be a temporary interruption in the feeding of such sheets. Referring to Figs. 3, 21, 24 and 27, an opening 403 is afforded in the bed plate 284 in the portion of the sheet guideway SG intermediate the roller 377 and the die assembly 273. As best shown in Figs. 21 and 27, a shaft 404 stationarily mounted in brackets 405 disposed on each side of the sheet guideway SG extends transversely of the guideway and parallel to the shaft 389. A rocker generally designated 406 is mounted on the shaft 404 and is connected by a leaf spring 407 to an arm 408 which carries a roller 409 substantially in vertical alignment with the aforesaid opening 403 in the bed of the sheet guideway SG. An arm 410 of the rocker 406 extends toward the shaft 389 and carries a roller 411 which cooperates with a cam 412 on the shaft 389. A spring 413 is anchored at one end to a retaining collar 414 fixed to the shaft 404, and at its other end to the arm 410 to urge the roller 411 into engagement with the periphery of the cam 412.

When a sheet S ejected by the face printing unit FP is caught by the rollers 377 and 400, Fig. 24, and is advanced toward the die assembly 273, the roller 411, Fig. 21, is riding on the high portion of the cam 412 so that the sheet is free to pass over the opening 403 in the bed plate 284. However, at a time when a sheet should be positioned over such an opening 403 in the course of operation of the machine, a relief in the cam 412 moves opposite the roller 411 and the rocker 406 is rotated counterclockwise, as viewed in Fig. 21, by the spring 413, thereby swinging the arm 408 downwardly. If a sheet S is over the opening 403 at the time the lowest point on the periphery

of the roller 409 is even with the surface of the bed plate 284; downward movement of the roller 409 and arm 408 is arrested and the leaf spring 407 is flexed. This does not interfere with the feeding of the sheet S inasmuch as the roller 409 is rotatably mounted on the arm 408 and the pressure exerted by the roller 409 on the sheet is relatively slight. Moreover, the roller 409 need only be lowered momentarily, as will be seen presently. If no sheet is engaged by the roller 409, the roller enters the opening 403 as the rocker 406 completes its counterclockwise movement, Fig. 21.

A block 415 of insulating material is secured to the rocker 406 for conjoint movement therewith and this block 415 supports a switch generally designated 416 which comprises two spaced upper and lower contact blades 418 and 417, respectively, which extend generally parallel to and above the level of the arm 408 at all times. The lower contact blade 417 bears on an insulated lug 419 on the arm 408 and when the rocker 406 is in its upper inoperative position, the upper contact blade 418 is out of engagement with the blade 417. When the arm 418 is rocked downwardly, however, and a sheet S is over the opening 403 to be engaged by the roller 409, downward movement of the contact blade 417 is arrested and this blade is flexed toward the blade 418. The block 415 continues to swing downwardly as the rocker 406 is pivoted about its axis and hence the blade 418 is brought into contact with the blade 417, thereby conditioning an electrical circuit for the purpose to be described hereinafter. If no sheet is present over the opening 403 at the time the arm 408 is rocked downwardly, the blade 417 is not arrested in the manner just described and hence it remains out of engagement with the blade 418. Thus, the rocker 406 and associated parts constitute a detector which is operative to detect the presence or absence of sheets over the opening 403 at predetermined times in the course of operation of the machine.

Consecutive numbering device

A consecutive numbering device which controls the solenoids 322, Figs. 2, 24 and 32, for slotting the consecutive numbers in the sheets as S, Fig. 52, is shown in detail in Figs. 35 to 38, inclusive, and comprises three stepping switch units respectively designated by the reference characters 441—U, 441—T and 441—H, Fig. 2 (respectively allocated to the tens, units and hundreds orders of the consecutive numbers) which are carried by the frame 271 of the slotting mechanism SL. These switch units are of identical construction except that certain parts present in 441—U and 441—T have been omitted from 441—H in the present instance, and hence a detailed description of the constructional features of the switch unit 441—U will be representative of the disclosures of all three such units, such differences as may exist being pointed out hereinafter.

Each switch unit as 441—U comprises a rotor 442, a stator 443 and an electromagnet as 444—U, Fig. 35, known as a stepping magnet, all of these parts being mounted on a vertical frame 445 that is secured at its top and bottom to girders 446 and 447 provided in the stand 271, Fig. 2. The rotor 442 includes a horizontal shaft 448, Figs. 35, 37 and 38, journaled at its ends in bearings formed in the frame 445 of the switch unit 441—U, and a series of five double-armed wipers 449—1,

449—2, 449—3, 449—4 and 449—5 fixedly mounted on this shaft in axial alignment and spaced from each other, these wipers being electrically insulated from the shaft. The magnet 444—U is supported in upright position above the rotor assembly 442, with its armature 450 at the top. An arm 451 depending from the armature 450 extends downwardly to one side of the magnet 444—U and below this magnet, and a pawl 452 pivotally mounted on the lower end of the arm 451 is urged by a spring 453 into engagement with the periphery of a ratchet wheel 454 fast on the shaft 448. Another spring 455, Fig. 37, fastened to a suitable anchor 456 on the frame of the magnet 444—U tends to urge the arm 451 and pawl 452 in such a direction as to impart counterclockwise movement to the ratchet 454 and shaft 448, as viewed in Fig. 37. Such movement of the pawl 452 under the influence of the spring 455, however, is normally restrained by a lug 457 on the frame 445. When the magnet 444—U is energized, it pulls its armature 450 downwardly to effect retraction of the pawl 452 in the amount of one tooth on the ratchet 454, and if the magnet is subsequently de-energized the spring 455 acting on the arm 451 restores the pawl 452 into engagement with the lug 457, thereby advancing the ratchet 454 in the amount of one tooth. A suitable spring detent 458 is provided to prevent reverse movement of the ratchet wheel 454.

The stator 443 has a bank of stationary contacts 460 comprising five sets of contacts 460—1, 460—2, 460—3, 460—4 and 460—5, Figs. 35, 37 and 38, which are arranged for cooperation with the wipers 449—1, 449—2, 449—3, 449—4 and 449—5 of the rotor 442, the contacts of the stator 443 being mounted in a hollow semi-cylindrical insulating member 461 that is secured to and carried between arcuate end pieces 462, Figs. 35 and 38, embodied in the frame 445 of the switch unit, so as to partially surround the wipers 449—1, 449—2, 449—3, 449—4, and 449—5. Each set of contacts 460 is aligned with a respective wiper 449 and comprises twenty-six contacts spaced apart and lying in a vertical plane with the individual contacts respectively positioned along radii of a semi-circle about the shaft 448. The inner ends of the contacts project from the interior of the insulating member 461 into the circular path of movement of the outer ends of the corresponding wiper for cooperation therewith. The outer ends of the stationary contacts 460 project from the insulating member 461 and are provided with soldering terminals. Corresponding contacts in each of the sets 460—1, 460—2, and so on, are in lateral alignment with each other, and the spacing of the various contacts in each set is equal to the amount of movement of the outer end of the cooperating wiper whenever it has been actuated by the stepping magnet 444—U. It will be noted in Fig. 38 that each arm of a wiper as 449—1 comprises a pair of cooperating spring contacts which are disposed one on each side of the plane in which the corresponding stationary contacts as 460—1 are positioned. As the wiper is rotated in a step-by-step manner as described above, the spring contacts of first one arm of the wiper and then the other arm successively grip and wipe over the opposing faces of the successive stationary contacts in the aligned set.

It will be noted in Figs. 43 and 45 that the inner ends of twenty-five of the twenty-six stationary contacts 460 in each set as 460—1 extend toward the shaft 448 merely far enough to enable the wiper arms to make contact therewith. However, the twenty-sixth or uppermost stationary con-

tact, as viewed in Fig. 37, extends farther inwardly and engages a commutating surface 463 on the associated wiper, thereby enabling an electric path to be established through this twenty-sixth contact and the wiper to any one of the remaining twenty-five stationary contacts. Referring now to the circuit diagram of the consecutive numbering device, Figs. 39 and 40, it will be noted that for convenience the twenty-sixth stationary contact has been omitted from each set and the wipers have been represented as being directly connected to the external circuits, the twenty-five stationary contacts shown in each set corresponding to the first twenty-five stationary contacts from the bottom, as viewed in Fig. 37.

Referring now to Figs. 21, 24 and 27, it will be recalled that the roller 409 of the sheet detector 406 is lowered into sheet engaging relation each time a sheet as S, Fig. 3, should be passing over the opening 403 in the bed plate 284, and if a sheet is present, the switch 416 on the rocker 406 is caused to close. As shown in the circuit diagram, Fig. 39, one of the contacts of the switch 416 is connected by a conductor 464 to one pole of a suitable source of current (hereinafter referred to as "battery") such as the generator G driven by the motor M3, Fig. 2. The other contact of the switch 416 is connected by a conductor 465 to one end of the winding of the stepping magnet 444—U of the switch unit 441—U, the other end of this winding being connected to another pole (hereinafter referred to as "ground") of the source of current as generator G, Fig. 2. Hence, if the presence of a sheet is detected and the switch 416 closed, the stepping magnet 444—U is energized and retracts the pawl 452, Fig. 37, one tooth on the ratchet 454. When the roller 409 of the sheet detector is again elevated by the cam 412, the switch 416 opens and thereupon the stepping magnet 444—U is deenergized to enable the spring 455, Fig. 37, to restore the pawl 452 and advance the ratchet 454, shaft 448 and wipers mounted thereon one step, thereby advancing each wiper from one stationary contact of the stator 443 to the next stationary contact in a counter-clockwise direction, as viewed in Fig. 37, or clockwise as viewed in Fig. 39. However, if the absence of a sheet is detected, the stepping magnet 444—U is not energized and hence the wipers of the switch unit 441—U remain stationary. Thus the switch unit 441—U may be utilized as a means for counting the sheets in a run as they are successively fed to the slotting mechanism SL.

As shown in Figs. 35, 36 and 37, an insulating stud 470 on the arm 451 cooperates with one of the blades of a normally closed contact 469 that is mounted on the frame of the stepping magnet 444—U, and when the magnet 444—U is in an energized condition, the stud 470 opens the contact 469, but when the magnet 444—U is deenergized, the contact 469 closes. The contact 469 is schematically represented in Fig. 39 where it is shown as a relay contact that is normally closed when the magnet 444—U is deenergized and opened when the magnet 444—U is energized. One terminal of the contact 469 is connected to the end of the winding of the magnet 444—U opposite the end of this winding which is connected to ground. The other terminal of the contact 469 is electrically connected by conductors 471 and 472 to the wipers 449—1 and 449—2.

It will be noted in Fig. 39 that all of the twenty-five contacts in the set 460—1 are wired together and are electrically connected to a conductor 466,

Figs. 39 and 40, connected to one terminal of a contact 467A of a manually operable switch generally designated 467 known as a zero-setting switch. The switch 467 includes three contacts 467A, 467B and 467C that are normally open when the handle 467E of the switch is not actuated, and a contact 467D which is normally closed when the handle 467E is not actuated. These contacts are all connected on one side to battery and are adapted to render certain circuits operable in dependence upon the setting of the switch 467. However, the switch 467 is not operated at any time in the operation of the machine other than a zero-setting operation of the consecutive numbering device, to be described subsequently, and hence for present purposes it may be assumed that the contacts 467A, 467B and 467C are open and that the contact 467D is closed. Thus the stationary contacts in the set 460—1 of the switch unit 441—U are ineffective to establish any circuit through the wiper 449—1 while consecutive numbering is taking place.

In the case of the stationary contacts 460—2, Fig. 39, commencing with the first contact at the top, each alternate contact 460—2 down to and including the nineteenth contact and thereafter each contact to the twenty-fifth contact, inclusive, are all wired together and are electrically connected by a conductor 467 to a conductor 468 which is connected to a terminal of the normally closed contact 467D of the switch 467, the other terminal of which contact is connected to battery. Assuming that the wipers of the switch unit 441—U are in their zero positions, as shown in Figs. 47 and 47A, the first time a sheet is detected and the stepping magnet 444—U is operated, the wiper 449—2 is stepped onto the first stationary contact 460—2 at the top, as viewed in Fig. 39. Thereupon a circuit is completed from battery at the contact 467D of the switch 467, Fig. 40, through the conductors 468 and 467 to the top contact 460—2, thence through the wiper 449—2 and conductors 472 and 471 to a terminal of the contact 469, which will have closed upon the deenergization of the magnet 444—U when the wiper 449—2 was stepped onto the first stationary contact 460—2. Circuit, therefore, is continued through the winding of the magnet 444—U to ground, causing a second energization of the magnet 444—U to take place. The pawl 452, Fig. 37, is retracted one tooth on the ratchet 454 when the magnet 444—U is energized as just described, and the contact 469 is opened to break the energizing circuit that has been established through this contact to the winding of the magnet 444—U, so that the magnet 444—U is again deenergized. Prior to the closure of the contact 469 upon this deenergization of the magnet, the pawl 452 will have advanced the ratchet 454 substantially in the amount of one tooth, thereby advancing the wiper arm 449—2 onto the second contact 460—2 from the top, Fig. 39. Inasmuch as this second contact is a dead contact, no further circuit is established through the contact 469 of the magnet 444—U and hence this magnet remains deenergized until the sheet detecting switch 416 is again closed.

Thus it will be seen that for each advance of the wiper arms as 449—2 occasioned by the closure of the sheet detecting switch 416, there is a succeeding advance of the wipers caused by the establishment of an automatic stepping circuit, as aforesaid, and this is continued until the wiper 449—2 attains a position in which it engages the eighteenth contact 469—2 from the top, Fig. 39.

(the direction of the movement of the wipers being clockwise, as shown in Figs. 39 and 40). Such positioning of the wiper 449-2 signifies that nine sheets have been counted since the wiper moved away from its zero position, shown in Fig. 39. When the tenth sheet is detected and magnet 444-U is alternately energized and deenergized, the wiper 449-2 moves onto the nineteenth contact and is thereafter stepped onto the twentieth contact by the automatic stepping means. However, it will be noted that the twentieth to twenty-fifth contacts, inclusive, are all electrically connected to the conductor 467 and hence the automatic stepping circuit is repeatedly established as the contact 469 successively opens and closes during successive energizations and deenergizations of the magnet 444-2, and this continues until the wiper 449-2, as well as the other wipers in the switch unit 441-U, has been restored to its zero position, whereupon the automatic stepping circuit is broken until a new sheet has been advanced to the slotting mechanism SL.

In the set of stationary contacts 460-3 of the switch unit 441-U, commencing with the second contact from the top, Fig. 39, the reference characters 1, 2, 3 and so on up to 9 have been applied to each alternate contact from the second to the eighteenth, inclusive, and the stationary contacts in the set 460-4 have been numbered in an identical manner. Since the consecutive numbering device is used to control notching of the consecutive numbers, Fig. 52, in the sheets fed to the slotting mechanism, this device is essentially a counter or odometer, and insofar as the units order is concerned, it repeatedly counts whole numbers in the series from one to ten as sheets are fed through the machine. For convenience in wiring the circuits for the consecutive numbering device, are so arranged that every alternate contact in the series 460-3 and 460-4 is allocated to one of the significant digits 1 to 9 counted by the units stepping switch 441-U, as aforesaid, and as has been noted hereinabove, the wipers of this switch unit are given two steps of advancing movement for each sheet counted, from the digit 1 to the digit 9 in each series of ten sheets. The wipers 449-3 and 449-4 will, therefore, always come to rest on a stationary contact pertaining to a significant digit, once they have been advanced away from their zero positions, shown in Figs. 39 and 40, until they have reached positions representative of the numerical value 10.

The contacts numbered 1 to 9, inclusive, in the sets 460-3 and 460-4 are electrically interconnected with the four slotting punch solenoids 322, Figs. 2 and 32, allocated to the units order of the consecutive number, in such a manner that as the wipers are progressively advanced from their number 1 to their number 9 positions, these solenoids 322 are energized in various combinations representative of the significant digits indicated by the angular positions of the wipers 449-3 and 449-4. For example, in the case of the digit 1, the wiper 449-3 engages the number 1 contact in the case 460-3 series, which contact is electrically connected by a conductor 473 to the winding of the first solenoid 322 to the left, Fig. 40, in the units order group, the other side of this solenoid winding being grounded. The number 1 contact of the 460-4 series is not electrically connected to the windings of any of the solenoids 322.

The wipers 449-3 and 449-4 are connected by conductors 474 and 475 to one terminal of a

switch 476; Figs. 19, 22 and 40, that is operated by a cam 477 on the shaft 389 of the slotting mechanism SL. At the proper time in the operation of the machine, after each instance the sheet detector 406, Fig. 21, has been operated, the cam 477 momentarily closes the switch 476 and extends battery through the conductors 475 and 474 to the wiper arms 449-3 and 449-4 thereupon, assuming these wipers to be in positions representative of the digit 1, circuit continues through the conductor 473 to the connected solenoid 322, thereby energizing the solenoid and causing it to adjust its punch interponent 305, Fig. 25, to an active position. In like manner, when the wipers 449-3 and 449-4 have been adjusted to positions representative of any of the other digits from 1 to 9, inclusive, the solenoids 322 are energized either singly or in the appropriate combinations for setting their punch interponents 305 to active positions. If the wipers are in their zero positions none of the solenoids 322 is energized.

The wiper 449-5 is advanced in unison with the other wipers in the stepping switch unit 441-U, and whenever the wipers 449-3 and 449-4 are advanced beyond positions representative of the digit 9, the wiper 449-5 successively engages the nineteenth contact 460-5 from the top, Fig. 40, then the twentieth contact designated by the reference character 10 pertaining to this numerical value, thence to the twenty-first contact, and finally back to its zero position, shown in Fig. 40; it being recalled that the automatic stepping circuit is repeatedly established through the wiper arm 449-2, Fig. 39, once the setting of the wipers has exceeded the digital value of 9, until such zero positions have been attained by the wipers. The number 10 contact 460-5 and the contact on each side of it are electrically connected by a conductor 478 to one side of the winding of the stepping magnet 444-T in the tens order switch unit 441-T, Fig. 39; the other side of this winding being grounded, as shown. The wiper 449-5 is electrically connected to battery at the switch contact 467D, Fig. 40, and hence, as the wiper 449-5 in the units order switch 449-U passes over the aforesaid three active contacts 460-5 including the number 10 contact in that series, the magnet 444-T is energized. Then as the wiper 449-5 returns to its zero position, the magnet 444-T is deenergized, and the wipers 449-1' to 449-5', inclusive, of the stepping switch 441-T are advanced one step away from their zero positions. A contact 469' on the magnet 444-T thereupon closes an automatic stepping circuit in the same manner as the contact 469 of the magnet 444-U does, to cause the wipers of the switch unit 441-T to be advanced into positions representative of the digit 1. Thus a carry-over is effected from the units order switch 441-U to the tens order switch 441-T for every tenth sheet detected by the detector 406. The wiper 449-5 is wide enough to engage two contacts 460-5 simultaneously so that only a single carry-over impulse is transmitted to the tens order in the above-described operation.

The construction and electrical connections of the stepping switch unit 441-T are identical with those for the switch unit 441-U, except that the tens order switch 441-T controls the energization of the four punch solenoids 322 allocated to the tens order of the consecutive number. Moreover, for every hundred sheets detected by the detector 406, a carry-over is made first from the units order switch 441-U to the tens order switch

441—T in the manner aforesaid, and then from the tens order switch 441—T to the hundreds order switch 441—H. This latter carry-over is effected by the wiper arm 449—5' of the switch 441—T as it passes over the number 10 contact in the 460—5' series, completing an energizing circuit to the stepping magnet 444—H of the switch 441—H, for imparting a step of advancing movement to the wiper arms 449—1'' of the hundreds order switch 441—H. The contact 469'' of the magnet 444—H thereupon closes an automatic stepping circuit to advance these wipers another step as in the case of the other switch units. The stepping switch 441—H controls the four punch solenoids 492 allocated to the hundreds order of the consecutive number in the same manner as the other switch units control like punch solenoids. Since the present structure has a capacity for consecutive numbers extending into three orders, no carry-over need be effected by the stepping switch 441—H and hence no carry-over wiper or stationary contacts corresponding thereto has been provided in this switch unit. In all other respects, however, the hundreds order switch unit 441—H is similar to the units and tens switches 441—U and 441—T, respectively.

Referring to Figs. 35, 36 and 38, a plate 480 attached to the frame 445 of each switch unit as 441—U carries a stub shaft 481 on which a number wheel 482 is fixedly mounted. A pinion 483 fast on the shaft 482 meshes with a pinion 484 fast on the shaft 448 so that the number wheel 482 is geared to the shaft 448 to be rotated in unison with the wipers 449. Numerals are marked on the periphery of the wheel 482 and as the wheel 482 is rotated these numerals are successively presented to a sight opening 485, Fig. 35, in a panel 486 to indicate the angular positions of the wipers in terms of the digits indicated by such positions. It may be desirable in some instances to adjust the wipers of the switch units as 441—U to positions representative of a selected numerical quantity prior to starting the machine in operation and for this purpose number-setting switches 487—U, 487—T and 487—H, Fig. 39, have been provided for the various orders. Taking the switch 487—U as an example, this switch is connected on one side to battery and on its other side to the conductor 465 leading to the winding of the magnet 444—U. A push button 488 is associated with each of the number-setting switches as 487—U and when it is desired to step the wipers of the switch 441—U around to a selected angular position, the magnet 444—U is operated by repeatedly depressing the push button 488 to effect the desired positioning of the wipers as indicated by the setting of the number wheel 482, Figs. 35 and 36. In a like manner the other switch units 441—T and 441—H can be manually adjusted for setting up the initial number upon the consecutive numbering device.

When it is desired to zeroize all of the switch units, the handle 467E of the zero-setting switch 467, Figs. 2 and 40, is rocked to close the contacts 467A, 467B and 467C, and open the contact 467D. Such closure of the contacts 467A, 467B and 467C extends battery to the conductors 466, 466' and 466'' leading to the stationary contacts in the sets 460—1, 460—1' and 460—1''. If any of the wipers 449—1, 449—1' or 449—1'' is standing in an off-zero position at this time, battery continues through such wiper and the contact as 469 of the stepping magnet as 444—U to effect energization of such stepping magnet, which re-

sults in opening of the contact as 469 and breaking the energizing circuit to thereby deenergize the magnet. Thus the wiper arms in that switch unit are advanced a step, and this operation repeats itself so long as the handle of the zero-setting switch 467 is held down until the wipers have returned to their zero positions in which the wiper as 449—1 is no longer in engagement with any of the stationary contacts as 460—1 shown in Fig. 39. Thus, the wipers of all the switch units 441—U, 441—T and 441—H are all restored to their zero positions shown in Figs. 39 and 40, and the handle 467E of the switch 467 may then be released. The carry-over circuits are disabled during this zero-setting operation due to opening of the contact 467D as aforesaid.

Transfer of classification data from printing devices to sheets

As previously explained, each printing device as D, Figs. 48 and 51, has twenty-four index positions at which identifying means such as tabs T may be located to represent various items of data referred to herein as classification data. The twenty-four index positions on each printing device D correspond respectively to the twenty-four index positions along the top of the bill sheet S, Fig. 52. The printing devices D additionally bear other records such as the identification data A and A', Fig. 52, which are transferred to the body and stub portions of each sheet S by direct contact of the sheet with the type characters on a printing device D. It is desired in the present instance that the classification data represented by the tabs T in the first twenty-three index positions from the left, as viewed in Fig. 3A, on each printing device D shall be transferred to the sheet S and represented therein by slots in the upper margin of the body 85, Fig. 63, of the sheet. Thus, if the printing device D bears a tab T in the first index position, as shown in full lines in Fig. 48, there should be a slot in the first index position from the right along the top of the sheet S, Fig. 52, and so on.

Preferably all those printing devices D which have tabs T in their twenty-fourth index positions, as indicated in broken lines on the device D shown in Fig. 41, are not to be utilized to produce impressions of identification data as A and A' upon the regular bill sheets S when the machine is utilizing other printing devices D not bearing such twenty-fourth position tabs to imprint data A upon these sheets. If any printing device D bearing a twenty-fourth position tab passes through the machine, it is skipped, which is to say, a bill as S, Fig. 52, is not prepared from or under control of such a printing device. This is done for the reason that when a printing device D bears a tab T in its twenty-fourth index position, the person whose name appears on the printing device is to receive a final bill, and it is desired that all these final bills be prepared out of the ordinary billing routine. As explained hereinabove, a slot is to be formed in the twenty-fourth index position from the right (designated "Reg."), Fig. 52, along the top of each regular bill S, Fig. 52, but, as has just been observed, the printing device D under control of which such a regular bill is to be produced has no tab in its twenty-fourth index position. Hence, during such a run of printing devices the lever 349, Figs. 2, 19 and 30, controlling the punch interponent 305 in the twenty-fourth, or "Reg." index position, Fig. 52, is so positioned as to render the interponent 305

active so that each of the sheets S produced by the machine in that run will bear a slot in the "Reg." position. When final bills are being prepared, however, the lever 349, Figs. 2, 19 and 30, is adjusted to its inactive position so that none of the sheets S that are passed through the slotting mechanism SL will be slotted in its "Reg." position.

Suitable means have been provided for sensing the classification data represented by the positions of tabs T on the printing devices D. Thus, referring to Figs. 41 to 45, inclusive, the rocker 247 which is part of the selector that controls operation of the platen P, Figs. 1A and 2A, and the web feeding, back printing, severing and other devices mounted in the frame 71, Fig. 3B, has an upstanding arm 490 which is connected by a link 491 to an arm 492 on another rocker 493 pivoted at 494 on the machine frame 72 intermediate the rocker 247 and the printing device magazine 229. The rocker 493 has a bridge portion 494 which transversely overlies the printing device guideway in the same manner as does the selector bar 245. As best shown in Fig. 51, the bridge 494 is C-shaped in cross-section to afford a recess 495 opening into the bridge 494 from the forwardly disposed or right-hand face thereof, as viewed in Fig. 44; this recess extending the length of the bridge.

The ends of a series of twenty-four Bowden cables 494, Figs. 44 and 45, the purpose of which will be explained subsequently, are mounted in alignment along the bridge 494, the sheaths of these cables being anchored to a plate 497 secured to the upper face of the bridge 494, and the Bowden wires encased by these sheaths extending down through suitable openings in the upper leg of the bridge 494 and through openings in one leg of an angle plate 498 that is disposed in the recess 495. Headed sensing pins 499 disposed in suitable openings in the lower leg of the bridge 494 are secured to the lower ends of the Bowden wires beneath the angle plate 498. The twenty-four Bowden cables 496 are mounted in the bridge 494 in such a manner that the sensing pins 499 are aligned with the twenty-four index positions on each printing device D as it is advanced through the guideway. A block 500, Figs. 44 and 45, is secured to the frame 72 below the level of the printing devices D in the printing device guideway and is provided with a series of twenty-four openings 501 substantially in vertical alignment with the sensing pins 499.

The printing device feeding means is operated in a step-by-step manner, and during each step of movement it withdraws the printing device D from the bottom of the magazine 229 and moves it into a position intermediate the sensing pins 499 and the magazine 229, the tabs T facing backward toward the magazine. In the next step of movement of the feeding means, the printing device D which was in this last mentioned position is advanced to a position in which the tabs T overlie the aligned openings 501 in the block 500. The printing device is now in a position to be sensed by the pins 499 when the rocker 493 is actuated, and such actuation of the rocker 493 is brought about when the rocker 247, Figs. 41 and 42, is depressed by the roller 253, this motion being transmitted through the link 491 to the rocker 493 so that the two sets of sensing pins 499 and 246 are concurrently lowered to sense the tabs on the printing devices, if any, disposed therebelow.

In this connection it is to be noted that the sensing pins 499 and 246 are spaced apart along the printing device guideway in an amount equal to the distance through which each of the printing devices D is moved whenever the printing device feeding means is actuated by the eccentric 230, Fig. 42, on the platen operating shaft 222. Hence, each printing device D, in the course of its movement along the printing device guideway, is sensed first by the pins 499 and then, after it has received another step of advancing movement, by the pins 246. After being sensed by the pins 246, each printing device D is again advanced a step to be brought into printing position beneath the platen P, Figs. 2A and 3A. Thus, it will be seen from the foregoing that from the time each printing device D is sensed by the pins 499, Figs. 44 and 45, it is advanced twice before it arrives at printing position beneath the platen P, and the rocker 493 which carries the sensing pins 499 will have been operated a second time to enable these pins to sense the next succeeding printing device D during this interval.

The platen is operated three times to make triplicate impressions of data A and A', Fig. 52, from the printing device D in printing position onto the sheet S in such position, and as an incident to the last of these printing operations of the platen P, the rocker 493, Figs. 42 and 44, is actuated a third time to enable the pins 499 to sense the third printing device D. As explained previously, the operation of the sheet feeding means of the machine is such that after a sheet S has received impressions of data as A and A', Fig. 52, from a printing device D, it is advanced to a position intermediate the platen P and the face printing unit FP, where it is arrested momentarily and then passes through the face printing unit FP and, upon being ejected therefrom, is advanced by the sheet feeding means of the slotting mechanism SL into the position shown in Fig. 3 in the die assemblies 272 and 273 of the slotting mechanism to be operated upon by the slotting punches. Then, in the course of the printing operations of the platen P upon the next succeeding sheet S, the rocker 493 is actuated a fourth time to sense the fourth printing device D. Shortly thereafter, the slotting punches are operated and the first sheet is slotted and discharged in the collector K, Fig. 2.

Thus, to summarize, after the sensing pins 499 have been operated once to sense the tabs T on a particular printing device D, they will be brought into operation three more times to sense the tabs on the next three succeeding printing devices D before the sheet S which received the impressions of identification data A and A' from the particular printing device D has been slotted. Therefore, if the sets of classification data successively sensed by the pins 499 are to be incorporated in the proper bill sheets as S, Fig. 52, some data storage means must be provided to retain the classification data represented by the positions of tabs as T on each printing device D, Fig. 41, until such time as the sheet S which is to receive such data has attained a position in the machine where such data may be recorded thereon by the slotting mechanism SL. To this end a data storage means to be presently described has been provided.

As has been explained, the sheaths of the Bowden cables 496 are anchored at one end to the bridge 494 of the rocker 493. The other ends of these cable sheaths are anchored in blocks

502, Figs. 3A, 41 and 42, supported on other blocks 503 carried by the machine frame 72. The Bowden wires extend downwardly through openings in the blocks 502 and 503 and are connected to pins 504 which bear in most instances on the upper blades of a series of switches 505 insulatedly mounted in blocks 506 carried by the machine frame 72. When the rocker 493 is depressed to enable the pins 499 to detect the presence or absence of tabs on the printing device D positioned in sensing relation therewith, the loops of the Bowden cable sheaths are drawn slightly downwardly and if a pin 499 should engage a tab and be thereby arrested, the loop of the Bowden cable sheath, which continues to constrict as the rocker 493 descends, exerts a camming action on the Bowden wire enclosed thereby to force the end of the wire carrying the pin 504 downwardly, thus actuating the associated switch 505.

In illustrating the control circuits of the machine in the wiring diagram of Fig. 46, only two representative control circuits for the punching means that are controlled by the sensing of tab positions 1 to 23 have been represented, and a further control circuit that is governed by the sensing of a tab in the twenty-fourth position is illustrated in association therewith so as to constitute a complete showing of the electrical control elements of the machine. Thus it will be noted in Fig. 46 that of the twenty-four Bowden cables 496, only three have been shown, and these are aligned with switches 505-22, 505-23 and 505-24, but it will be understood that similar switches 505-1 to 505-21 are also provided in the machine in circuits which correspond with the circuits associated with the switches 505-22 and 505-23. The switches 505-1 to 505-23 are normally open when the sensing pins 499 are in their upper positions, and hence, in the case of these switches, when a sensing pin 499, in being lowered, engages a tab T and causes the connected Bowden wire to be cammed a certain distance out of its sheath as just explained, the connected switch in the series 505-1 to 505-23, inclusive, is closed. However, in the case of the sensing pin 499 in the twenty-fourth position, or to the extreme left as viewed in Fig. 46, engagement of such a pin with a tab T in the twenty-fourth index position on the printing device D causes a normally closed switch 505-24 to open, for a purpose to be explained presently. Thus it will be seen that the switches 505 (with the exception of the switch 505-24) indicate by their closed positions the positions of tabs as T on the printing device D in the course of a sensing operation performed by the pins 499.

The angle plate 499, Figs. 42, 44 and 45, disposed in the recess 495 in the sensing bridge 494 rests on the lower leg of the bridge 494 when the rocker 493 is in its upper or inoperative position. The leg of the angle plate 498 through which the wires of the Bowden cables 496 pass is seated at its ends in slots formed in arms 507 pivotally connected to the rocker 493, Figs. 41 to 45, inclusive. When the rocker 493, bridge 494 and sensing pins 499 are lowered toward the printing device guideway to bring about a sensing operation, the plate 498 tends to move downwardly with the bridge 494. Upon engagement of one or more sensing pins 499 with a tab or tabs T on the printing device D, downward movement of the plate 498 is arrested by the heads of the pins 499 that are engaging tabs

abutting against the leg of the plate 498. The arms 507 and plate 498 are, therefore, held stationary while the rocker 493 completes its downward movement to bring about the actuation of the switches 505 as aforesaid. Then as the rocker 493 is restored to its upper position, should there be any tendency for the previously actuated Bowden wires remaining in the same positions relative to their sheaths which they occupied during the sensing of the tabs T, the plate 498 is drawn upwardly in unison with the bridge 494 until the arms 507 engage the lower ends of adjusting screws 508 supported by brackets 509 on the machine frame 72. The plate 498 is thereupon arrested in its upward movement while the rocker 493 and bridge 494 continue to ascend to their fully restored positions shown in Fig. 44, and any sensing pins 499 which were displaced upwardly relative to the other pins 499 in the bridge 494 are brought back into alignment with these pins, thereby restoring the wires of the connected Bowden cables.

As mentioned previously, the data represented by the positions of identifying means such as tabs T on each printing device D, are not utilized immediately, but must be held in abeyance until such time as the sheet S in which such data are to be recorded has reached the position in the slotting mechanism SL shown in Fig. 3, which is an appreciable time subsequent to the sensing of the aforesaid data on the printing device D. For the purpose of temporarily retaining the data sensed on succeeding printing devices D, four banks of storage relays generally designated 510, 511, 512 and 513, Fig. 46, are provided for retaining the data sensed by the pins 499 on successive printing devices D, these relays constituting settable storage devices controlled by the switches 505.

Thus, to consider the first bank of storage relays 510, it will be noted that there are twenty-three of these relays respectively designated 510-1, 510-2, 510-3 and so on to 510-23. It will be noted however that only two of such storage relays are shown in Fig. 46. Each of these relays is double-wound, having, as in the case of the relay 510-23, an energizing winding as 514 and a holding winding as 515. Moreover, each such relay has two contacts as 516 and 517 which are normally open when the relay is deenergized. Suitable automatic switching means comprising the contacts of three multi-contact relays 518 are operatively interposed between the tab-controlled switches 505 and the energizing windings as 514 of the storage relays 510. The relays 518 have, in the aggregate, twenty-three contacts as 519 which are normally open when these relays are deenergized. One terminal of each such relay contact is connected to a corresponding one of a series of twenty-three conductors generally designated 520, each of which is respectively connected by a conductor as 521 to one terminal of a respective switch as 505-1 in the series 505-1 to 505-23, inclusive, the other terminals of all of the switches 505-1 to 505-23, inclusive, being connected by a common conductor 522 and a normally closed switch 564 to ground. The contacts as 519 of the relays 518 are connected on their other sides by conductors as 523, to one end of the energizing winding as 514 of a respective relay as 510-23 in the bank of storage relays 510. The other ends of the windings as 514 of these storage relays are connected by a common conductor as 524 to a conductor 525 which is also connected to one end of the winding of each of

the relays 518, which will be hereinafter referred to as transfer relays, the other ends of the windings of these relays being grounded. The conductor 525 leads to a terminal of a contact 526A associated with a cam 526 which is one of a series of three cams, 526, 527 and 528 diagrammatically represented in Fig. 46.

The actual construction of this cam assembly and the cooperating contacts thereof will be described in detail hereinafter but for the present it will be assumed that the cams are of the configurations shown in Fig. 46 and that they are mounted on a shaft 529 which is driven in timed relation with the advancing movement of printing devices as D, through the printing device guideway, the direction of rotation of the cams 526, 527 and 528 being counterclockwise as viewed in Fig. 46. It may be mentioned at this point that the cam 526 controls the entry of classification data, derived from the sensed printing and control devices, into the banks of storage relays in sequence; the cam 528 controls the reading out of such data bank by bank to the slotting punch solenoids 358, Figs. 36, 28 and 46; and cam 527 effects the clearing of the banks in rotation after the data stored therein have been read out.

The cam 526 has a lobe 526X which successively closes and opens four contacts 526A, 526B, 526C and 526D equidistantly spaced around the periphery of the cam 526 as the cam is rotated. The rider of each of the cam contacts 526A, 526B, 526C and 526D is connected to a common conductor 530 which is electrically connected by a conductor 531 to one terminal of the switch 505—24, the other terminal of this switch being connected to battery. It will be assumed that when the printing device D is in a position to be sensed by the pins 499, the lobe 526X of the cam 526 is in a position whereat it closes the contact 526A at the instant when the sensing pins 499 are lowered into engagement with the tabs as T on the printing device D. (In order to facilitate illustration, the pins 499 have been shown in their raised positions, Fig. 46, notwithstanding that the cam 526 has closed its contact 526A, Fig. 46.) Assuming that this printing device bears a tab T in its twenty-second position from the right, the aligned sensing pin 499 upon engaging this tab pushes the connected wire of its Bowden cable and closes the switch 505—22, Fig. 46. Thereupon ground is extended through this switch to the conductor 521 and a conductor 520 leading to the contact 519 of the transfer relay 518. Further assuming that the printing device D does not bear a tab in its twenty-fourth index position, the switch 505—24 remains closed and thus battery is extended from this switch through the conductors 531 and 530 to the closed contact 526A and thence by conductors 525 and 524 to the windings of the transfer relays 518, and to the energizing windings as 514 of the storage relays 510 at the instant when the switch 505—22, Fig. 46, is closed. Hence, the transfer relays 518 are energized and the ground which has been applied on the relay contact 519 in the manner aforesaid continues through the conductor 523 to the winding 514 of the storage relay 510—22, which relay thereupon energizes and closes its contacts 516 and 517.

The windings as 515 of the storage relays 510 are connected on one side by a conductor 532 to battery, and on their other sides to the contacts as 516 of these relays, and when a relay contact as 516 is closed, it enables battery to be extended through the winding as 515 of the relay

to a conductor 533 which leads to a contact 527A associated with the cam 527. This cam has four contacts 527A, 527B, 527C and 527D equidistantly spaced around its periphery, and these contacts are closed at all times except when a notch 527X in the cam 527 successively moves opposite the riders of these contacts to successively open and close the contacts as the cam 527 rotates. Each contact as 527A is grounded when closed and it will be noted that all of the contacts of the cam 527 are closed whenever the lobe 526X on the cam 526 closes a contact as 526A of this cam. Hence, at the instant the switch 505—22 is closed to apply ground on the winding 514 of the storage relay 510—22 and thereby energize this relay to close its contact 516, the contact 527A of the cam 527 is closed and applies ground on the conductor 533. Thus a circuit is completed from battery through the conductor 532, winding 515 of relay 510—22, relay contact 516, conductor 533 and through the closed cam contact 527A to ground. A holding circuit is therefore established for the storage relay 510—22 through the winding 515 thereof to hold this relay energized so long as the cam contact 527 is closed. Hence when the switch 505—22 opens upon restoration of the sensing pins 499 to their upper positions shown in this figure and removes ground from the winding 514 of the relay 510—22; this has no effect upon the relay 510—1 inasmuch as it is being held in its operated condition by its winding 515. Cam 526 opens its contact 526A concurrently with the restoration of the sensing pins 499 to thereby remove battery from the windings of the transfer relays 518 and thereby deenergize these relays which thereupon open their contacts as 519.

Thus it will be seen that the storage relay 510—22 in the first bank of storage relays 510 is energized and locked up through its holding circuit whenever a printing device D bearing a tab T in the first index position is sensed by the pins 499 at a time when the cam 526 is in position to close its contact 526A. Similarly, if tabs had been present in any other of the first twenty-three index positions on such a printing device, corresponding ones of the storage relays 510 would be energized and locked up through their holding circuits in the same manner as was the relay 510—22, and thus the settings of the storage relays 510 would represent the positions of the tabs T on the printing device in the same manner as the setting of the relay 510—22 of this bank of relays indicates that a tab is present in the twenty-second index position on the printing device D. Of course, it is apparent that several transfer relays 518 may be employed, or a single transfer relay having twenty-three contacts as 519 could be utilized; however, such a relay might not be as reliable in operation as the several relays 518 each having, at the most, eight contacts, and hence the latter arrangement is preferred in the present instance.

A group of three transfer relays 536 (only one shown); is associated with the second bank of storage relays 511, these transfer relays being similar to the relays 518 and having, altogether, twenty-three contacts 536A which are normally open when the relays 536 are deenergized. Each of these relay contacts is connected on one side to the energizing or left-hand winding, Fig. 46, of a respective storage relay 511—1, 511—2, and so on, in the bank of storage relays 511, and on the other side to a respective one of a series of conductors 535 which are respectively connected to

the conductors 520 leading from the tab-controlled switches 505. The windings of the transfer relays 536 are grounded on one side and are connected on the other side by a conductor 537 to a conductor 538 that leads to the contact 526B of the cam 526. The conductor 538 is also connected to the ends of the energizing windings of the storage relays 511 opposite the ends of these windings to which the contacts 536A of the transfer relays 536 are connected. The holding or right-hand windings of the storage relays 511 are connected on one side by a conductor 539 to battery and on their other sides to contacts as 540 of their respective storage relays 511 so that when any of these relays is energized, a holding circuit is completed from battery through the holding winding of such relay, a relay contact as 540, and a conductor 541 to the contact 527B of the cam 527, which contact will be closed and grounded at the time any of the storage relays 511 is initially energized.

The cams 526, 527 and 528 are all rotated through ninety degrees in the time interval which elapses during the advance of successive printing devices D into sensing position with respect to the sensing pins 499. Hence, after the first printing device D has been advanced away from this sensing position and the second printing device has attained sensing position, the lobe 526X on the cam 526 closes the contact 526B. Such closure of contact 526B extends battery through the conductor 538 to one side of the energizing or left-hand windings of the storage relays 511, at the same time applying battery on the windings of the transfer relays 536 to energize these relays and close the several contacts thereof. The storage relays 511 are thus conditioned for energization under control of the switches 505, which are responsive to the sensing pins 499, and depending upon which of the switches 505 are closed when the second printing device D is sensed by the pins 499, selected ones of the storage relays 511 are energized and are locked up through their holding circuits including the conductor 541 and cam contact 527B in a manner similar to that explained hereinabove with reference to the storage relays 510.

When the storage relays 511 in the second bank have been set in accordance with data derived from the second printing device D, the printing device feeding means is actuated to advance a third printing device D into sensing position, and thereafter the cam 526 attains a position whereat it closes the cam contact 526C to thereby apply battery on a conductor 542 that leads to the energizing windings of the storage relays 512 in the third bank. The windings of the transfer relays 543 for the third bank of storage relays 512 are grounded at one end and are connected at their other ends to a conductor 544 which is connected to the conductor 542. Therefore, when the sensing pins 499, Fig. 46, are lowered to engage the tabs T on the third printing device D, the transfer relays 543 are energized and close their several contacts 543—A, and the energizing windings of the storage relays 512 are thus conditioned for energization under control of the switches 505. The contacts 543—A of the transfer relays 543 interconnect the conductors 520 leading from the switches 505 with the energizing windings of the storage relays 512 in the same manner as do the transfer relays 518 in the case of the storage relays 510, and depending upon which of the tab-controlled switches 505 have been closed in response to the engagement of cor-

responding sensing pins 499 with tabs T, selected of the storage relays 512 are energized and are locked up through their holding or right-hand windings which are incorporated in a holding circuit including a conductor 545 that leads to the contact 527C of the cam 527.

When the printing device feeding means has been operated to feed the third printing device D away from sensing position and has advanced the fourth printing device D into such position, the cam 526 attains a position in which it closes the contact 526D when the sensing pins 499 are lowered into engagement with the tabs T on the fourth printing device D. Closure of contact 526D extends battery through a conductor 546 to the energizing windings of the storage relays 513 in the fourth bank, thereby conditioning these windings for energization, and also applies battery on the windings of transfer relays 547 associated with the storage relays 513. The transfer relays 547 thereupon energize and close their several contacts 547—A to interconnect the energizing windings of the storage relays 513 with the conductors 520 leading to the respective tab-controlled switches 505. Depending upon the presence or absence of tabs beneath the sensing pins 499, the switches 505 are selectively closed as aforesaid and thereupon the corresponding storage relays 513 are energized, these relays being then locked up through their holding windings and a holding circuit including the conductor 548 that leads to the contact 527D of the cam 527.

The cam 528, Fig. 46, has four contacts 528A, 528B, 528C and 528D, equidistantly spaced around the periphery thereof, and these contacts are successively closed and opened by a lobe 528X of the cam 528. Prior to the time the fifth printing device D is sensed by the pins 499, the lobe 528X engages and closes the contact 528A to thereby cause ground to be applied on a conductor 550 that leads to the windings of three shift relays 551 associated with the first bank of storage relays 510. These shift relays 551 have, in the aggregate, twenty-three contacts 553 which are normally open when the relays are deenergized. The windings of the relays 551 being connected through battery to ground at one end and connected at their other ends to the conductor 550, these relays energize when the cam 528 closes its contact 528A. The contacts as 517 of the storage relays as 510—1 in the bank of storage relays 510 are grounded on one side and on their other sides are connected by conductors as 552 with the terminals of respective contacts as 553 of the shift relays 551. Closure of the contacts as 553 of the shift relays 551 applies the ground derived from the relay contacts as 517 of the energized ones of the storage relays 510 to corresponding conductors as 554, included in a group of twenty-three conductors generally designated 555, which are respectively connected to the windings of the punch solenoids 358, Figs. 2, 28 and 46, controlling the interponents 305 for the slotting punches 301 that record the classification data in the first twenty-three index positions from the right, Fig. 52, along the tops of the bill sheets as S.

The windings of the solenoids 358 are connected on one side to battery, as shown, and hence when the other end of the winding of one of these solenoids is grounded as just described, the solenoid energizes and adjusts its interponent 305 to an active position. It is to be noted in this connection that only those storage relays

510 which were energized and locked up in response to the sensing of tabs in the corresponding index positions on the aforesaid first printing device D to be sensed, will have their contacts as 517, Fig. 46, closed to supply ground to the windings of the corresponding punch solenoids 328, and hence the punch solenoids 358 which are energized under control of the storage relays 510 are operated in accordance with the classification data stored in these storage relays to effect recording of such data on the sheet S which bears the impression of the identification data A and A', Fig. 52, made from the first printing device D.

Once the selected punch interponents 305 have been adjusted to their active positions by energization of their controlling solenoids 358, they retain such active positions until the slotting operation has been performed and hence it is no longer necessary to maintain the solenoids 358 or the storage relays 510 energized. Hence, prior to the time the fifth printing device D is sensed by the pins 499, the cam 528 opens its contact 528A, thereby removing ground from the conductor 550 and deenergizing the shift relays 551, Fig. 46, and the punch solenoids 358, and the cam 527 momentarily opens its contact 527A, thereby removing ground from the conductor 533 and breaking the holding circuits of the locked up storage relays 510, causing these relays to be deenergized. While the fifth printing device D is in sensing position, the cams 527 and 528 attain the angular positions shown in Fig. 46 with respect to their cooperating contacts, and it will be noted that the cam 527 will have again closed its contact 527A to enable the holding circuits for the storage relays 510 in the first bank to be re-established, if and when any of these storage relays is energized. The cam 526 closes its contact 526A concurrently with the lowering of the sensing pins 499 into engagement with the aligned tabs T on the fifth printing device D (it being recalled that these pins 499 are shown in their elevated positions in Fig. 46 although the cam contact 526A is closed, to facilitate illustration). The data represented by the positions of tabs on the fifth printing device D is entered in the first bank of storage relays 510 in the same manner as the data derived from the first printing device D was entered in this bank of relays, which is to say that depending upon the tab positions selected of the storage relays 510—1 to 510—23, inclusive, are energized and locked up until shortly prior to the time when the ninth printing device D is to be sensed.

Prior to the time the sixth printing device D is sensed by the pins 499, the cam 528 closes its contact 528B to apply ground on a conductor 556 which leads to the windings of the shift relays 557, Fig. 46, associated with the second bank of storage relays 511 and thereupon the shift relays close their several contacts 557A to enable ground to be extended from the contacts as 558 of the energized ones of the storage relays 511, through the contacts 557A of the relays 557 in circuit therewith, and through conductors generally designated 559 to the conductors generally designated 554 and thence to the windings of the punch solenoids 358, which correspond to the locked up ones of the storage relays 511. Thus the data which was derived from the second printing device D and stored in the second bank of storage relays 511 is transferred, in effect, to the solenoids 358 which set the punch interponents 305, Fig. 28, accordingly. When this has

been accomplished, the cam 528, Fig. 46, opens its contact 528B to remove ground from the conductor 556 and thereby deenergize the shift relays 557, and the cam 527 opens its contact 527B to break the holding circuit for the storage relays 511 and release those storage relays which were locked up, the cam contact 527A again closing when the storage relays 511 have been so released.

When the sixth printing device D has attained sensing position and is sensed by the pins 499, Fig. 46, the cam 526 will have closed its contact 526B to enable the data derived from this printing device D to be stored in the second bank of storage relays 511 in the manner described hereinabove in the case of the second printing device D. The data derived from the second printing device which was transferred to the punch solenoids 358 and thence to the punch interponents 305 is recorded by the slotting of the upper edge of the corresponding bill sheet S, Fig. 52, upon operation of the slotting punches 301.

Prior to the time that the seventh printing device D is sensed by the pins 499, the cam 528 closes its contact 528C to ground the conductor 560 that leads to the windings of the shift relays 561, Fig. 46, thereby energizing these relays and causing them to close their several contacts 561A. The data which was derived from the third printing devices and stored in the third bank of storage relays 512 is transferred to the punch solenoids 358 through the medium of the shift relays 561 in the same manner as was explained hereinabove in connection with the storage relays 510 and 511 and when such transfer of data has been effected, the cam 528 opens its contact 528C to deenergize the shift relays 561 and the punch solenoids 358; also, the cam 527 momentarily opens its contact 527C to break the holding circuit for the locked up storage relays 512 and thus deenergize these relays. When the seventh printing device D is to be sensed, the cam 526 closes its contact 526C to enable the data derived from this printing device to be stored in the third bank of storage relays 512 in the same manner as was the data derived from the third printing device D.

Prior to the sensing of the eighth printing device D by the pins 499, the cam 528 momentarily closes its contact 528D to apply ground on a conductor 562 that leads to the windings of shift relays 563 associated with the fourth bank of storage relays 513, and upon the consequent energization of these shift relays the data retained in the storage relays 513 is transferred to the punch solenoids 358; thereupon the cam 528 opens its contact 528D to deenergize its shift relays 563 and punch solenoids 358, and the cam 527 momentarily opens its contact 527D to release the locked up storage relays 513. When the eighth printing device D is sensed, the cam 526 closes its contact 526D to divert the data derived from this printing device into the fourth bank of storage relays 513 in the same manner as the data derived from the fourth printing device D was previously stored in this bank of relays.

From the foregoing it will be seen that means have been provided to enable the classification data represented by tabs T on each printing device D, Fig. 41, to be sensed, stored, and thereafter transferred to the punch solenoids 358 at a time in the operation of the machine when the sheet S, Fig. 52, which has received imprints of

identification data A and A' from said printing device D has attained a position in the slotting mechanism SL at which it may be operated upon by the slotting punches 301. Since there are four printing device feeding operations intermediate the sensing of the classification data represented by tabs as T on a given device D, and the time in the operation of the machine when such data are recorded by the slotting punches in the sheet S which bears the identification data A and A', Fig. 52, imprinted directly from said printing device D, four banks of the storage relays 310, 311, 312 and 313 have been provided to enable the classification data derived from successive printing devices to be stored in rotation in the different banks of storage relays until the first bank has been cleared, whereupon the data derived from the next printing device to be sensed by the pins 499 is stored in this first bank of relays, and the process is then repeated. It will be evident, however, that if a greater or less number of printing device feeding operations occurred between the sensing of the classification data represented by the tabs and the time when such data are recorded by the slotting punches, a correspondingly greater or less number of storage relays would be provided, the object in all instances being to enable the derived data to be held in abeyance until such time as it is needed.

It may be desirable in some instances to render the data storage means inoperative during a run of printing devices D through the machine and to this end a switch 564, Figs. 1A, 3A and 46, has been interposed between ground and the conductor 522, leading from the tab-controlled switches 505. This switch is normally closed when the data storage means is to be operative, but when it is not desired to store data the switch 564 is opened to disable the energizing circuits for the storage relays in the various banks. The machine then operates in the conventional manner without slotting the bill sheet S, the selector including the sensing pins as 246, Fig. 42, continuing to function as explained in Hartley Patent No. 2,002,737.

If, in the course of normal operation of the machine, a printing device D having a twenty-fourth position tab is sensed, the switch 505-24, Fig. 46, opens and withholds battery from the energizing windings of the bank of storage relays which would otherwise receive the data derived from such printing device, thereby preventing any of these storage relays from being energized and locked up. Then, when this bank of storage relays is placed in controlling relation to the slotting punch solenoids 358, no data will be read out therefrom and the punch interponents 305 will therefore remain in their inactive positions.

The means for timing the operations of the various parts of the data storage apparatus has been represented in Fig. 46 as comprising cams 526, 527 and 528 and their cooperating electrical contacts. In the actual construction of the machine, this function is performed by a sequence switch generally designated 570, Figs. 1, 19, 47 and 48. In the sequence switch 570, those parts which perform the same functions as do corresponding parts of the timing cam assembly diagrammatically shown in Fig. 46, bear identical reference characters. Thus, as shown in Figs. 47 and 48, a shaft 529 is journaled at its ends in bearings 571 carried by upright arms 572 of a bracket 573 secured to the upper surface of the bed plate 284 of the slotting mechanism SL. A sprocket wheel 574 is fast on the shaft 529, and

a sprocket chain 575 is passed around this sprocket wheel and around a sprocket wheel 576 on the shaft 389 which drives the cam shaft 391 of the slotting mechanism SL. Since the shaft 389 is driven in timed relation with the shaft 380, Fig. 3A, which in turn drives the shaft 241 on which is mounted the cam 238, Fig. 42, that controls the printing device feeding means, the shaft 529 is rotated at a rate determined by the rate at which the printing devices D are advanced through the machine. The ratio of the sprocket wheels 574 and 576 being in this instance four-to-one, the shaft 529 of the sequence switch 570 advances through ninety degrees in the interval from one printing device feeding operation to the next, the direction of rotation of the shaft 529 being counterclockwise as viewed in Fig. 48.

The shaft 529 has a square cross-section for a portion of its length, as shown in Fig. 48, and there are five sequence cams 577, 578, 579, 580 and 581, Fig. 47, mounted on the square portion of the shaft 529 to be rotated therewith. The front faces of these cams as viewed in Fig. 48, are shown in perspective in Fig. 49, and the opposite faces of these cams are shown in perspective in Fig. 50. Each cam comprises a central disc 582 of insulating material having a square opening 583 to receive the shaft 529, and a pair of metal plates 584 and 585 mounted on opposite faces of the disc 582, as shown in Figs. 49 and 50. The metal plates 584 and 585 serve as electrical conducting surfaces and are electrically and mechanically connected together by rivets 590 which are passed through the plates and the intervening insulating material of the cam, binding the parts together as a unit. Spring contacts 586 are mounted in suitable insulating blocks 587 supported by an arm 588 of the bracket 573, Figs. 47 and 48, in position to cooperate with the faces of the cams 577 to 581, inclusive.

Considering particularly the cam 577, Fig. 49, it will be noted that there are two contacts 586 cooperating with the conductive plate 584. One of these contacts 586 bears constantly on the plate 584 and is electrically connected to ground, thereby maintaining ground on both of the plates 584 and 585 of the cam 577, Figs. 49 and 50. The other contact 586 bears on the plate 584 the greater portion of the time while the cam 577 is being rotated by the shaft 529 but intermittently enters a cut-out portion or recess 527A in the plate 584 to bear upon the insulating disc 582. The recess 527A corresponds to the contact 527A of the cam 527, Fig. 46, inasmuch as the contact 586 which constantly engages the plate 584 is grounded and the other contact 586 is connected to the conductor as 533, Fig. 46, and at predetermined intervals the electrical connection from conductor 533 to ground is broken when the recess 527A moves under the aforesaid other contact 586. Similarly, two spring contacts 586 cooperate with the plate 585 on the cam 577, Fig. 50, and are circumferentially aligned with recesses 527B and 527C, respectively, corresponding to the cam contacts 527B and 527C, Fig. 46, so that the electrical connections from ground to these contacts 586, and hence to the conductors 541 and 545 (see Fig. 46), respectively, are intermittently broken and reestablished as these recesses move under their respective contacts. The relative angular spacing of the recesses 527A, 527B and 527C in the plates 584 and 585 on the cam 577, Figs. 49 and 50, are such that during the rotation of the shaft 529, Figs. 47 and 48 (assuming an

initial position of the cam 527 as shown in Figs. 49 and 50), the recess 527B is the first to open its contact, followed ninety degrees later by the recess 527C opening its contact, and one hundred eighty degrees subsequent to the latter, by the recess 527A opening its contact, in the same sequence as the cam 527, Fig. 46, opens the contacts 527B, 527C and 527A, it being assumed throughout the present description that the directions of rotation of the cams 577 to 581, inclusive, are counterclockwise, as viewed in Fig. 49, and clockwise as viewed in Fig. 50.

The plate 584 of the cam 578 cooperates with a pair of contacts 586, one of which is grounded and bears constantly on the surface of the plate 584, and the other of which is circumferentially aligned with a recess 527D in the plate 584 and is electrically connected to the conductor 548, Fig. 46. This recess is so positioned with respect to the recesses as 527A in the plates as 584 of the cam 577 that it corresponds to the contact 527D, Fig. 46, of the cam 527, which is to say, that it breaks the electrical connection between the contacts 586 bearing on the plate 584 of the cam 578 at a time ninety degrees after the recess 527C, Fig. 50, opens its contact. The plate 585 on the opposite face of the cam 578 is grounded by the contact 586, Fig. 49, through the medium of the rivets 550, and cooperates with two contacts 586 which are aligned respectively with lugs 528A and 528B of the plate 585 and are electrically connected to conductors 550 and 556, Fig. 46, an electrical connection between the grounded plate 585 and either of the two contacts 586 being established only when such contact is riding on a lug 528A or 528B. The times at which such electrical connections are established during the rotation of the cam shaft 529, Figs. 47 and 48, are such as to provide the same effect as in the case of the cam 528, Fig. 46, successively closing the contacts 528A and 528B.

A pair of contacts 586, one of which is grounded, cooperates with the plate 584 of the cam 579, Fig. 49, which plate has a lug 528C that engages the other of the contacts 586 (connected to the conductor 560, Fig. 46) and establishes an electrical connection between it and the grounded contact at a time in the rotation of the cam shaft 529 corresponding to the time when the cam 528, Fig. 46, would close its contact 528C. Likewise, the plate 585 on the opposite face of the cam 579 cooperates with a pair of contacts 586, one of which is idle and the other of which is connected to the conductor 562, Fig. 46, and this plate has a lug 528D which intermittently establishes electrical connection between the grounded plate 585 and the contact 586 connected to the conductor 562 to produce the same effect as the cam 528 closing its contact 528D.

Each of the plates 584 and 585 of the cams 580 and 581 cooperates with a respective pair of contacts 586, and one contact of each pair cooperating with the plates 584 is connected by the common conductors 530 and 531 (as in the case of the contacts associated with the cam 526, Fig. 46) to one terminal of the switch 505—24, Figs. 46 and 49, controlled by the Bowden cable 496 that is allocated to the twenty-fourth index position on the printing devices D. The plates 584 and 585 of the cam 580, and 584 and 585 of the cam 581 have lugs 526A, 526B, 526C and 526D, respectively, corresponding to the cam contacts having like reference characters in Fig. 46, these lugs operating to close circuit between the co-

operating pairs of contacts 586 to produce the same effect (that is, successively applying battery to the conductors 525, 538, 542, and 546, respectively, Fig. 46) as would the cam 526 in successively closing and opening its contacts as the shaft 529 rotates.

Thus it will be seen that the cams 577 to 581, inclusive, Figs. 49 and 50, of the sequence switch 570, Figs. 47 and 48, perform the same functions as would the cams 526, 527 and 528, Fig. 46, in controlling the timing of the various parts of the data storage apparatus. As explained hereinabove, the arrangement of cams and contacts shown in Fig. 46 is merely diagrammatic, the actual arrangement of the sequence switch preferably being that shown in Figs. 47 to 50, inclusive. These devices have the advantages of being of simple and inexpensive construction and easy to repair. Moreover, they are compact and can, therefore, be installed in a location on the machine, as shown in Fig. 19, where space is limited.

Operation of the machine

Prior to initiation of operation of the machine, a roll of paper R, Fig. 2A, is mounted in the stand 70 and a web W, Figs. 2A and 3B, is led from this roll and is threaded through the various devices such as the web looping and withdrawing, back printing, and severing means mounted in the frame 71. A supply of printing devices D is stacked in the magazine 229, Figs. 1A, 3A, 41 and 42, from which they are to be withdrawn and advanced serially through the machine. The ratio of the gears as 243, Fig. 3A, is adjusted in accordance with the type of printing to be effected, for example, in case bill sheets as S, Fig. 52, are to be produced by the machine, the ratio must be such as to accommodate triplicate printing inasmuch as the identification data A and A' are to be impressed at three places upon a sheet as S from each printing device D. This means that during two out of every three revolutions of the platen operating shaft 222, Fig. 42, the sleeve 234 is disconnected from the plunger 232 of the eccentric 231 to thereby disable the printing device feeding means during such cycles and maintain each printing device D in printing position beneath the platen P, Figs. 3 and 3A, while three impressions are made therefrom by the platen P onto a sheet as S. As explained previously, the knob 268, Fig. 42, is adjusted to its "skip" position and a single pin 246 is inserted in the selector bar 245 in the twenty-fourth position thereon to cause the machine to skip all printing devices D carrying tabs as T in their twenty-fourth positions, as shown in dotted outline in Fig. 41.

The motors M2 and M3, Figs. 2 and 2A, which drive the perforating mechanism PM and slotting mechanism SL are set into operation for constantly driving the flywheels 104 and 104a which constitute the driving members of the clutches 103 and 103a, respectively. The motor M1, Fig. 2A, for the main section of the machine is now set into operation for driving the main drive shaft 80, Fig. 3B, and this drive shaft, through the medium of the bevel gears 220 and 221 constantly drives the platen operating shaft 222. The clutch 81 is normally in its operative condition and hence when drive shaft 80 commences to rotate, it acts through the medium of the clutch 81 to drive the web feeding, back printing, severing and other devices mounted on the frame 71, and the sheet feeding and stopping means for the main section of the machine in-

cluding the feed tape pulley shafts 136 and 136', the stop finger cam shaft 623 and the feed roller 634, Fig. 2A.

Also included among the operative mechanisms driven by the shaft 80 through the medium of the clutch 81 are the sheet feeding and stopping and clutch control means for the perforating mechanism PM. Thus in Figs. 3B, 5, 8, 9 and 10, the pulley shaft 136 drives the feed rollers 122, 142 and 205, and the shaft 160 drives the cam shaft 151 which controls the gripping rollers 156 and 212, the sheet stop fingers 165, and the clutch 103 for the punch operating shaft 102 of the perforating mechanism PM. Referring to Figs. 2A, 3A, 19 and 27, the shaft 359, which is part of the sheet feeding means of the face printer FP, continually drives the feed rollers 377, 378 and 379 of the slotting mechanism SL in the manner explained hereinabove, and the shaft 380 which is geared to the platen operating shaft 222 drives the cam shafts 389 and 391 of the slotting mechanism SL to thereby control operation of the sheet detector 416 of the consecutive numbering means, the sequence switch 570, and to control the gripping roller 401, the sheet stop fingers 420 and the clutch 103a, Fig. 23, for the punch operating shaft 287.

In the following description of operation of the machine, reference will be made to "cycles" of the machine and by a cycle is meant the period normally required for the cam shaft 623, Figs. 3A and 3B, to make a complete revolution starting from its rest position. Because of the fact that the machine is in the present instance adapted for triplicate operation, the cam shaft 623 makes only one revolution to three of the platen operating shaft 222; hence, a "cycle" is equivalent to three revolutions of the platen shaft 222.

Inasmuch as several printing device feeding operations are required at the initiation of each run to bring the first printing device D to printing position beneath the platen P, the first few cycles of the machine are at least partially idle, which is to say, the various mechanisms may function in the normal manner but are merely effective to produce a series of incomplete or dummy bill sheets which do not bear any identification or classification data such as are derived from the printing devices. However, such sheets may be back-printed and face-printed with the form or re-occurring data. Likewise, those slotting punches which are manually controlled, namely, the book number punches and the punch which is adapted to make an indication at the position designated "Reg.," Fig. 52, to indicate that the bill is regular, are rendered operative.

Furthermore, the consecutive numbering device is operated in response to the passage of these dummy sheets into the slotting mechanism SL and thereby causes these sheets to be slotted according to consecutive numbers. It is desired, of course, that the first completely printed and slotted bill sheet S to be produced by the machine shall bear the lowest consecutive number in the predetermined series of numbers for that particular run, so that it becomes necessary to compensate in some manner for the preliminary actuations of the consecutive numbering device in response to the passage of the preceding dummy sheets through the machine. Such adjustment may be effected by setting of the number wheels of the consecutive numbering switches 441—U, 441—T and 441—H, Fig. 2, to such a numerical value prior to the start of operation of the machine, by means of the push button switches 488,

Figs. 2 and 39, that the wipers of the stepping switches are advanced to the aforesaid lowest number in the desired series by the time the first completely printed bill sheet S has attained a position in the slotting mechanism SL at which it may be operated upon by the slotting punches. Alternatively, the operation of the machine may be interrupted after all the dummy sheets have passed through to enable the consecutive numbering switches to be adjusted in accordance with the desired initial value. If such initial value is zero, the zero-setting switch 467, Figs. 2 and 40, may be conveniently utilized for zeroizing the stepping switches in the manner explained hereinabove.

Referring to Figs. 57 and 58, the operation of the machine throughout four consecutive cycles has been diagrammatically illustrated, commencing with the cycle in which the first printing device D in the run is sensed by the pins 499 of the electrical sensing means, Figs. 42 and 46. Each of these cycles has been subdivided into three parts corresponding to the three revolutions of the platen operating shaft 222, Figs. 3A, 3B and 42, inasmuch as the machine has been assumed hereinabove to be adapted for triplicate printing. Thus in the first cycle, Fig. 58, the platen P is operated three times, but such operation of the platen is idle in this cycle since there is no printing device D positioned beneath the platen as yet. The sensing bridge 494, Figs. 43, 44 and 45, is depressed concurrently with the down stroke of the platen P during the third impression-making operation of the platen in the first cycle, and the pins 499 are caused to sense the tabs T on the first printing device D which is then in position to be sensed thereby. Assuming that the control cams 526, 527 and 528, Fig. 46, are at this time in the positions there shown, the classification data derived by the pins 499 from the first printing device D are entered in the first bank of storage relays 510. Concurrently with the sensing of the first printing device by the electrical sensing means, the mechanical sensing means including the selector bar 245 and sensing pin 246 is operated but such operation is idle inasmuch as there is no printing device D disposed at that time in position to be sensed by the pin 246. Following such sensing of the first printing device D by the pins 499, and while the platen P is being restored to its upper position following the third impression-making operation thereof, the printing device feeding means is actuated to advance the first printing device D to the second sensing station beneath the selector bar 245, Fig. 42, and the second printing device D to the first sensing station beneath the bridge 494.

The sheet feeding means operates to feed a dummy sheet into printing position beneath the platen P while the platen is being restored toward the end of the first cycle, but this is, in effect, an idle operation since the first printing device D is at the second sensing station during the second cycle and there will be no printing device beneath the platen P to operate upon this sheet. The face printer FP is likewise operated to print the re-occurring data on the face of the preceding dummy sheet during the first cycle and the slotting punch heads 292 and 293, Figs. 19 and 20, are operated to form slots representative of a book number, a consecutive number and a regular bill designation in another of such dummy sheets.

In the second cycle, Fig. 57, the platen P is again idly operated three times in succession. Concurrently with the third down stroke of the platen,

the electrical sensing means operates to enter the classification data derived from the second printing device D in the second bank of storage relays 511, Fig. 46. The mechanical sensing means likewise operates to detect the presence or absence of a tab in the "skip" or twenty-fourth index position of the first printing device D. In the present description of the operation it will be generally assumed that the printing devices are all active, that is, they do not bear tabs in their twenty-fourth index positions, and hence the mechanical selector is not conditioned to cause a skipping operation of the machine. Such a skip operation will be described in detail hereinafter.

After the operations of sensing the first and second printing devices D have been performed, the printing device feeding means operates to advance the first printing device D into printing position beneath the platen P, the second printing device D into the second sensing station, and the third printing device D into the first sensing station. The sheet feeding means concurrently operates to feed a back-printed and perforated sheet S, Fig. 3B, from the perforating mechanism PM into printing position beneath the platen P, Fig. 3A, the sheet being timed in its advance by the stop finger 628 which momentarily arrests the sheet to enable the preceding sheet to be advanced away from the platen P. The face printer FP operates to print a form on the face of the dummy sheet that has been advanced away from the platen, and the slotting punches are operated to slot a book number, consecutive number and regular bill designation in the preceding dummy sheet which is then positioned in the slotting mechanism SL.

In the third cycle, Fig. 58, the first effective operations of the platen P take place. When the platen descends the first time in this cycle it makes an impression of identification data A and A', Fig. 52, on the face of the bill sheet S disposed therebelow, these impressions being located on the body 85 of the sheet. As the platen is raised following this printing operation the stop finger 631 is raised and the sheet feeding means advances the leading edge of the sheet S into engagement with the stop finger 632. The platen then descends a second time and makes an impression of the data A' on the portion 86a of the stub 86 of sheet S, that part of the platen which normally effects printing of the data A being rendered ineffective in this operation as explained hereinabove. The platen P returns to its upper position and the sheet S is freed from the stop finger 632 and advances into engagement with the stop finger 633. The platen P descends a third time to make an impression of the data A on the portion 86b of the stub 86, that part of the platen which normally effects printing of the data A' being ineffective in this instance.

Concurrently with this third down stroke of the platen P the electrical and mechanical sensing means are operated and the classification data derived from the third printing device D are entered in the third bank of storage relays 512, Fig. 46. Thereafter the printing devices are advanced, the first printing device being discharged into suitable collecting means, the second printing device advancing into printing position beneath the platen P, the third printing device advancing into the second sensing station, and the fourth printing device being advanced into the first sensing station. The stop finger 633, Fig. 3A, is elevated and the first bill sheet S bearing the identification data A and A', Fig. 52, is advanced toward

the face printer FP. The stop finger 637 momentarily arrests the sheet S to time its entrance into the face printer, and the sheet is then passed through the face printer FP which operates to print the form F, Fig. 52, on the face of the sheet. The slotting punches likewise operate in this portion of the third cycle, but idly, that is to say, they are effective only to slot a book number, consecutive number and regular bill designation in the last of the dummy sheets. After this dummy sheet is ejected, the sheet feeding means of the slotting mechanism SL advances the first bill sheet S into position to be subsequently operated upon by the slotting punches, Fig. 3. As indicated in Fig. 58, this latter sheet feeding operation may extend slightly into the fourth cycle; however, if desired the operation of the parts can be so timed that this sheet arrives at the slotting station by the end of the third cycle.

In the fourth cycle, Fig. 58, the second regular bill sheet S receives impressions of the identification data A and A', Fig. 52, from the second printing device D in a manner explained hereinabove with reference to the preceding bill sheet in the third cycle. During the last impression-making operation in the fourth cycle the electrical sensing means senses the classification data represented by the tabs T on the fourth printing device D and enters such data in the fourth bank of storage relays 513, Fig. 46, and thereafter the printing device feeding means discharges the second printing device D and advances the third printing device into printing position, the fourth printing device into the second sensing station, and the fifth printing device into the first sensing station. The second bill sheet S is advanced to the face printer FP to have the form F imprinted on its face.

The first completely printed bill sheet S is at this time in the slotting station as previously explained and shortly after the fourth bank of storage relays has been set up, the slotting punch solenoids 358, Figs. 2 and 36, which control the notching of classification data in the first twenty-three index positions from the right, Fig. 52, along the top of the bill sheet S, are placed under the control of the first bank of storage relays 510 and are selectively operated to adjust their punch interponents 305 in accordance with the classification data represented by the operative conditions of these storage relays. The punch solenoids 358 need only be energized momentarily, since the interponents 305 are capable of retaining their settings, and thereupon the punch heads 292 and 293, Figs. 19 and 20, are depressed to cause the particularizing and classification data comprising the consecutive number, the book number and the data represented along the top of the bill sheet S, Fig. 52, to be slotted in this sheet. The interponents 305 for the slotting punches 301 which effect the slotting of the consecutive number and the classification data derived from the printing devices, are restored to their inactive positions when the slotting operation has been performed, as has been described. The slotting punch heads 292 and 293 are then restored and the first complete bill sheet S is shortly thereafter ejected to the collector K, Fig. 2.

Toward the close of the fourth cycle, when the classification data stored in the first bank of storage relays 510 has been read out to the punch solenoids, these relays are cleared preparatory to receiving an entry of the classification data represented on the fifth printing device D which is

advanced to the first sensing station. The second bill sheet S, after passing through the face printer FP, advances to the slotting mechanism SL, arriving at the slotting station subsequent to the discharge of the first bill sheet S therefrom.

The subsequent machine operation is substantially a repetition of that described hereinabove for the fourth cycle, which is to say, that for every cycle of the cam shaft 623, Figs. 3A and 3B (or for each printing device feeding operation in the event there are no skips, there will be a completely printed, perforated and slotted bill sheet as S, Figs. 51 and 52, ejected from the machine. The various banks of storage relays 510, 511, 512 and 513, Fig. 46, inclusive, are rendered effective in rotation for storing classification data derived from the successive printing devices D, and at the appropriate time in the operation of the machine, when the sheet S which bears the identification data A and A' that have been impressed thereon from a particular printing device D has been advanced into the slotting mechanism SL, the punch solenoids 358 are placed under control of the bank of storage relays in which the classification data derived from such printing device D has been stored. The machine is so constructed and arranged that a minimum of time is required to produce a complete bill sheet S, Figs. 51 and 52, from the point of beginning in the web feeding, back printing and severing unit mounted in the frame 71, Figs. 2A and 3B, thence through the perforating mechanism PM, the printing station beneath the platen P, the face printing unit FP, the slotting mechanism SL, and finally to the sheet collector K.

Thus far it has been assumed that a skipping operation of the machine is not necessary. However, in the event a printing device D bearing a tab in its twenty-fourth index position is advanced to the first sensing position near the bridge 494, Figs. 41, 42 and 44, the corresponding sensing pin 499 upon engaging such tab actuates its Bowden cable 496 and opens the special switch 505—24, Fig. 46. Thereupon battery is removed from the conductors 531 and 530 to remove battery from the contacts as 526A of the cam 526. Under these circumstances the closure of any of the other switches 505—1 to 505—23, inclusive, in response to the presence of tabs at corresponding index positions on the printing device D is without effect since battery is withheld from the transfer relays as 518 and the energizing windings of the storage relays as 510, assuming that these relays would otherwise have been rendered operable. Hence no data are stored in this bank of storage relays since none of the relays can become energized in response to the closure of a corresponding switch 505.

When the printing device D bearing the twenty-fourth position tab moves into the sensing station near the selector bar 245, Fig. 42, and is sensed by the pin 246 in the twenty-fourth index position thereon, the link 255 is pulled downwardly and actuates the lever 256 to cam the dog 259 out of the notch 258 in the lip 257. On the next upward stroke of the eccentric plunger 232, Fig. 43, the rocker 264 is swung clockwise, as viewed in Fig. 42, and inasmuch as the lever 261 has been elevated by the upward movement of the dog 259 attached thereto, the lug 263 on the rocker 264 seats in the notch 262 in the lever 261, so that the rocker 264 is held locked in its extreme clockwise position, as viewed in Fig. 42. This has no effect upon the pawl 225 during the current impression-making operation of the

platen P, Figs. 2A and 3A. However, toward the end of the cycle, when the platen is being restored and the printing device D is advancing toward the platen P, the disc 227 is rotated into a position in which the tail of the pawl 225 is engaged by the rocker 264 and this results in swinging the pawl 225 out of engagement with the lug on the sleeve 223, thereby uncoupling the sleeve 223 from the shaft 222 and disabling the platen P. Moreover, when the rocker 264 is locked by the lever 261, the bar 269, Figs. 42, 3A and 3B, so positions the rocker 270 that the clutch 31 is released to thereby uncouple the drive shaft 80 from the driving means for the web feeding, back printing and severing devices. This also has the effect of suspending operation of the sheet feeding and positioning means in the main section of the machine, as explained in the aforesaid Hartley Patent No. 2,002,737, thereby retaining the sheet S then positioned beneath the platen P, as shown in Figs. 3A and 3B, at such printing position until the platen P is again rendered operative to make the required number of impressions of identification data A and A', Fig. 52, from a subsequent active printing device D onto the face of the sheet. The cam shaft 151, Fig. 3B, of the perforating mechanism PM remains stationary while the web feeding and severing devices are inactive, and hence no operation of the perforating mechanism is brought about during this interval.

The operation of the face printing unit FP, Fig. 3A, and the slotting mechanism SL, Figs. 2 and 3, however, are not affected by the disabling of the platen P and the other devices mentioned above, so that the slotting punches operate at the usual time upon the sheet S which is then in position to be slotted in the mechanism SL, and this sheet is then ejected to the collector K. The feed rollers 377, 378 and 379, Fig. 27, of the slotting mechanism SL are driven by the sheet feeding means for the face printer FP, which operates constantly, and hence these feed rollers continue to rotate notwithstanding that the sheet feeding means in the main section of the machine is disabled when a printing device D bearing a twenty-fourth position tab is in printing position beneath the platen P. The cam shaft 391, Figs. 3 and 3A, that controls the operation of the sheet stop fingers 420, Figs. 19, 27 and 28, the clutch 103a of the slotting mechanism SL, and the gripping roller 401, likewise continues to function inasmuch as it is driven by the platen operating shaft 222. Hence when the aforesaid sheet S has been slotted, the stop fingers 420 are elevated and the gripping roller 401 descends as usual to enable the feed roller 378 to advance the sheet into the bite between the rollers 379 and 402 which thereupon feed it to the ejector 431. The stop fingers 420 are then lowered to arrest the next succeeding sheet S which has by this time passed through the face printer FP and has been advanced into the slotting mechanism SL, this sheet having been previously fed to the face printer by the constantly driven feed rollers 634 and 636, Figs. 2A and 3A.

The printing device feeding means and the two sensing devices continue to operate irrespective of whether or not the platen P is coupled to the operating shaft 222, and during the last third of the cycle in which the platen P is inoperative, the selector bar 245 is lowered. If the printing device D which is disposed in sensing relation therewith does not bear a tab T in the twenty-fourth index position, the rocker 264, Fig. 42, is

released to enable the sleeve 223 to be again coupled to the shaft 222 by the pawl 225 during the succeeding cycles and until another printing device D bearing a twenty-fourth position tab is sensed by the selector 245. Thus the printing device D which brought about the skipping operation is advanced through printing position beneath the platen P without producing any impression upon the sheet S in such printing position and the next succeeding printing device D is brought beneath the platen P. As the platen P operates to make impressions from this new printing device upon the sheet S positioned therebelow, the sheet S in the slotting mechanism SL is slotted and ejected.

Since there is a hiatus in the feeding of sheets into the slotting mechanism SL, caused by the aforesaid interruption of the sheet feed in the main section of the machine, the sheet detector 406, Figs. 21 and 27, fails to detect the presence of a sheet at a time when a new sheet should be advancing into the slotting mechanism SL, and therefore does not send an impulse to the units stepping switch 441—U of the consecutive numbering device, Figs. 2 and 35 to 40, inclusive, so that the consecutive number is maintained at the proper value. The slotting mechanism SL goes through its cycle of operation even though no sheet is positioned therein, but in this instance the slotting punches 301 which are controlled by the storage relays as 510 are all inactive since, it will be recalled, no data were stored in these relays when the printing device D which had the twenty-fourth position tab was being sensed by the pins 499.

As soon as the sheet S has received the triplicate impressions of the data A and A', Fig. 52, from the new printing device D, it continues to advance along the sheet guideway SG, Fig. 3A, toward the face printing unit FP, and from this point on the operation is the same as has been described hereinabove. The face printer FP has its own safety device to prevent the formation of offset impressions on the impression roll thereof when for any reason, such as in the event of a skipping operation, the sheet feeding means fails to feed sheets at the usual intervals to this printer. The sequence switch 570, Figs. 19, 47 and 48, is constantly driven and continues to place the slotting punches in controlled relation to the proper bank of storage relays as each bill sheet S is advanced into the slotting mechanism SL, and if the sheet feed is again interrupted during a subsequent skip operation, a bank of storage relays will be left vacant for each such skip operation so that there is no likelihood of the wrong bank of relays being placed in punch-controlling relation at any time.

Summary

It is believed to be apparent from the foregoing description that I have provided a novel and advantageous machine for preparing business instruments of the character illustrated in Figs. 51 and 52, such an instrument commonly bearing printed impressions of identification data as an address A and analogous data A', and reoccurring data or forms which may be printed on both faces of the instrument, and being also provided with representations of classification data, such as a book number, rate schedule number and like data, related to the aforesaid identification data, as well as particularizing data which usually consists of a number which indicates the position of the instrument in a series. These instruments

may be conveniently used in the preparation of public utility bills or the like in the manner disclosed in the aforesaid copending application of Harold M. Whittlesey, and more specifically, the instruments produced by the present machine may be provided with additional representations of variable data such as kilowatt-hours consumed and the like, as disclosed in said Whittlesey application. The present invention, moreover, is equally well adapted to the production of complete instruments which may be utilized in sorting systems as shown, for example, in Perkins Patent No. 1,544,172.

The various units of the machine which operate on the instruments are so arranged in relation to each other that a minimum of time is required for the passage of each instrument through the machine. Thus, as soon as a back-printed sheet S, Fig. 3B, is severed from the web W by the knife 74, it is advanced into the perforating mechanism PM, Figs. 1A, 4 and 5, where it is provided with the marginal perforations 84 and corner bevel 87, Fig. 51. The sheet is then discharged from the mechanism PM and is conveyed to a printing position beneath the platen P, Figs. 2A and 3A, where it receives the impressions of identification data as A and A', Fig. 52, from a printing and control device as D, Fig. 41, then in printing position. The sheet stopping and printing control means are so arranged that the desired number of impressions, in the present case three, are effected from each active device D and are properly spaced on the sheet, and a receding platen structure may be employed in the manner described herein to suppress the printing of a part of the identification in certain of these printing operations if desired. Upon receiving the requisite impressions of identification data, the sheet S is fed to the face printing couple FP, Fig. 3A, which rapidly prints the form F, Fig. 52, on the face of the sheet and delivers the sheet to the feeding means of the slotting mechanism SL, Figs. 2 and 3. The sheet is thereupon advanced past the detector comprising the rocker 406, roller 409 and switch 416, Figs. 21 and 27, and into the slotting mechanism SL to be operated upon by the slotting punches 301, Figs. 24, 25, 26 and 28. As the sheet momentarily cooperates with the detecting roller 409, the switch 416 closes and sends an impulse to the stepping magnet 444—U, Figs. 35, 38 and 39, in the units order of the counting device, to thereby adjust the setting of this device to the proper consecutive number.

The slotting punches 301 are selectively operated, in accordance with the data to be recorded, to form slots registering with selected index positions defined by the perforations 84, Figs. 51 and 52, in each sheet S, these slots consisting of trapezoidal openings which extend to the margin of the sheet and obliterate the perforations 84 at such index positions. Thus, the interponents 305 of certain slotting punches 301, Fig. 25, are selectively adjusted under control of the counting device for slotting a representation of the particularizing data or consecutive number, Fig. 52, in each sheet S. Other interponents 305, Figs. 26 and 30, are manually adjusted to effect recording of classification data comprising the book number and "regular bill" designation. Still other interponents 305, Fig. 28, are adjusted indirectly under control of the control indicia such as tabs T, Fig. 41, on the printing and control devices D, for recording the remaining classification data. In order that the operation of the machine will

not be unduly slow because of this transfer of classification data from the devices D to the sheets S, storage means have been provided to enable the data represented by the indicia as tabs T to be sensed and stored and then read out when needed so that the device D need not be retained in a sensing position while the interponents of the slotting punches are being set up.

The storage means in the present instance comprises banks of storage relays which are set up in rotation as the printing and control devices D are sensed. As a sheet bearing identification data imprinted upon it by a particular device D attains slotting position in the mechanism SL, the bank of relays in which the classification data derived from the particular device D are stored is rendered effective to set up the appropriate punch interponents for slotting that sheet in accordance with such stored data. In the event a printing and control device D is to be "skipped," that is, not utilized in a printing operation, a bank of storage relays is left vacant. In this way the timed sequence in which the banks of relays are rendered effective for both storing and reading out data is maintained despite the momentary interruption in the feeding of completely printed bill sheets to the slotting mechanism SL. The sheet feeding means is so arranged that whenever a skip operation occurs, those sheets which have already been printed at the platen P will continue their advancing movements, while all sheets not so printed are arrested until an active printing and control device D is brought beneath the platen P. The consecutive numbering means operates solely in dependence upon the detecting of sheets, and hence when the sheet feed is interrupted the count is maintained constant until a sheet is again detected upon resumption of sheet feeding.

An outstanding advantage of my invention is the compactness of the various parts of the apparatus. For example, the counting means of the consecutive numbering device, Figs. 2, and 35 to 38, inclusive, and the sequence control switch 570, Figs. 1, 47 and 48, are of relatively simple construction and require very little space. The storage relays 510, 511, 512 and 513 are very conveniently mounted on the frame of the slotting mechanism SL, as indicated in Fig. 3. The slotting mechanism itself is very compactly arranged and yet all the parts thereof are readily accessible for servicing. The stand 271, Fig. 2, which supports the entire slotting mechanism is adapted to be added to or removed from the basic machine as an attachment thereto. The perforating mechanism PM, Figs. 1A and 2A, may be readily incorporated in existing machines of the character disclosed in the aforesaid Hartley patents, and is quite rapid in its action so that it may be operated together with the conventional web feeding, back-printing and severing unit. The sensing means utilizing Bowden cables 496, Figs. 1A, 3A and 46, affords a highly flexible medium for transferring data from the printing and control devices to the storage means. The devices which operate this sensing means are embodied in the conventional selector mechanism including the rocker 247, Fig. 42, so that little extra space for the additional sensing means is required.

The novel clutch construction illustrated in Figs. 15 to 18, inclusive, is well adapted to the type of work which it is called upon to perform. In addition to the spring tension acting upon

the friction shoes of the clutch, a positive wedging action is set up between the shoes and the driven parts as the clutch is operated, and this forces the shoes into firm contact with the driving member so that no slippage can occur, thus insuring that there will be no lost motion between the driving and driven parts, once the clutch has been engaged, until the driven parts have been restored to their normal rest positions. The clutch is therefore reliable in operation and substantially eliminates the likelihood that the perforating mechanism PM or slotting mechanism SL, as the case may be, will operate out of their proper timed relations with respect to other portions of the machine.

From the foregoing description it will be evident that the machine of the present invention enables large groups of public utility bills and like business instruments to be prepared with greater facility and accuracy than has heretofore been possible, for through the use of this machine the basic instruments required for use in various sorting methods of accounting or billing are prepared rapidly, economically and accurately. The preparation of instruments with the present machine utilizes printing and control devices, as D, which are relatively permanent in character, and easy to handle and store, and which when once prepared and verified, require no further checking or verification in their normal useful life.

By the use of the machine of the present invention, a series of business instruments is provided with particularizing data whereby in subsequent operations on a series of instruments, the loss of one or more of the instruments may be readily detected. The preparation of business instruments with the present machine enables physical representations of various types of classification data to be incorporated in the instruments, and this desirable end is attained in the present machine through the use of printing and control devices, as D, which have a wide range of usefulness in accounting, sales and promotional activities of the user apart from their usefulness with the present machine.

While I have illustrated in the drawings and have herein described in detail the preferred embodiment of my invention, it is to be understood that I do not thereby intend to limit the invention to the specific form disclosed, but aim to cover all modifications and alternative constructions falling within the spirit and scope of the invention as expressed in the appended claims.

I claim:

1. In a printing machine, means for feeding a series of unitary printing and control devices each bearing printing means and control means representing classification data into sensing and printing positions in the machine, means at said sensing position for sensing the control means on said devices, settable storage means, means under control of said sensing means for setting said storage means in dependence upon the classification data represented by said control means, means for feeding a series of sheets through said printing position and through another recording station in the machine, means at said printing position for making impressions on said sheets from the printing means of said devices, and means at said recording station comprising a plurality of recording members respectively allocated to different index positions on said sheets and operable selectively under control of said storage means for recording on said sheets the classifica-

tion data represented by the control means on said printing and control devices.

2. In a printing machine, means for feeding a series of unitary printing and control devices each bearing printing means and control means representing classification data into sensing and printing positions in the machine, means at said sensing position for sensing the control means on said devices, settable storage means, means under control of said sensing means for setting said storage means in dependence upon the classification data represented by said control means, means for feeding a series of sheets through said printing position and through another recording station in the machine, means at said printing position for making impressions on said sheets from the printing means of said devices, means at said recording station comprising a plurality of recording members respectively allocated to different index positions on said sheets and operable selectively under control of said storage means for recording on said sheets the classification data represented by the control means on said printing and control devices, and timing means governing said storage means to enable the classification data represented by the control means of each printing and control device to be recorded on the same sheet as that on which an impression is made from the printing means of such printing and control device.

3. In a printing machine, means providing sensing and printing positions in the machine, means for feeding sheets in succession to printing position, means for feeding a series of unitary printing and control devices each bearing printing means and control means representing classification data into sensing and printing positions in the machine, means at said sensing position for sensing the control means on said devices, impression means at said printing position for producing impressions from said devices onto sheets located at printing position, groups of settable storage devices, means under control of said sensing means and operable to set a selected group of said storage devices in dependence upon the classification data represented by certain control means on each printing and control device as it is sensed, timing means operating to determine the selection of said groups of storage devices in relation to the sensed printing and control devices in accordance with a predetermined rotation, and means responsive to the presence of certain other control means on the sensed printing and control devices to prevent said setting means from entering classification data derived from such printing and control devices in the corresponding groups of storage devices.

4. In a printing machine, means affording printing and recording positions in the machine, means for feeding sheets one by one to said printing and recording positions, means for feeding a series of unitary printing and control devices each bearing printing means and control means representing classification data into sensing and printing positions in the machine, sensing means for reading the classification data represented by the control means on said devices, settable storage means under control of said sensing means for retaining the readings of such classification data, means at said printing position for making impressions from the printing means of said devices on sheets fed successively through the machine, means at said recording position comprising a plurality of recording members respectively allocated to different index positions on said

sheets and operable selectively under control of said storage means for recording on said sheets the classification data represented by the control means on the sensed devices, and governing means maintaining a timed interrelation in the operations of said impression-making and recording means and rendering said storage means and recording means effective to transfer to said sheets the classification data derived from the respective devices from which impressions have been made on such sheets.

5. In a printing machine having printing, sensing and recording positions and wherein unitary printing and control devices each bearing printing means and control means representing classification data are advanced in a series into sensing and printing positions in the machine, means for advancing printing and control devices one by one to sensing and printing positions, sheet feeding means operable to feeding sheets one by one to printing position, means at said sensing position for sensing the control means on said devices, groups of settable storage devices, means under control of said sensing means and operable to set a selected group of said storage devices in dependence upon the classification data represented by certain of said control means on each printing and control device as it is sensed, timing means operating to determine the selection of said groups of storage devices in relation to the sensed printing and control devices in accordance with a predetermined reoccurring rotation and succession, impression means at said printing position for producing impressions from the printing means of said printing and control devices onto sheets located at printing positions and other recording means located at said recording position and comprising a plurality of recording members respectively allocated to different index positions on said sheets and operable selectively under control of said storage devices, said timing means also operating to place said recording means in controlled relation to said groups of storage devices in accordance with said predetermined reoccurring rotation and succession.

6. A machine as claimed in claim 5, in which said timing means additionally operates to clear each group of storage devices of its previous setting after such group has been placed in controlling relation with respect to said operating means.

7. In a printing machine which utilizes sequentially fed printing and control devices bearing printing means for making impressions of identification data on sheets advanced serially through the machine, said devices also bearing control means representative of classification data, means affording printing and recording positions in the machine, means for feeding sheets one by one to said printing and recording positions, means for advancing printing devices to printing position, impression means at said printing position for producing impressions from such printing devices onto sheets located at printing position, and means at said recording position for recording such classification data on said sheets at said recording position in the machine, comprising normally ineffective recording members respectively allocated to predetermined index positions on said sheets, means for sensing the control means on successive printing and control devices, settable data storage means controlled by said sensing means and operating to retain a setting according to the classification data derived from each device for at least a predetermined time after such device has been sensed,

selecting means under control of said storage means for conditioning selected of said recording members to record classification data in each of said sheets, and governing means for effecting the transfer of data from said storage means to said recording means in such timed sequence that each sheet produced by the machine bears a record of classification and identification data derived from the same printing and control device.

8. In a printing machine, means affording sensing, printing and recording positions in the machine, means for feeding sheets one by one to said printing and recording positions, means for feeding a series of printing and control devices through sensing and printing positions in the machine, said devices being provided with printing means for making impressions of identification data directly therefrom and having a plurality of index positions at which indicia may be selectively located to represent classification data respectively related to such identification data, impression means at said printing position for producing impressions from said printing devices onto sheets located at printing position, sensing means comprising a plurality of analyzing members respectively allocated to the various index positions on the printing and control devices and operable to sense the presence or absence of indicia at the corresponding positions on each device as it attains sensing position, a plurality of switches respectively controlled by said analyzing members and operable in response to the sensing of printing and control devices, settable data storage means comprising a plurality of banks of storage relays, each bank including as many relays as there are analyzing members, energizing circuits leading from said switches in parallel to the corresponding storage relays in the several banks thereof, transfer relays respectively associated with the banks of storage relays and each effective when operated to condition the energizing circuits for its bank to enable the storage relays thereof to be selectively operated under control of said switches, holding circuits for said banks of storage relays and normally effective to enable each bank to retain its setting, a plurality of electrically operated recording members located at said recording position and each allocated to a corresponding index position on said sheets, operating circuits leading from the last-named members in parallel to contacts of corresponding storage relays in the several banks thereof, shift relays respectively associated with the banks of storage relays and each effective when operated to condition the operating circuits for its bank to enable said electrically operated members to be selectively controlled in response to the settings of the storage relays of such bank, and timing means governing said transfer relays, said holding circuits and said shift relays whereby classification data derived from said printing and control devices by said sensing means are stored in said banks of storage relays and then transmitted to said electrically operated members, and said banks of storage relays are cleared, in accordance with a predetermined sequence.

9. In a printing machine having printing and recording positions and which utilizes sequentially fed printing and control devices bearing printing means for making impressions of identification data on sheets advanced serially through the machine, said devices also bearing control means representative of classification data related

to such identification data, impression means at said printing position for producing impressions from said devices onto sheets located at printing position, sheet feeding means operable to feed sheets to said printing and recording positions, recording means at said recording position comprising recording members respectively allocated to predetermined index positions on said sheets, means selectively governing some of said recording members in accordance with the control means on said devices, means operable to determine the position of each sheet in a series of sheets passed through the machine, and means controlled by said last mentioned means and governing other of said recording members in accordance with the position of each sheet in a series of sheets passed through the machine.

10. In a machine for producing a series of business instruments under the control of and in accordance with a series of unitary printing and control devices each having printing means and related control means representing related classification data, means for feeding such a series of devices through the machine, means for feeding a series of sheets through the machine, a first sensing means including a plurality of sensing members for sensing the control means of said devices as they are passed through the machine, impression means operable upon said devices to produce printing impressions from the printing means thereof onto such sheets, a second sensing means operable to sense only a portion of said control means on each device and operative in response to such sensed control means to govern the operation of said impression means, slotting means including slotting members allocated respectively to predetermined areas of said sheets and operable selectively under the control of said first sensing means to form slots in said sheets corresponding to the sensed control means, a portion of said first sensing means being operable to sense said portion of the control means and being operable in response to predetermined sensed control means to prevent a slotting operation of said slotting means, and means so coordinating the operation of said impression means, said sheet feeding means and said slotting means that the printing impression and the slotted representations formed on each such sheet are derived from a single one of said devices.

11. In a machine for producing a series of business instruments under the control of and in accordance with a series of unitary printing and control devices each having printing means and related control means representing related classification data, means for feeding such a series of devices through the machine, means for feeding a series of sheets through the machine, recording means for recording classification data on such sheets one sensing means operable to sense certain control means of such devices and having an operative connection with said recording means to record classification data on a sheet in conformity with the sensed control means, primary sensing means operable to sense other control means on said devices and operative selectively in predetermined instances in accordance with the sensed control means to disable said operative connection and prevent recording operation of said recording means, impression means for producing printing impressions from said devices onto said sheets, and another sensing means operable at another point in the machine cycle to sense said other control means and operable in

accordance with such sensing to control the operation of said impression means.

12. In a printing machine affording printing and recording positions and which utilizes sequentially fed printing and control devices bearing printing means for making impressions of identification data on sheets advanced serially through the machine, said devices also bearing control means representative of classification data, means for recording such classification data on said sheets at said recording station in the machine, comprising normally ineffective recording members respectively allocated to predetermined index positions on said sheets, means for sensing the control means on successive printing and control devices, settable data storage means controlled by said sensing means and operating to retain a setting according to the classification data derived from each device for at least a predetermined time after such device has been sensed, selecting means under control of said storage means for conditioning selected of said recording members to record classification data in each of said sheets, governing means for effecting the transfer of data from said storage means to said recording means in such timed sequence that each sheet produced by the machine bears a record of classification and identification data derived from the same printing and control device, a sheet detecting device movable into the path of said sheets for detecting the presence or absence thereof, means intermittently actuating said device into such sheet detecting position in timed relation with the normal rate of feeding of said sheets but without obstructing the passage of the sheets, counting means controlled by said detecting device and registering a unit count each time the presence of a sheet is detected, and recording means comprising a plurality of recording members respectively allocated to different index positions on said sheets and operable selectively controlled by said counting means for recording on the sheets data particularizing them according to their relative positions in the series.

13. In a printing machine wherein printing and control devices adapted to bear printing and identifying means are utilized sequentially to print data upon sheets advanced successively through a printing position in the machine, means operating to sense each device for determining an indication represented by the presence or absence of certain identifying means thereon, means governed by said sensing means and effective in response to the sensing of a predetermined indication to prevent the printing of data from the sensed device onto a sheet and to interrupt the feeding of sheets through said printing position until a printing device bearing a different indication has been sensed and utilized to print data on such sheet, means for detecting the passage of sheets away from said printing position, means operating in timed relation with said sensing means to actuate said detecting means to and from a sheet detecting relation, counting means, and means under control of said detecting means and operating only when the presence of a sheet is detected to actuate said counting means in the amount of one digit whereby the count is maintained correct regardless of interruptions in the sheet feed.

14. In a printing machine wherein printing and control devices adapted to bear printing and identifying means are utilized sequentially to print data upon sheets advanced successively through a printing position in the machine,

means operating to sense each printing device for determining the indication represented by the particular identifying means thereon, means governed by said sensing means and effective in response to the sensing of a predetermined indication to prevent the printing of data from the sensed printing device onto a sheet and to interrupt the feeding of sheets through said printing position until a printing device bearing a different indication has been sensed and utilized to print data on such sheet, means for detecting the passage of sheets away from said printing position, means operating in timed relation with said sensing means to actuate said detecting means to and from a sheet detecting relation, counting means, means under control of said detecting means and operating only when the presence of a sheet is detected to actuate said counting means in the amount of one digit whereby the count is maintained correct regardless of interruptions in the sheet feed, and means controlled by said counting means for serially numbering the printed sheets.

15. In a printing machine through which sheets are successively advanced to have printing and other recording operations performed thereon, a sheet detecting device movable into the path of said sheets for detecting the presence or absence thereof, means intermittently actuating said device into such sheet detecting position in timed relation with the normal rate of feeding of said sheets but without obstructing the passage of the sheets, counting means controlled by said device and registering a unit count each time the presence of a sheet is detected, and recording means controlled by said counting means for recording on the sheets data particularizing them according to their relative positions in the series.

16. In a machine for producing a series of business instruments under the control of a series of unitary printing and control devices each bearing printing means and each adapted to bear related control means of at least two different classes the first of which is representative of variable classification data and the second class of which indicates whether or not an instrument is to be prepared under control of the device, means for feeding a series of such devices through the machine, sheet feeding means for feeding a series of sheets through the machine, impression means for forming printed impressions on such sheets from the printing means of such devices, recording means for recording classification data on such sheets, sensing means operable to sense the control means of said devices successively and to control operation of said recording means and said impression means in accordance with the sensed control means to produce related printing impressions and recorded classification data on each sheet passed through the machine, sensing means operable to sense control means of said second class and operative in accordance with such sensing to prevent operation of said recording and impression means when said control means of the second class indicates that an instrument is not to be prepared under control of a particular device, additional recording means comprising a plurality of recording members respectively allocated to different index positions on said sheets and operable selectively to record particularizing data on each sheet in accordance with its position in a series, and sheet detecting means operable to modify the normal action of said addi-

tional recording means whenever said recording means is maintained out of operation as aforesaid.

17. In a printing machine wherein printing and control devices adapted to bear printing and identifying means are utilized sequentially to print data upon sheets advanced successively through a printing position in the machine, means operating to sense each device for determining the indication represented by the particular identifying means thereon, means governed by said sensing means and effective in response to the sensing of a predetermined indication to prevent the printing of data from the sensed device onto a sheet and to interrupt the feeding of sheets through said printing position, means for counting the sheets advanced through the machines by said sheet feeding means, and means operating in coordinated relation to said counting means for serially numbering said sheets.

18. In a printing machine which utilizes sequentially fed printing and control devices bearing printing means for making impressions of identification data on sheets advanced serially through the machine, said devices also bearing control means representative of classification data related to such identification data, means for recording classification and particularizing data pertaining to said identification data on said sheets at a recording station in the machine, comprising normally ineffective recording members respectively allocated to predetermined index positions on said sheets, selecting means for conditioning certain of said recording members for operation to record on each sheet advanced to said recording station data particularizing such sheet according to its relative position in the series, other selecting means responsive to the control means on said printing and control devices for conditioning certain other of said recording members to record on each sheet the classification data pertaining to the identification data which are printed on such sheet, and means for operating the conditioned recording members to record the appropriate particularizing and classification data on each sheet.

19. In a printing machine, means providing sensing, printing and recording positions in the machine, means for advancing sheets successively through the machine, means for perforating each sheet in a plurality of index positions adjacent margins thereof, means for feeding a series of printing and control devices bearing printing means and control means through said sensing and printing positions in the machine, means for sensing the control means on said devices at said sensing position, means at said printing position operating to make impressions of identification data from the printing means of said devices onto corresponding sheets, means for detecting and counting the passage of sheets through the machine, and means for recording classification and particularizing data pertaining to said identification data on said sheets at a recording station in the machine, comprising a plurality of punch members each allocated to a respective one of said index positions on each sheet and operable to form therein an opening extending inwardly from the adjacent margin of the sheet to the perforation at such index position, manually manipulative means for setting up certain of said punch members to record classification data in said sheets, other means controlled by said counting means and operating to set up certain other of said punch members for recording in said sheets data particularizing the sheets according to their

respective places in the series, and still other means governed by said sensing means for setting up still other of said punch members to record in each sheet classification data derived from the control means of the respective printing device from which the identification data are printed on such sheet.

20. In a machine for producing a series of business instruments bearing related identification and classification data and bearing individual particularizing data determined by the positions of the instruments in the series, means for advancing a series of unitary printing and control devices each bearing printing means and related control means representing related classification data, means for advancing a series of sheets through the machine past printing and recording positions, means at said printing position for forming printing impressions from the printing means of selected of said devices, a plurality of selectively operable recording members at said recording station each allocated to different index positions on such sheets and operable under the control of the control means on said devices to record the represented classification data on said sheets, and other recording members each allocated to different index positions on such sheets and operable to record individual particularizing data on each sheet in accordance with the positions of such sheets in a series.

21. In a machine for producing a series of business instruments from and under control of printing and control devices successively advanced through the machine, means for printing identification data on said instruments directly from said printing and control devices, and means operating on said instruments to form therein slots representative of related classification data and data particularizing such instruments according to their respective positions in the series and comprising slotting punches respectively aligned with predetermined index positions on each instrument as it is disposed in position to be operated upon by said slotting means, a punch head reciprocable to and from an operative position, interponents respectively disposed between said punch head and said punches and individually adjustable to alternative active or inactive positions for determining which of the punches are to be effective in an operation of the slotting mechanism, means responsive to control indicia on each printing and control device for selectively adjusting certain of said interponents in accordance with the classification data to be recorded in the corresponding instrument, means for counting such instruments and operating in accordance with a progressive count of said instruments to selectively adjust other of said interponents for recording a consecutive number in each instrument, operating means for reciprocating said punch head and thereby causing the selected punches to slot the instrument, and cam means rendered effective by the movement of said punch head for restoring the active interponents to their inactive positions when the slotting has been performed.

22. In a printing machine having sensing and printing positions, impression means at said printing position, means for advancing a series of printing and control devices bearing printing means and control means through sensing and printing positions in the machine, means normally operating to successively advance sheets through said printing position to receive a printed impression from the printing means of corresponding printing and control devices, selector means including

sensing means for sensing the control means of said printing and control devices and responding to the presence of control means of a predetermined character on any of said devices for suspending operation of said sheet feeding means at least until a succeeding device bearing control means of a different character has been sensed, recording means operated in timed relation with said printing device advancing means, a plurality of control units operating in rotation to govern respective operations of said recording means, sensing means for sensing the control means of such printing and control devices and governing said control units in accordance with the control means thus sensed, and sheet feeding means operating independently of said selector means to advance printed sheets from said printing position to said recording station to be operated on by said recording means, the normal sequential interrelations of the printed sheets and the control units which are to be effective with respect thereto being thereby unaffected by an interruption of operation of the first-named sheet feeding means as aforesaid at least until the last sheet printed prior to such interruption has been operated upon by said recording means.

23. In a machine for producing a series of business instruments, means for feeding sheets in timed relation through the machine along a predetermined path to have recording or like operations formed thereon, a sheet detecting device movable transversely into and then out of said path at a predetermined position therealong to detect the presence or absence of a sheet at said position, means operable to move said sheet detecting device into and then out of said guideway each time a new sheet should normally be fed to said predetermined position by said sheet feeding means, counting means controlled by said sheet detecting means and operable to register a unit count each time a sheet is detected, and recording means controlled by said counting means for recording on the sheets data particularizing the sheets according to their positions in the series.

24. In a machine for producing a series of business instruments, means for feeding a series of sheets through the machine, perforating means including a plurality of perforating members each allocated to a predetermined area of said sheets and operable to produce a plurality

of spaced perforations along at least one edge, and means operable to form representations of consecutive numbers on said sheets successively comprising a plurality of slotting members allocated one to each of said areas and operable to slot the edge of each sheet in accordance with a predetermined positional code.

25. In a machine for producing a series of business instruments, means for feeding a series of sheets through the machine, perforating means including a plurality of perforating members each allocated to a predetermined area of said sheets and operable to produce a plurality of spaced perforations along at least one edge, means operable to form representations of consecutive numbers on said sheets, successively, comprising a plurality of slotting members allocated one to each of said areas and operable to slot the edge of each sheet in accordance with a predetermined positional code, and means for controlling said consecutive numbering means including a sheet detector operable periodically to sense the presence or absence of a sheet in another portion of said sheet feeding means.

26. In a machine for producing a series of business instruments bearing individual particularizing data determined by the positions of the instruments in the series, means for advancing a series of sheets through the machine, punching means operable to punch a series of apertures along at least one edge of each of such sheets, and means operable upon said sheets to form slots from selected of the apertures to the adjacent edge of the sheet in accordance with a predetermined positional code in such sequence as to constitute a consecutive numbering of the sheets of a series.

27. In a machine for producing a series of business instruments bearing individual particularizing data determined by the positions of the instruments in the series, means for advancing a series of sheets through the machine, punching means operable to punch a series of apertures along at least one edge of each of such sheets, and means operable upon said sheets to form slots from selected ones of the apertures to the adjacent edge of the sheet in accordance with a predetermined positional code in such sequence as to constitute a consecutive numbering of the sheets of a series.

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