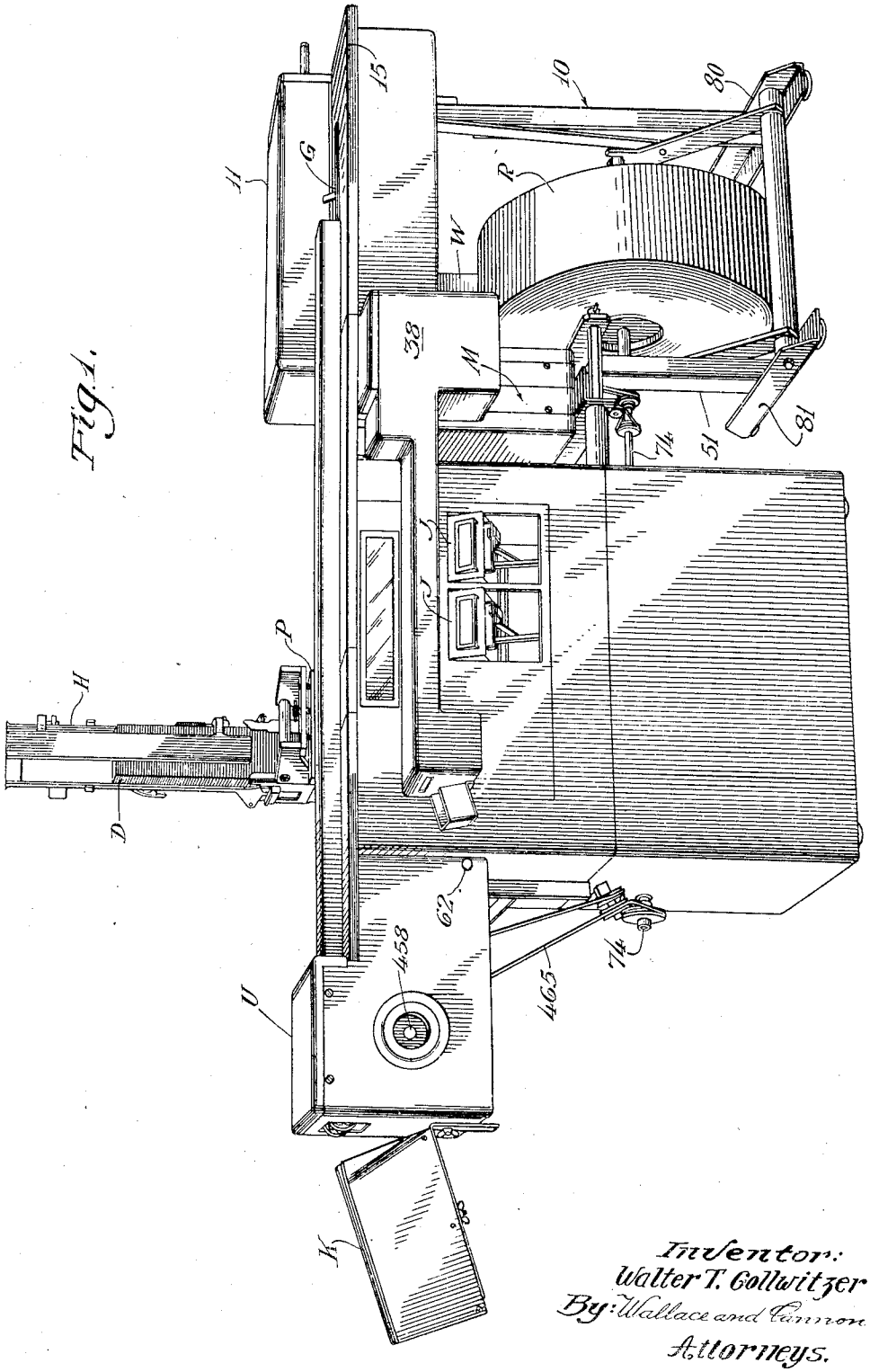
Jan. 16, 1945. W. T. GOLLWITZER 2,367,395

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Fig. 1.



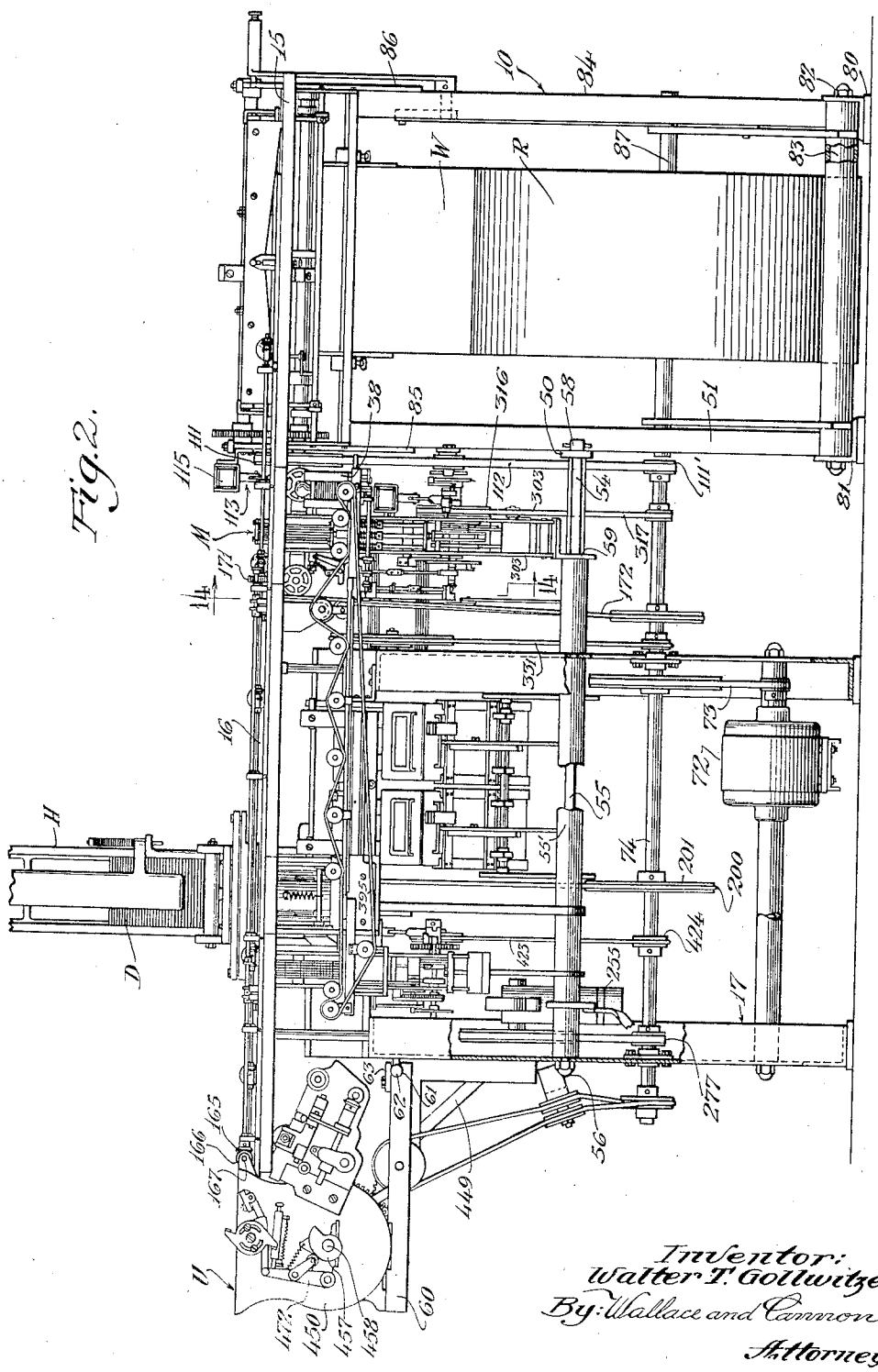
Inventor:
Walter T. Gollwitzer
By: Wallace and Cannon
Attorneys.

Jan. 16, 1945. W. T. GOLLWITZER 2,367,395

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Fig. 2.



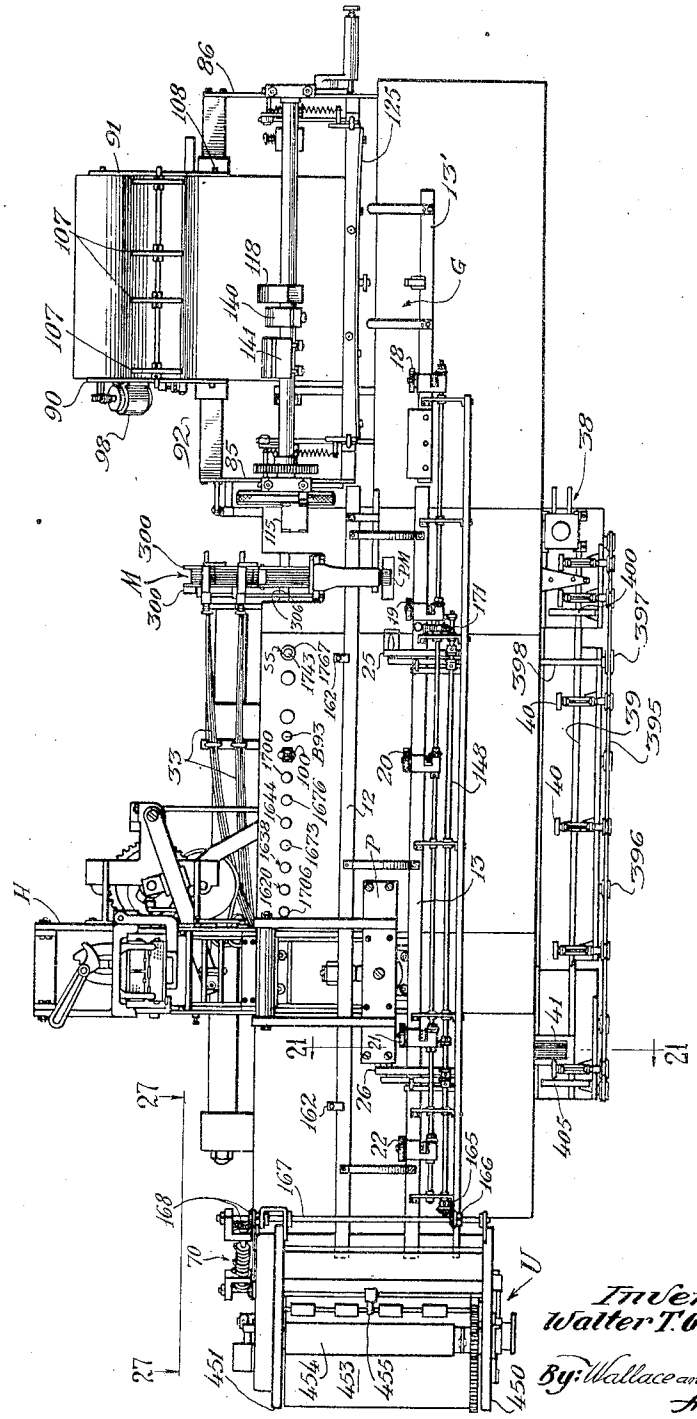
Inventor:
Walter T. Gollwitzer.
By: Wallace and Cannon
Attorneys.

Jan. 16, 1945. W. T. GOLLWITZER 2,367,395

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Fig. 3.



Inventor:
Walter T. Gollwitzer
By: Wallace and Cannon
Attorney.

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Fig. 4.

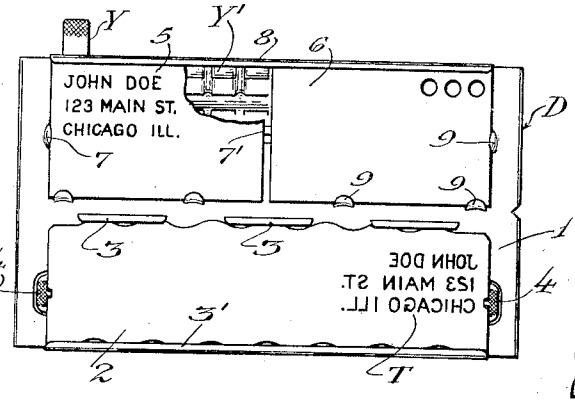


Fig. 4A.

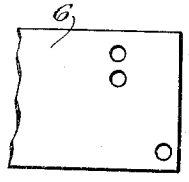


Fig. 4B.

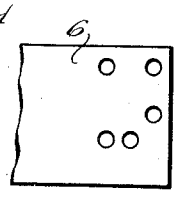


Fig. 5.

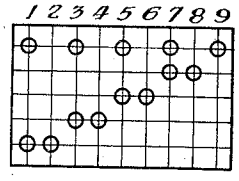


Fig. 6.

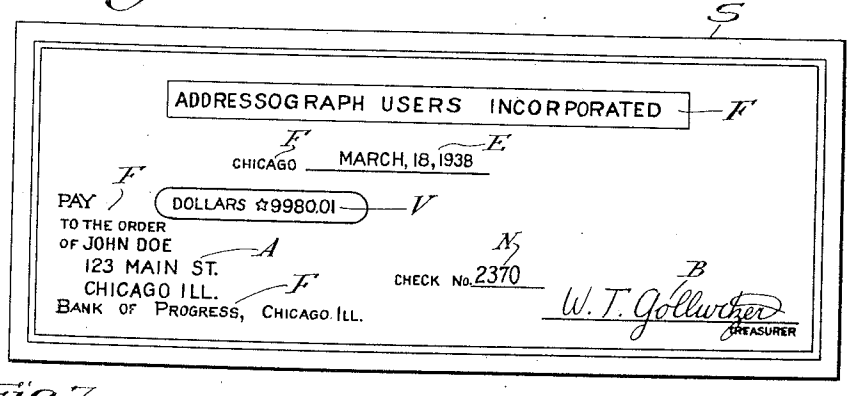
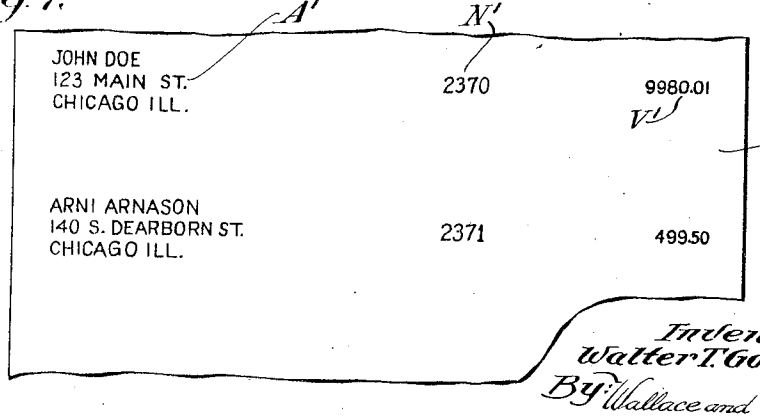


Fig. 7.



Inventor:
Walter T. Gollwitzer;
By Wallace and Cannon
Attorneys

Jan. 16, 1945. W. T. GOLLWITZER 2,367,395

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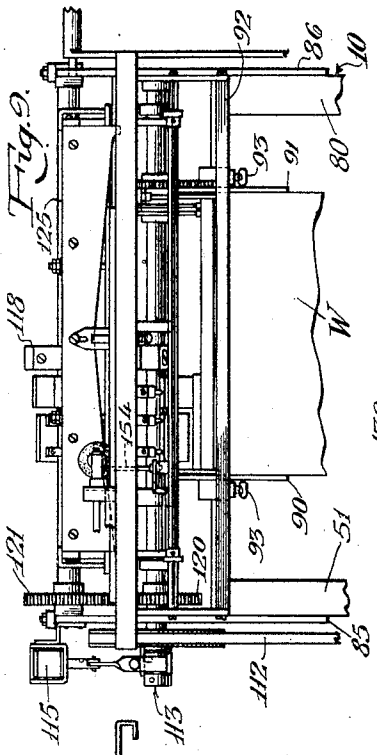


Fig. 9.

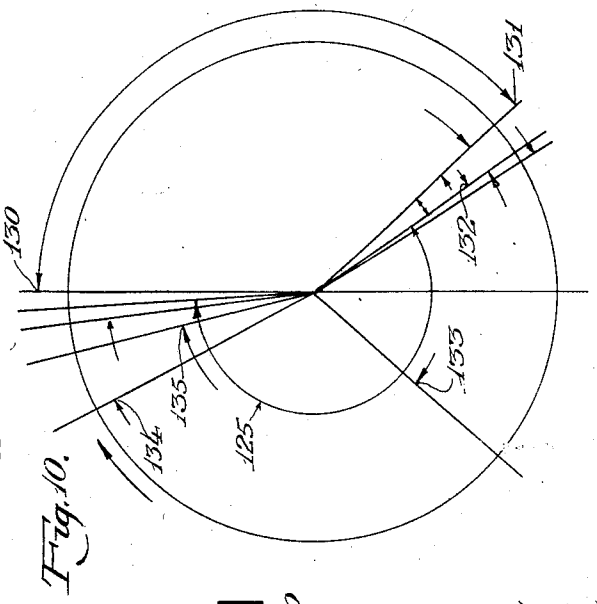


Fig. 10.

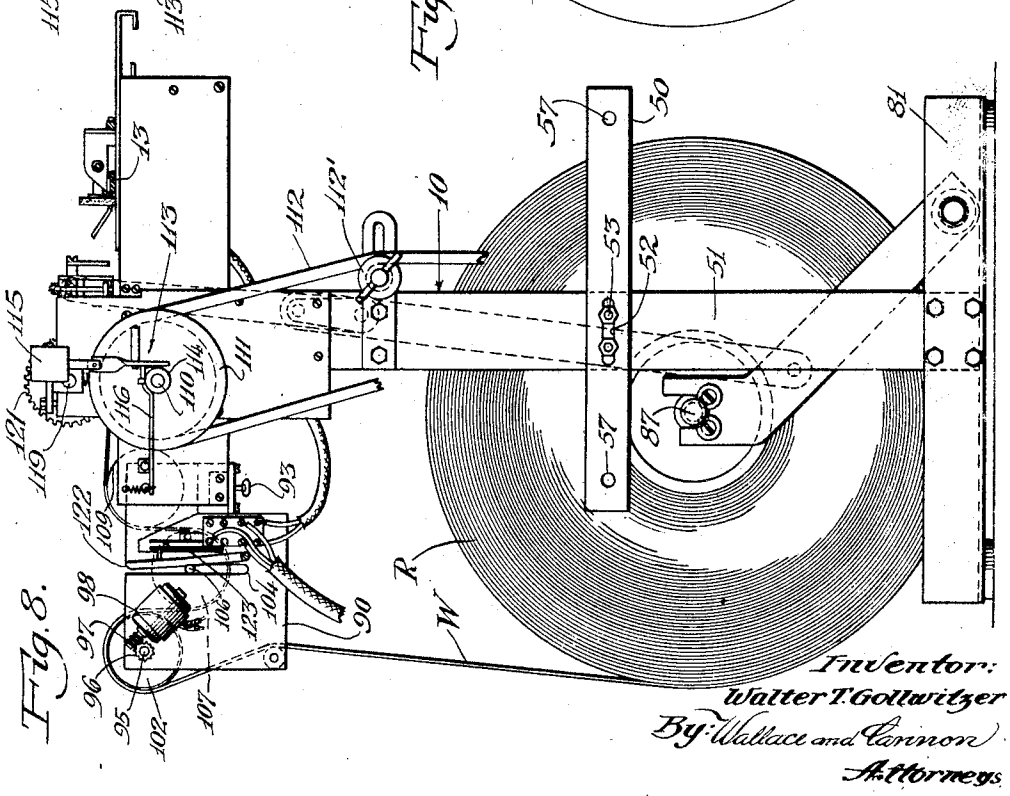


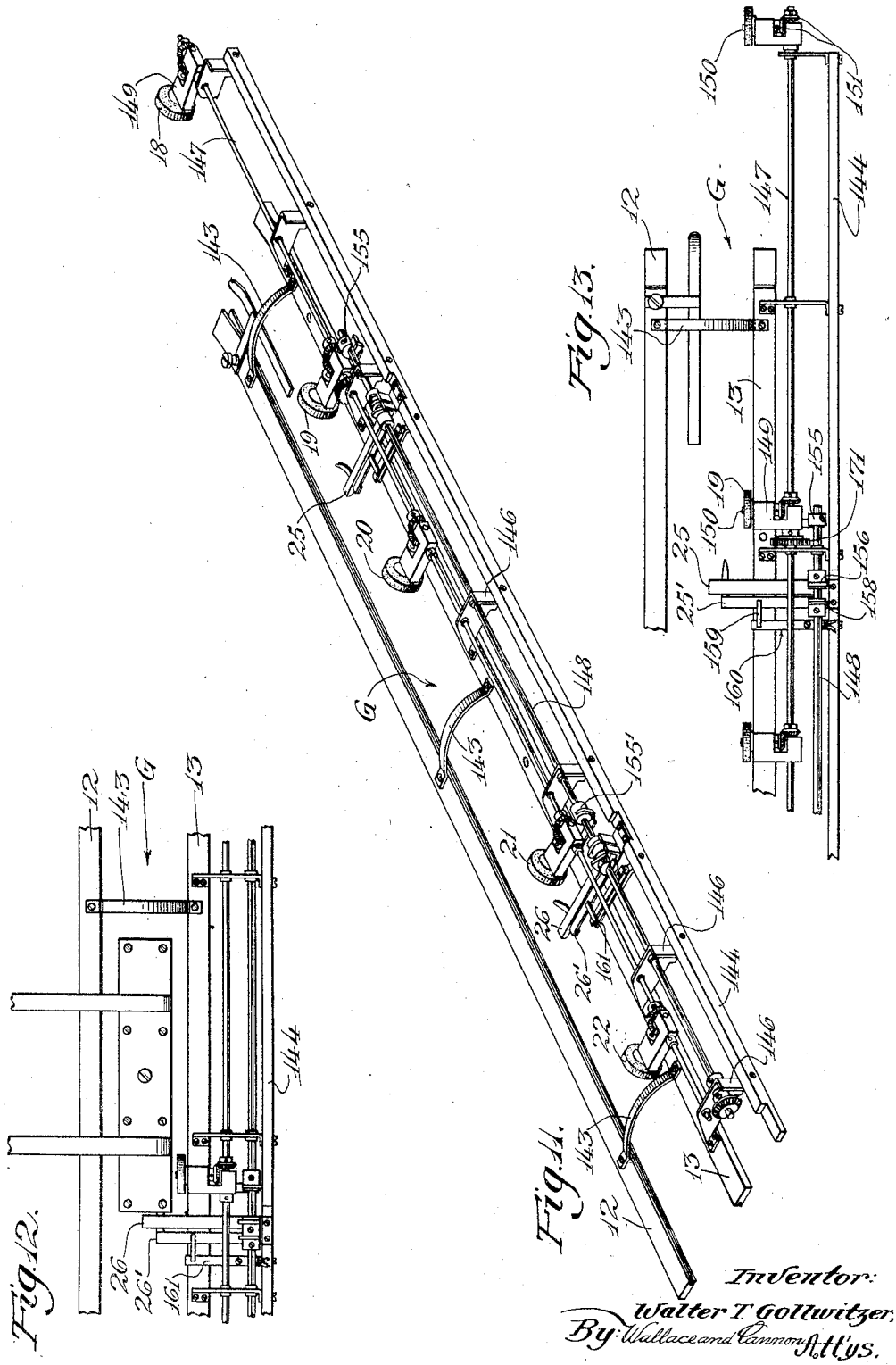
Fig. 8.

Inventor:
Walter T. Gollwitzer
By: Wallace and Cannon
Attorneys

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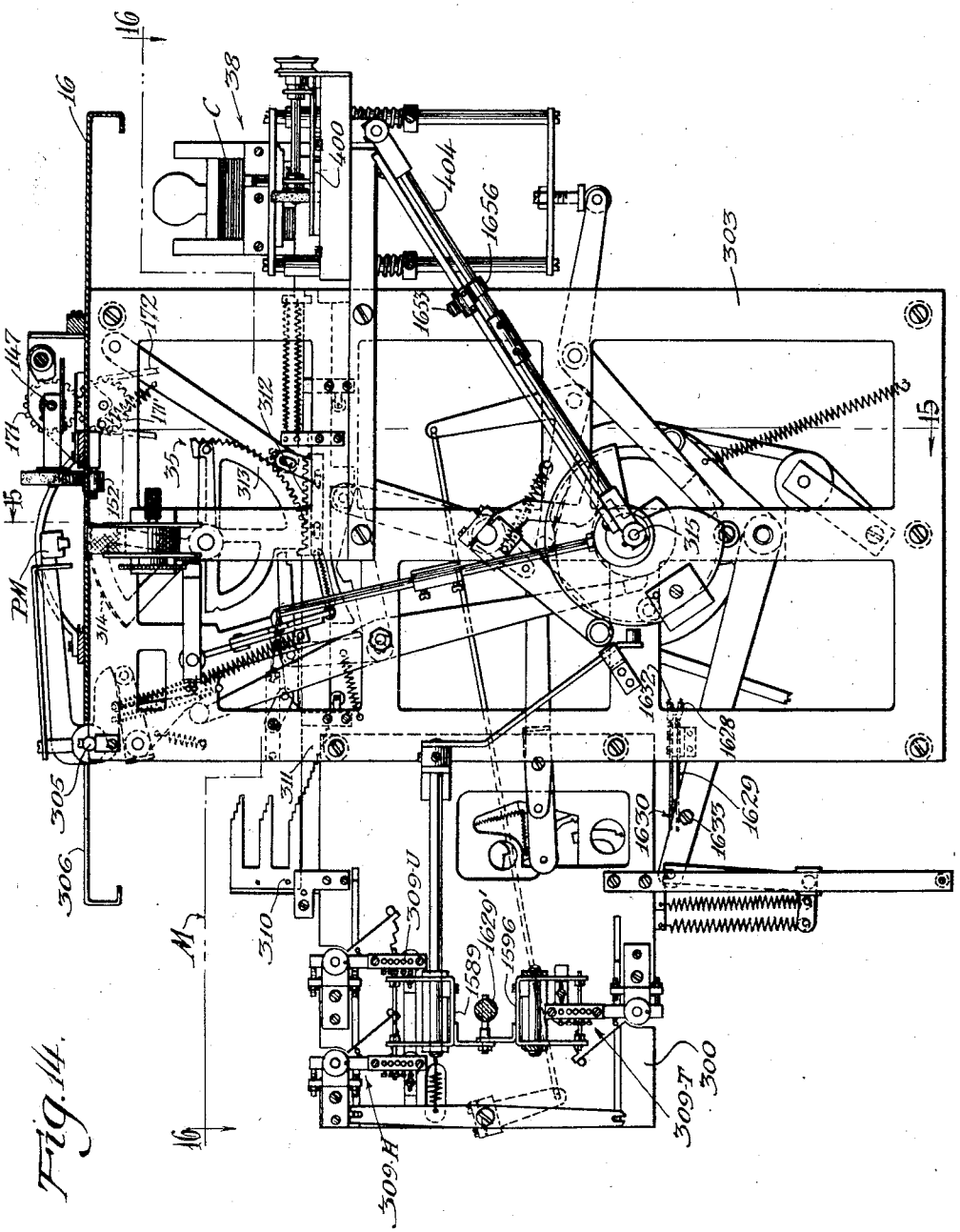


Fig. 14.

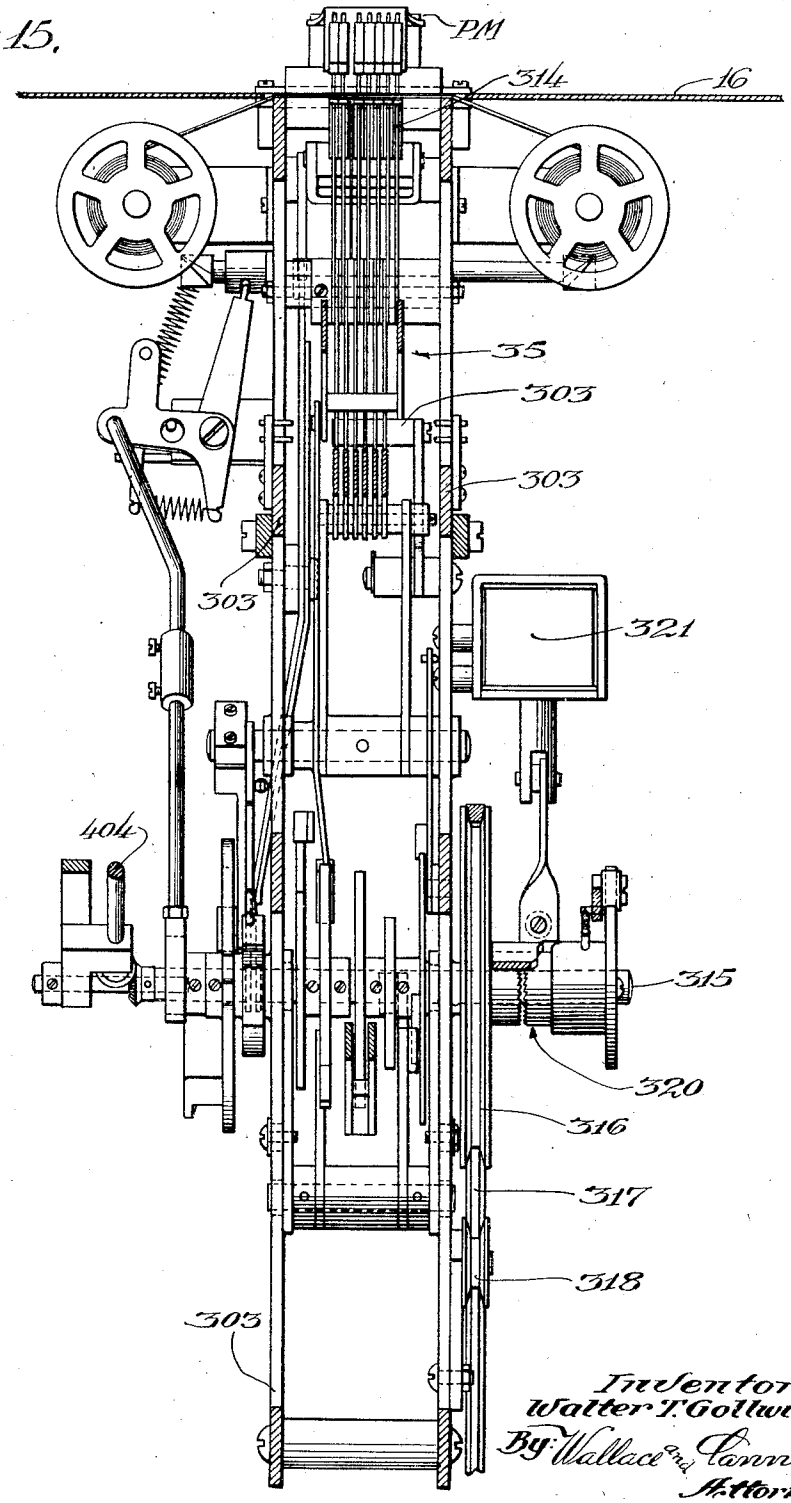
Inventor:
Walter T. Gollwitzer;
By: Wallace and Cannon
Attorneys

Jan. 16, 1945. W. T. GOLLWITZER 2,367,395

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Fig. 15.



Inventor:
Walter T. Gollwitzer
By: Wallace & Cannon
Attorneys

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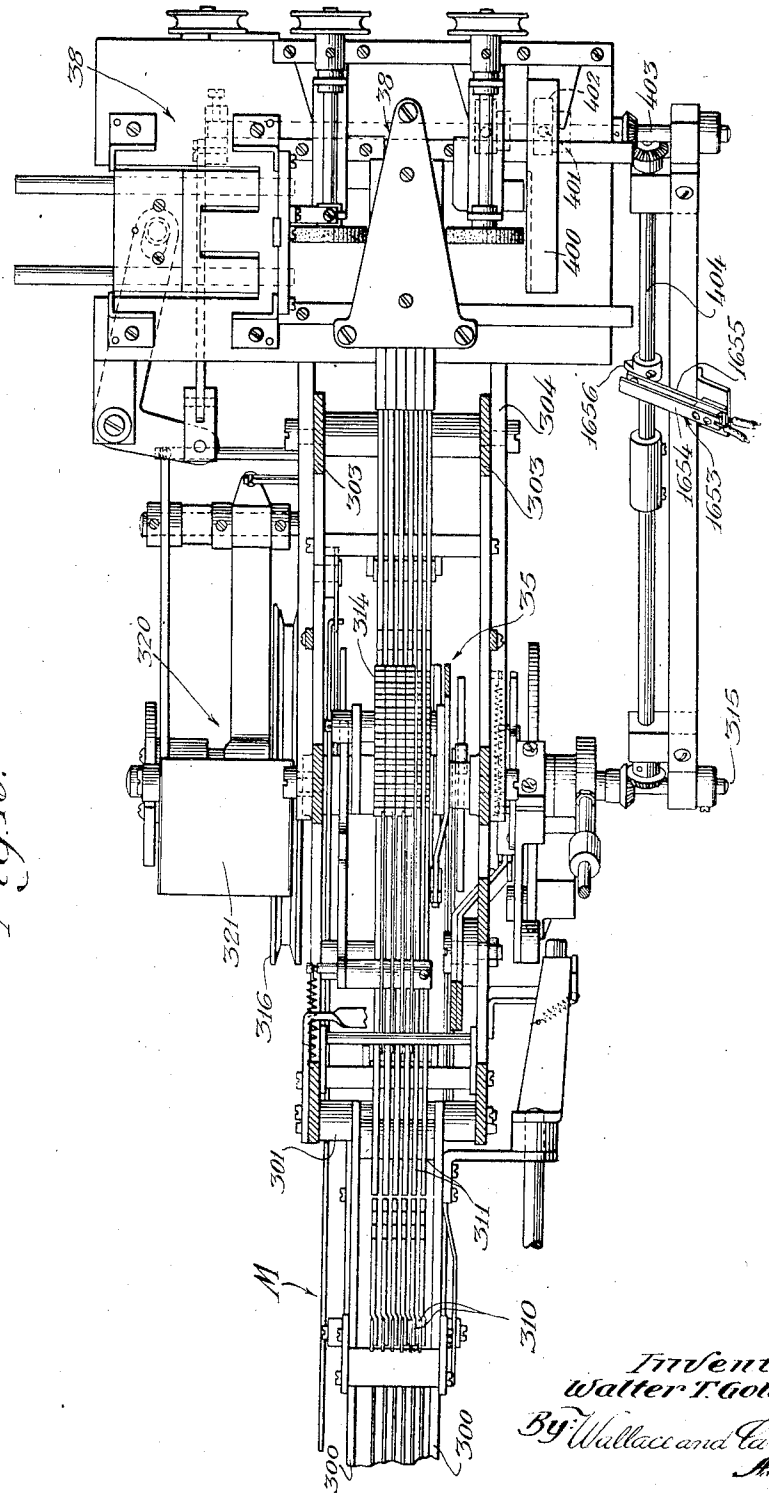


Fig. 16.

Inventor:
Walter T. Gollwitzer.
By Wallace and Cannon
Attorneys

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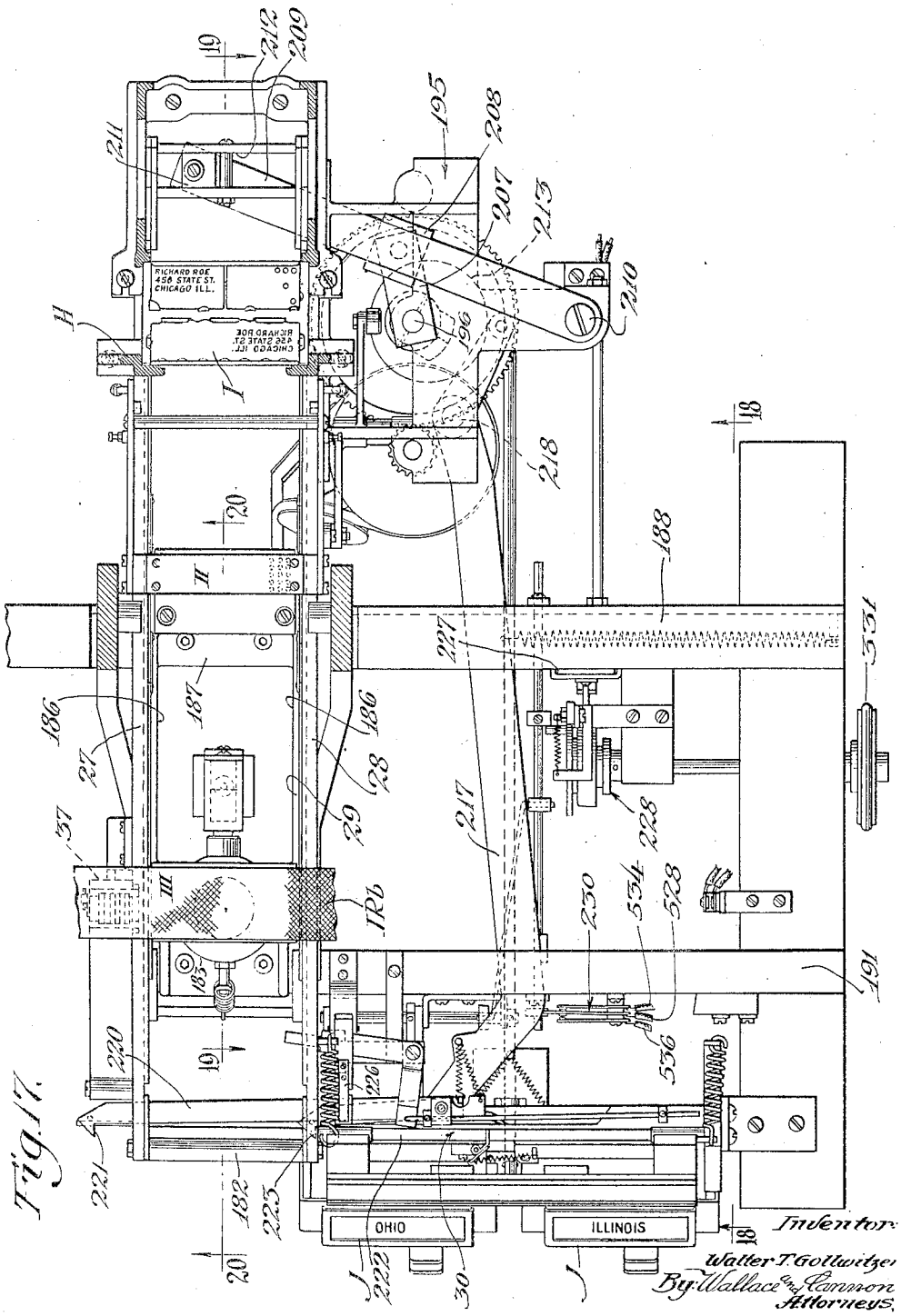


Fig. 17.

Inventor:
Walter T. Gollwitzer
By: Wallace & Cannon
Attorneys.

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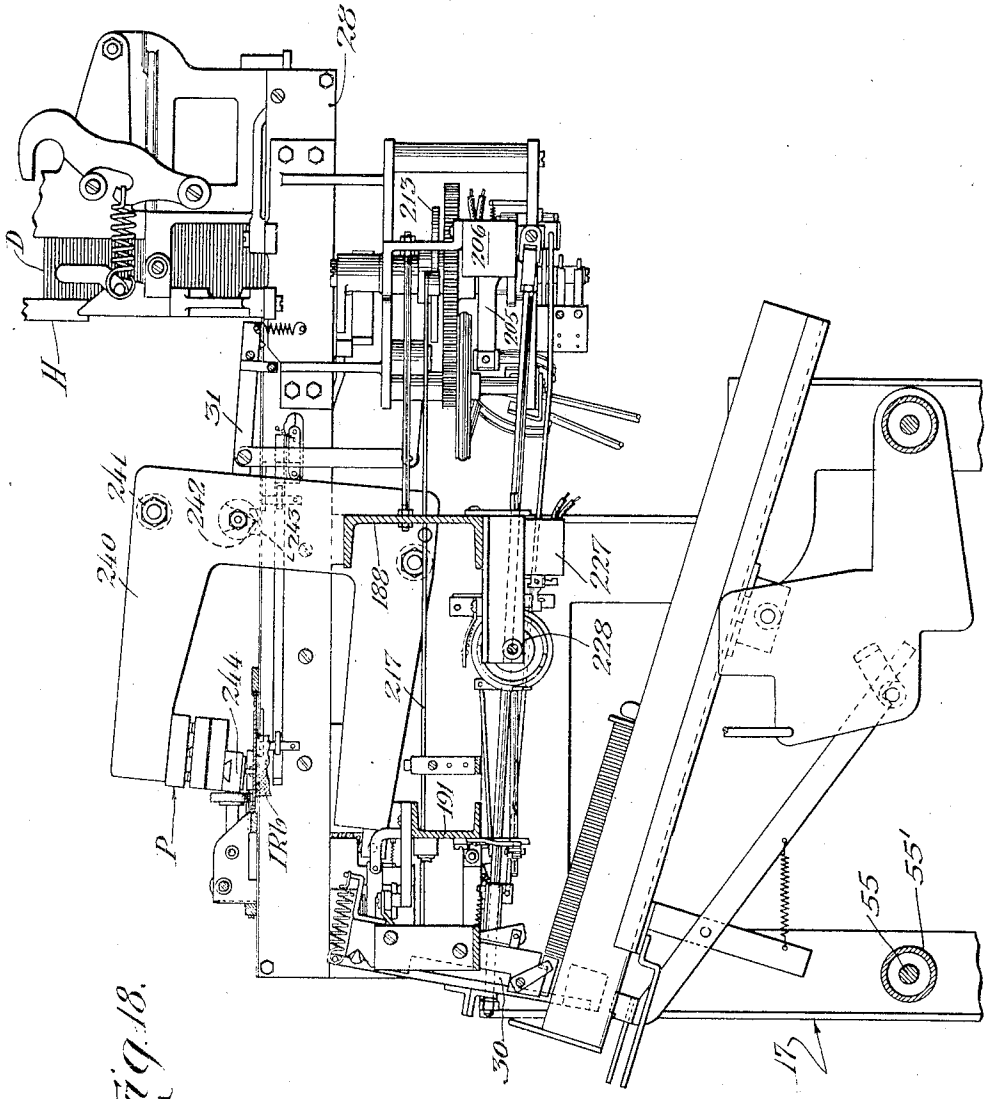


Fig. 18.

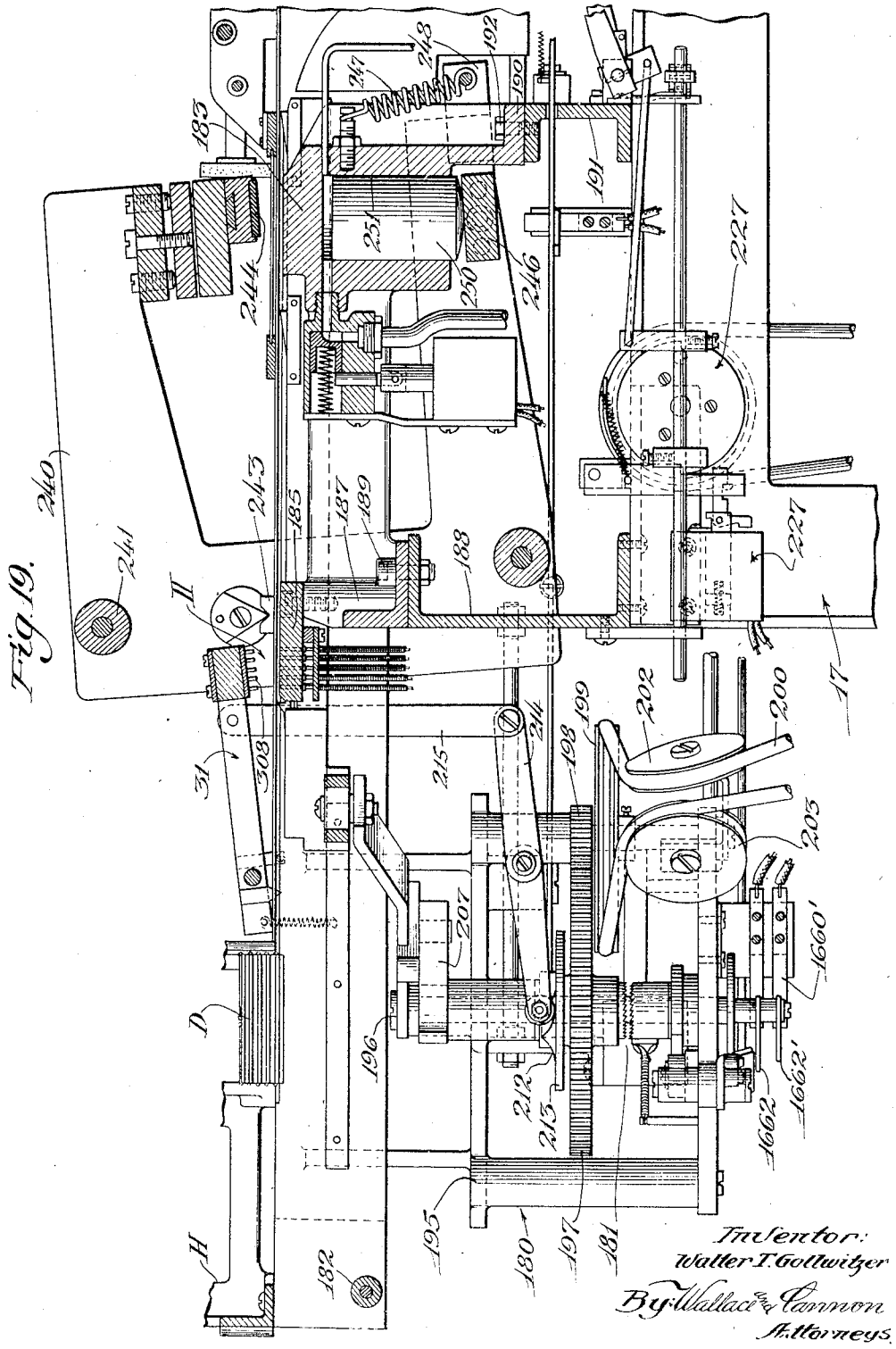
Inventor:
Walter T. Gollwitzer.
By: Wallace and Cannon
Attorneys

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Fig. 19.



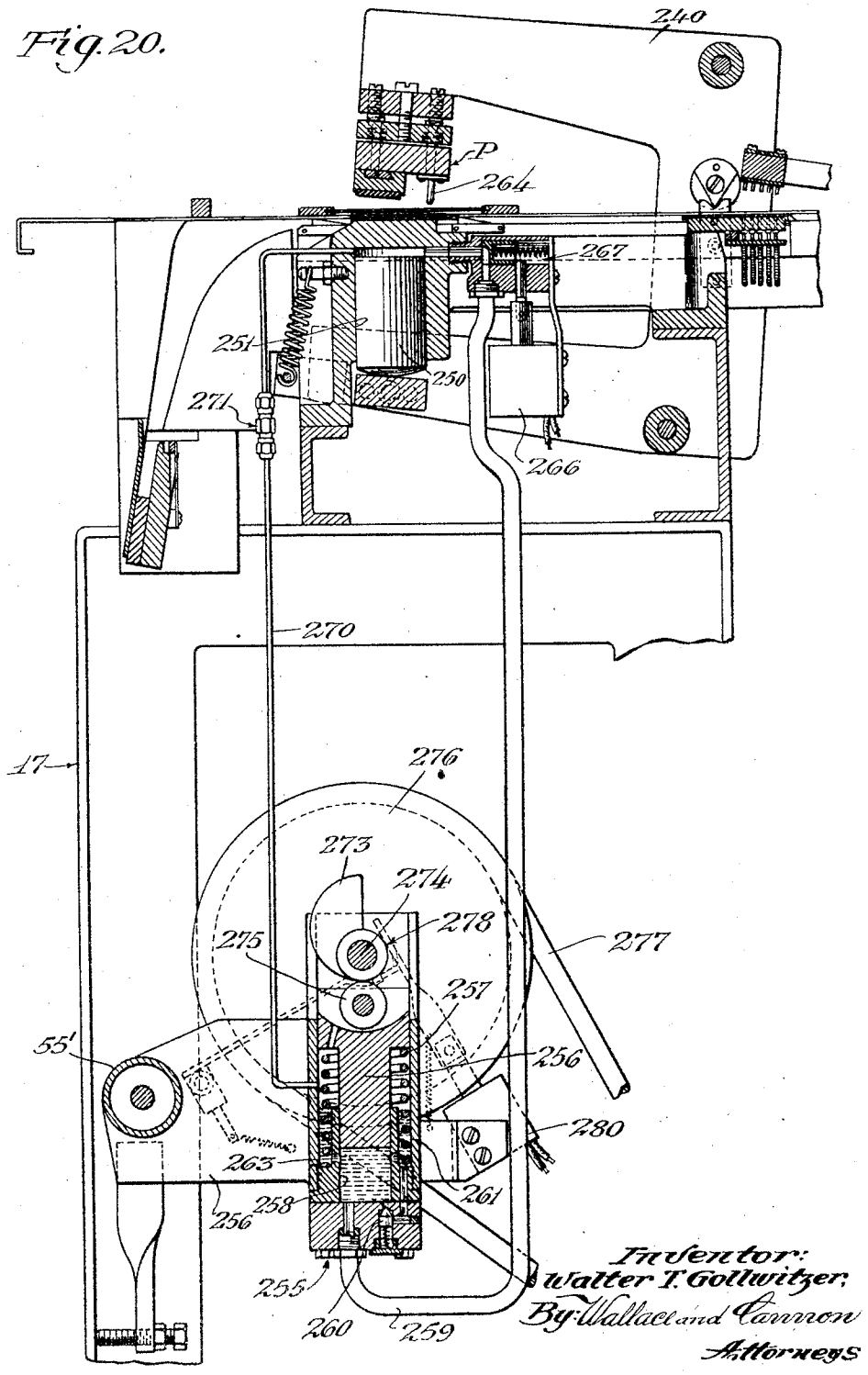
Inventor:
Walter T. Gollwitzer
By: Wallace & Cannon
Attorneys

Jan. 16, 1945. W. T. GOLLWITZER 2,367,395

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Fig. 20.



Inventor:
Walter T. Gollwitzer,
By: Wallace and Cannon
Attorneys

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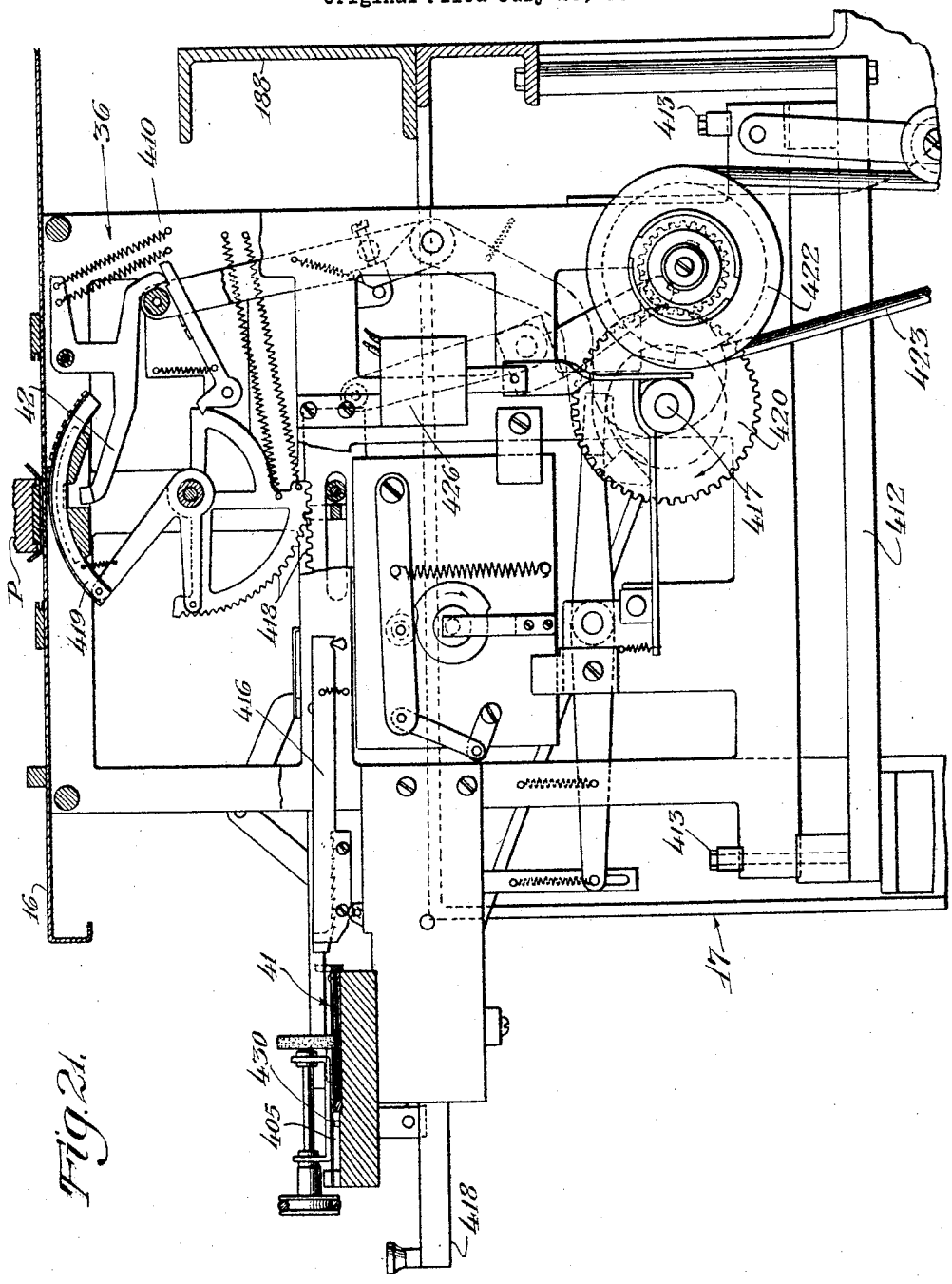


Fig. 121.

Inventor:
Walter T. Gollwitzer,
By: Wallace & Cannon
Attorneys

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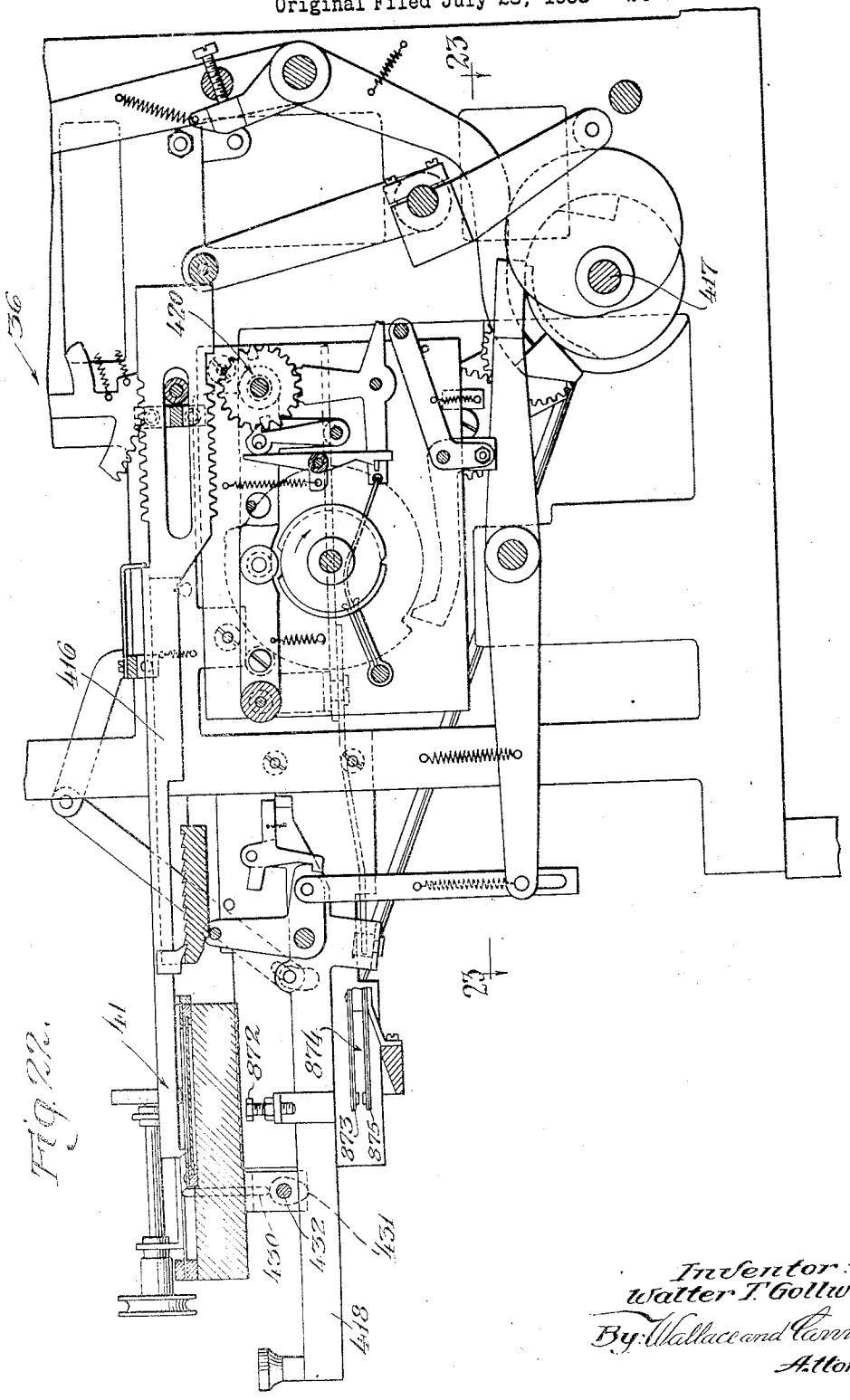


Fig. 22.

Inventor:
Walter T. Gollwitzer,
By: Wallace and Cannon
Attorneys

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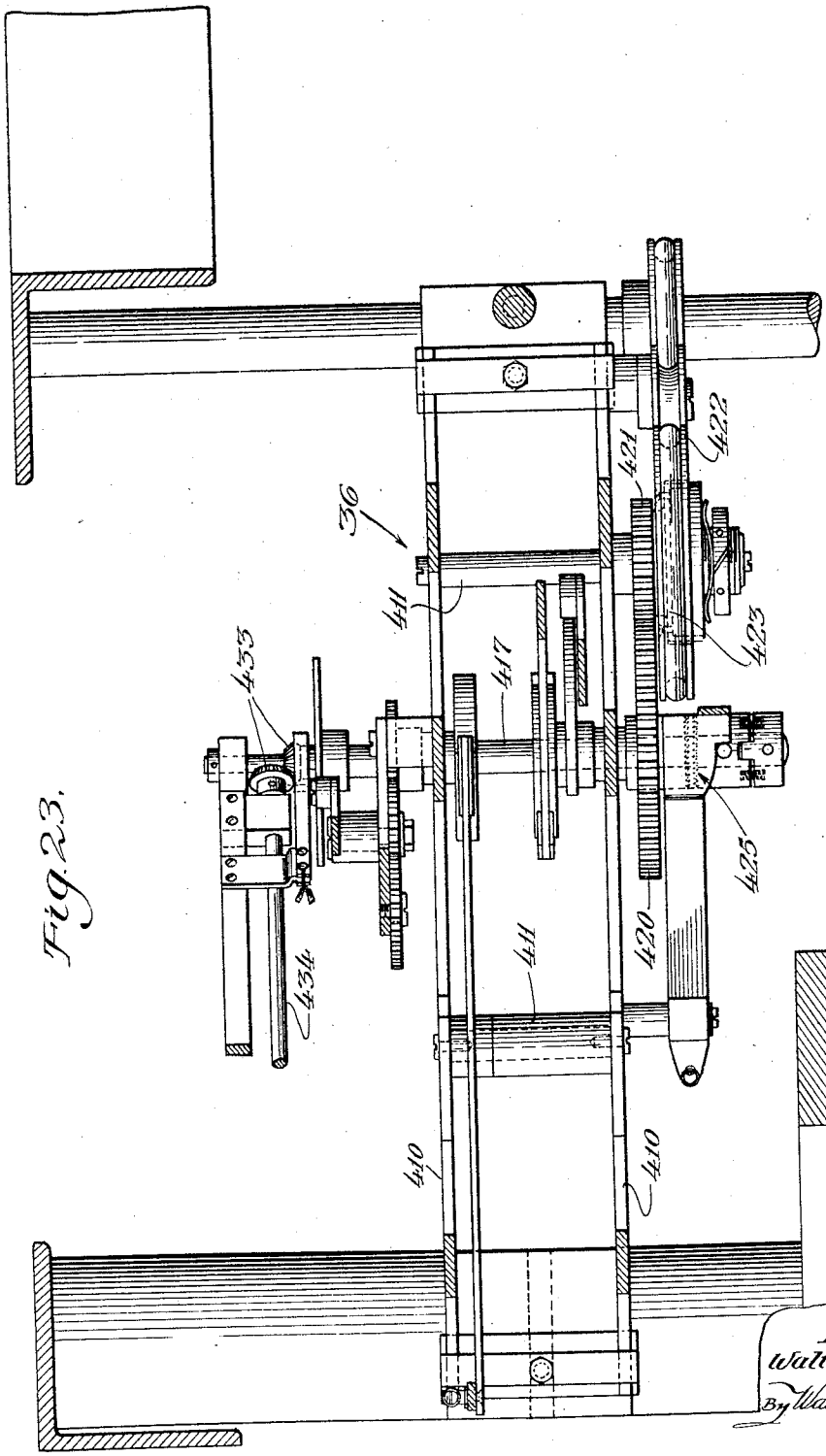


Fig. 23.

Inventor:
Walter T. Gollwitzer
By Wallace & Cannon
Attorneys

Jan. 16, 1945. W. T. GOLLWITZER 2,367,395

PRINTING MACHINE

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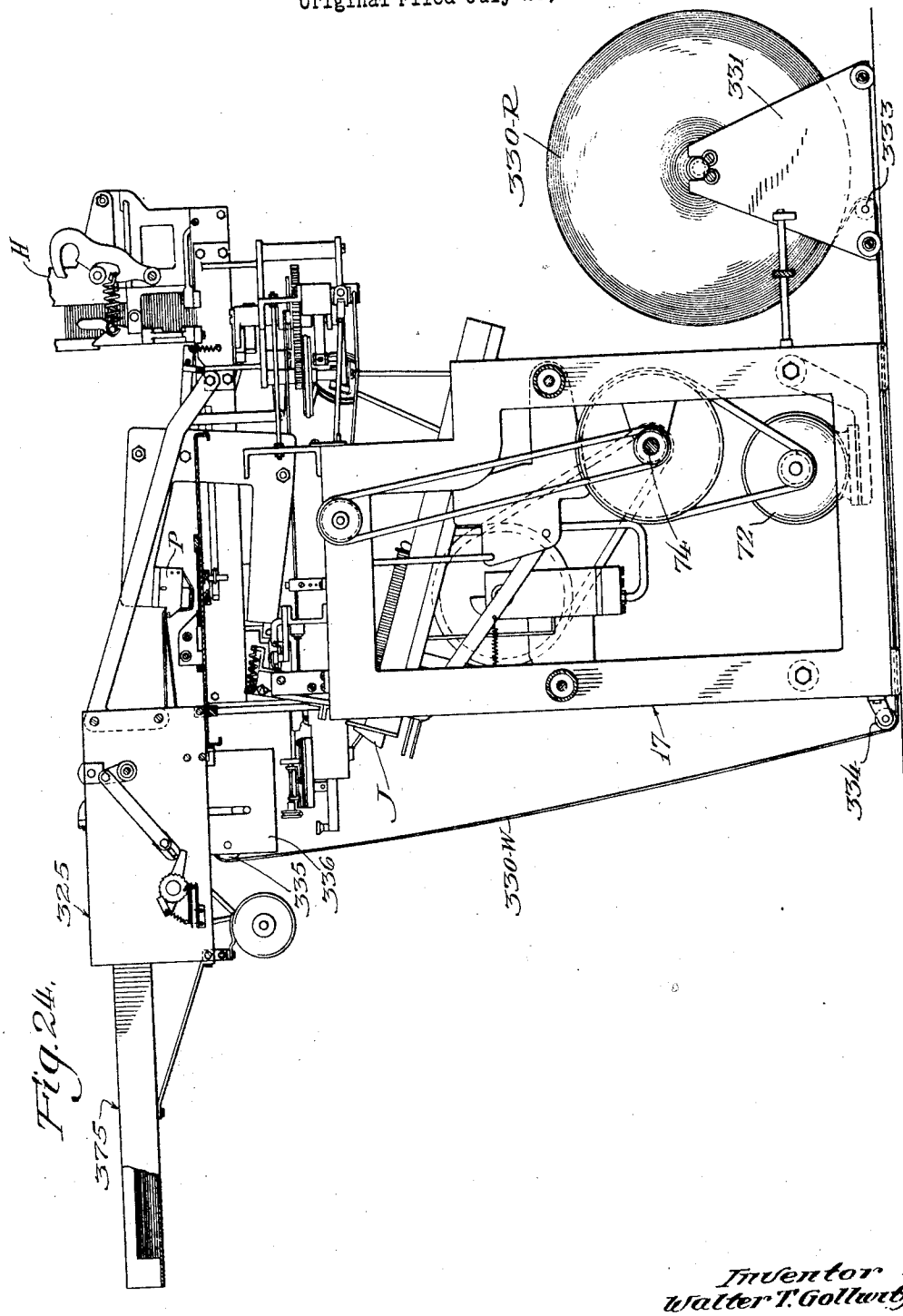


Fig. 27.

Inventor
Walter T. Gollwitzer.
By: Wallace and Cannon
Attorneys

Jan. 16, 1945. W. T. GOLLWITZER 2,367,395

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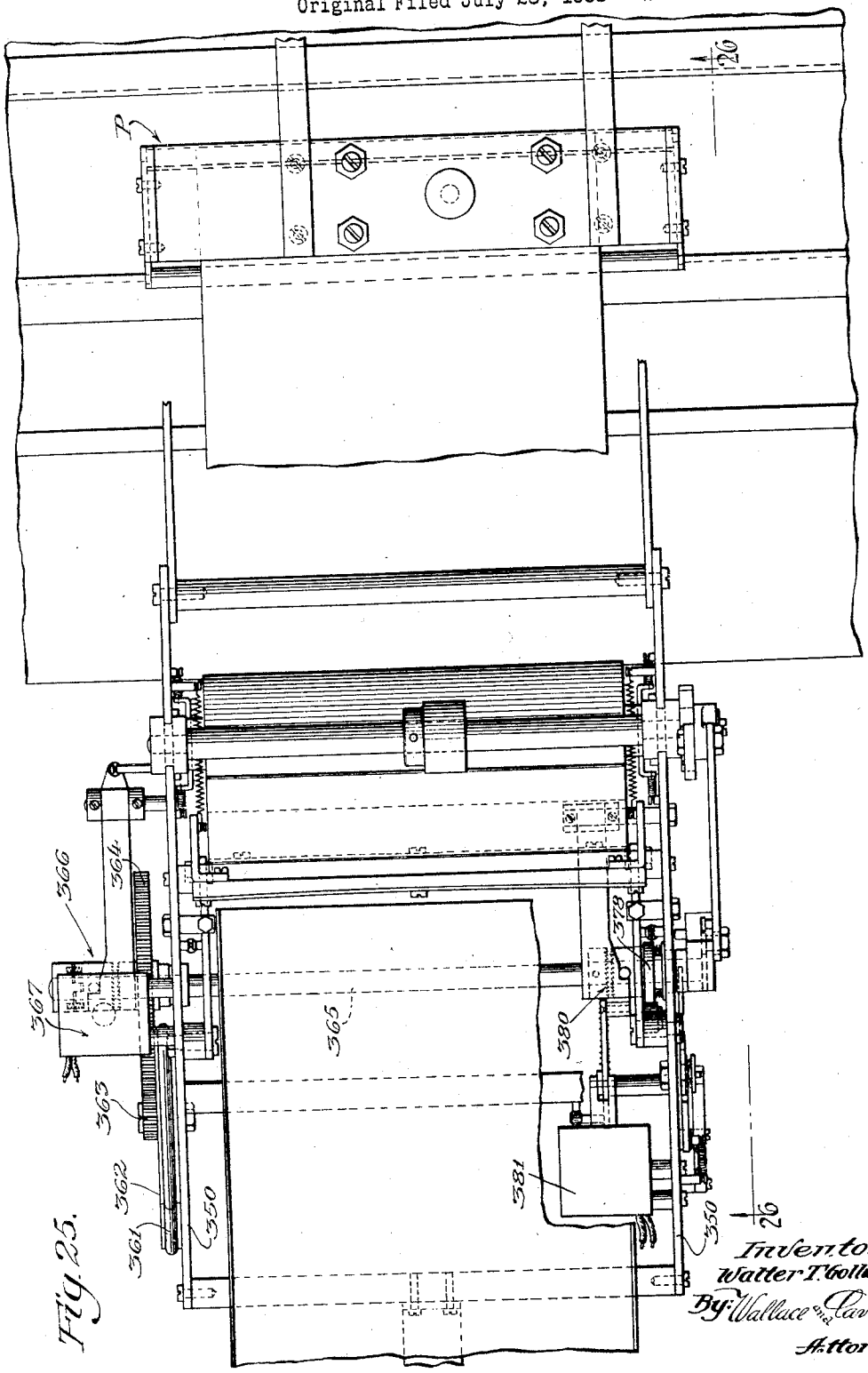


Fig 25.

Inventor:
Walter T. Gollwitzer,
By: Wallace & Cannon
Attorneys

Jan. 16, 1945. W. T. GOLLWITZER 2,367,395

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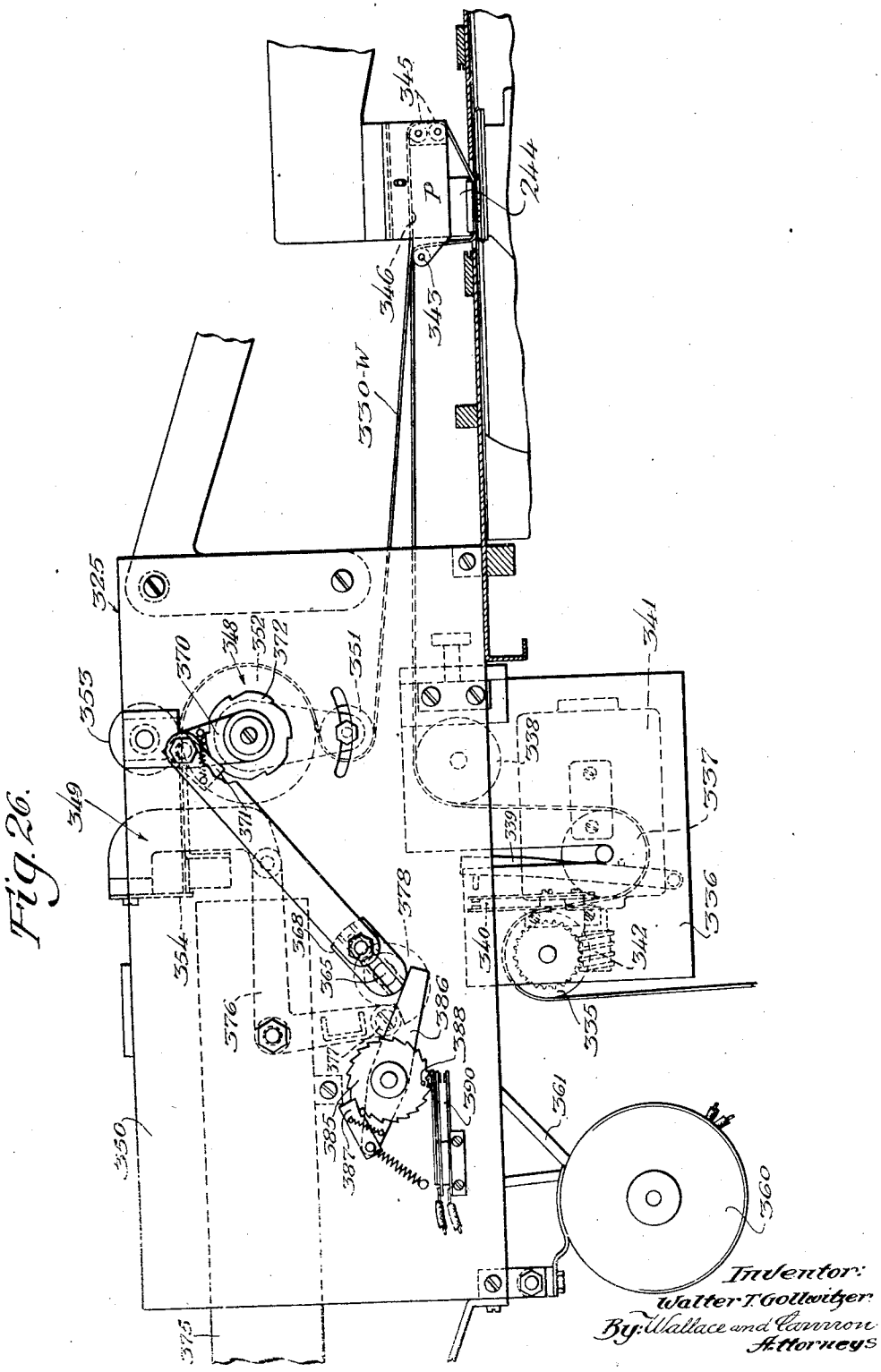


Fig. 26.

Inventor:
Walter T. Gollwitzer
By: Wallace and Cannon
Attorneys

Jan. 16, 1945. W. T. GOLLWITZER 2,367,395

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Fig. 27.

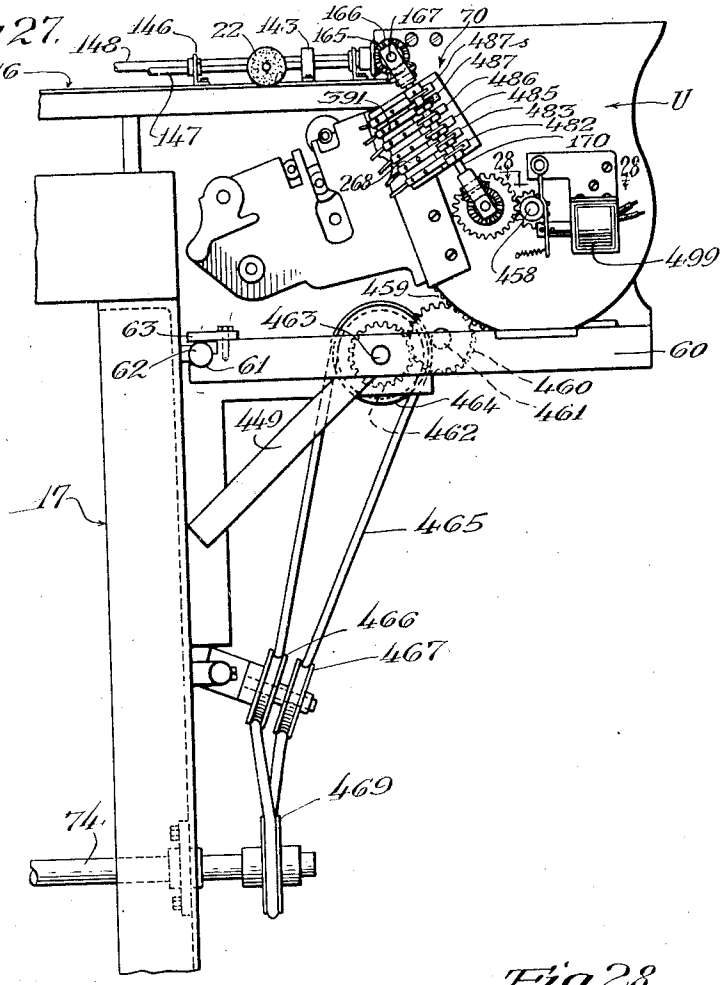


Fig. 29.

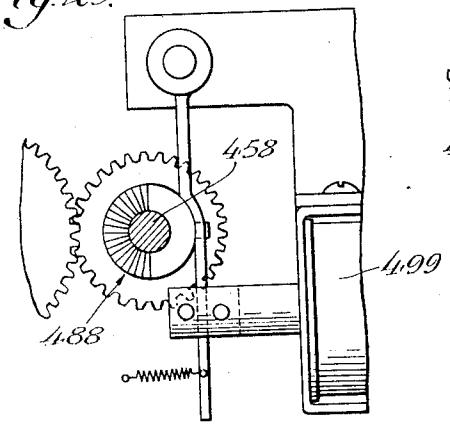
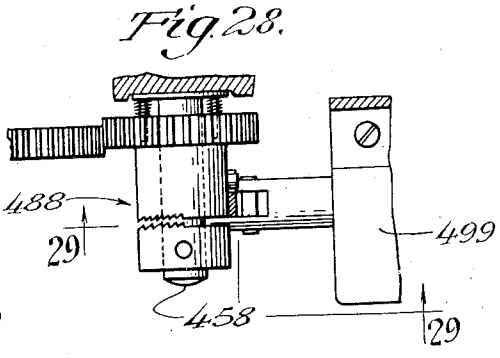


Fig. 28.



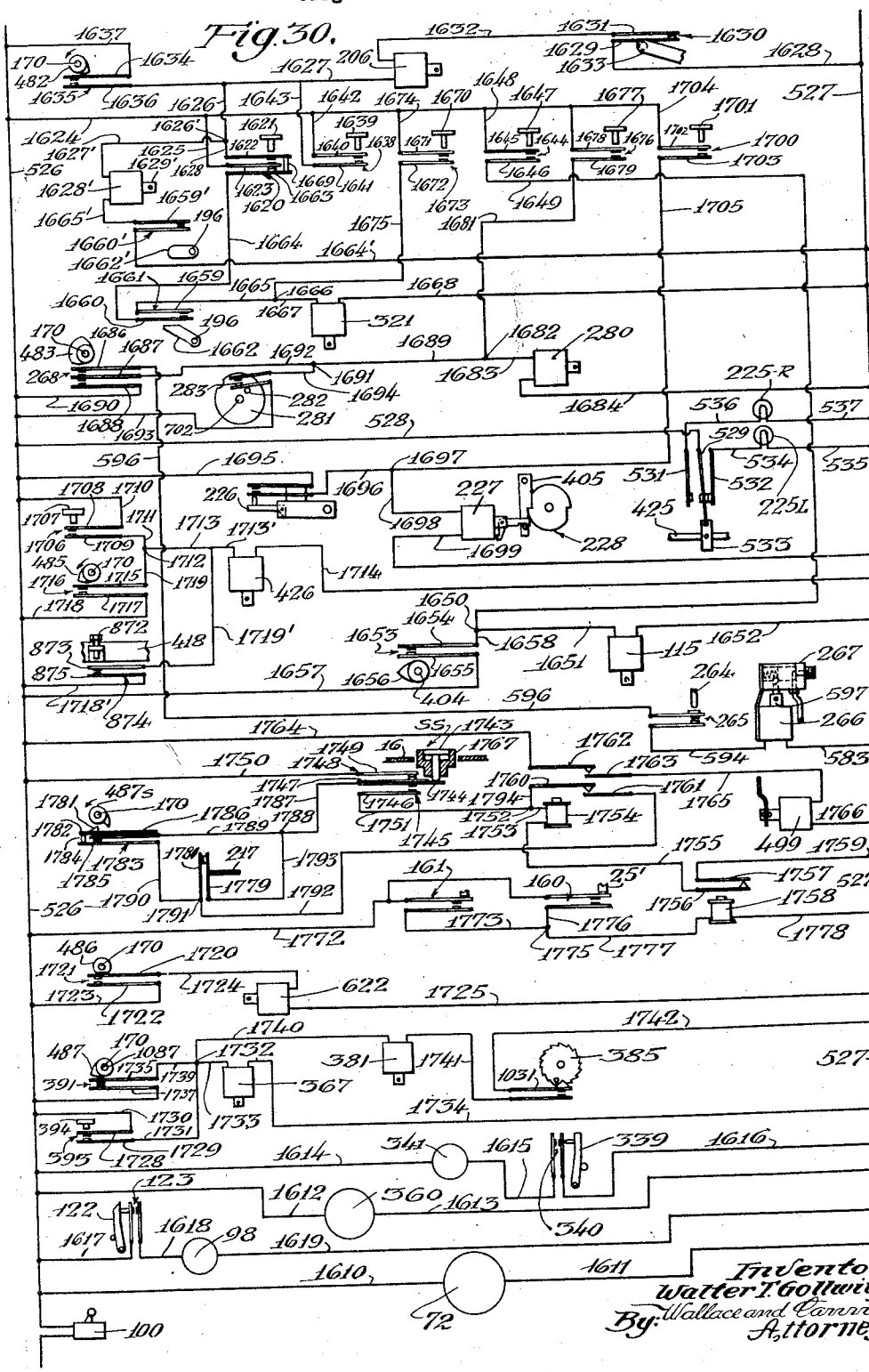
Inventor:
Walter T. Gollwitzer;
By: Wallace and Cannon
Attorneys

Jan. 16, 1945. W. T. GOLLWITZER 2,367,395

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Fig. 30.



Inventor:
Walter T. Gollwitzer,
By: Wallace and Cannon
Attorneys.

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Fig. 31.

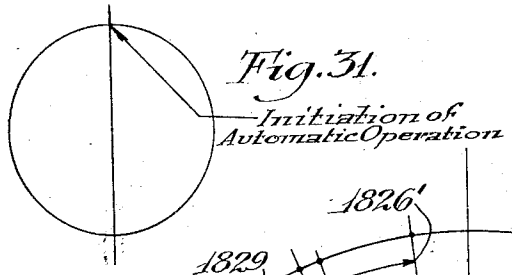
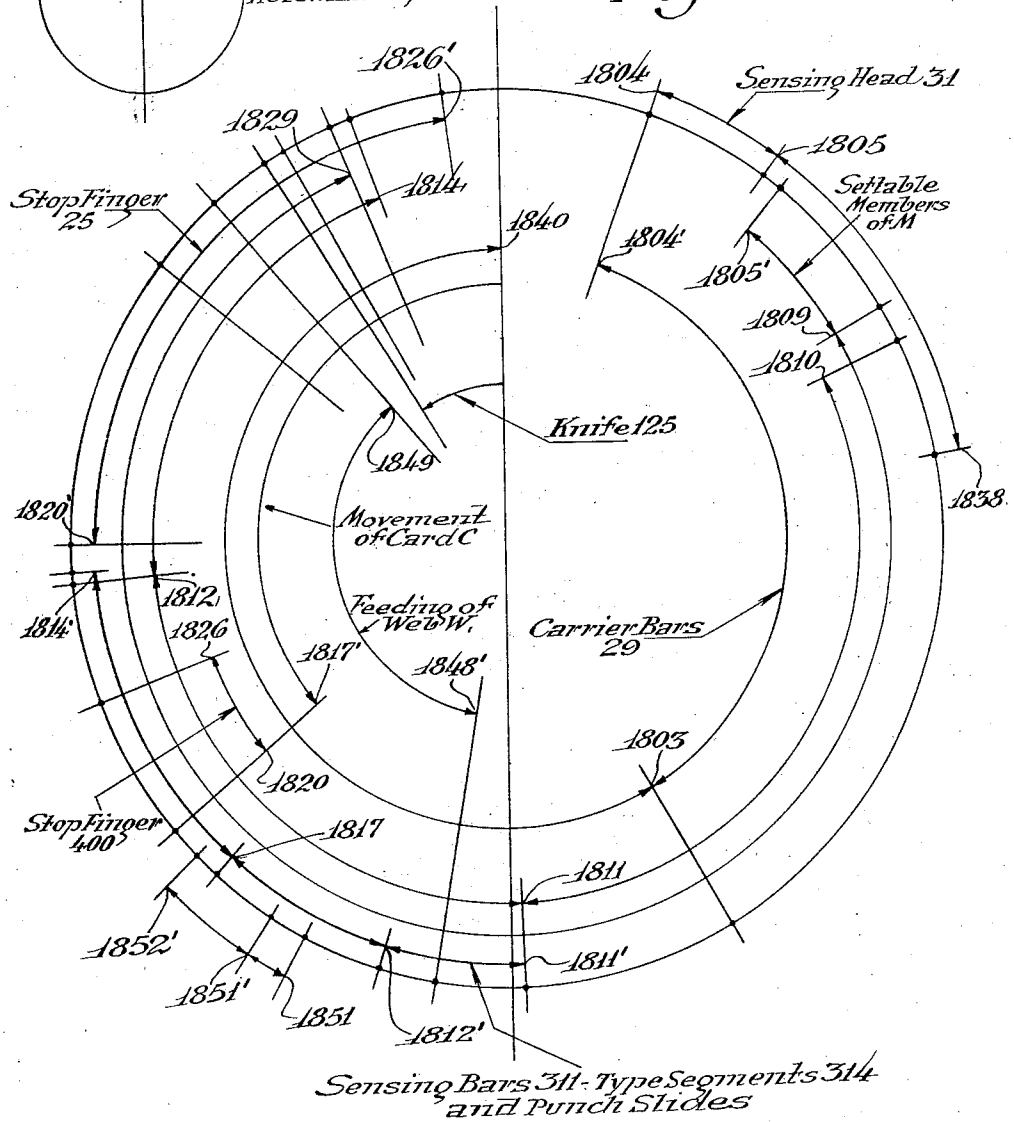


Fig. 31A.



Inventor:
Walter T. Gollwitzer.
By: Wallace and Cannon
Attorneys

Jan. 16, 1945. W. T. GOLLWITZER 2,367,395

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Fig. 32.

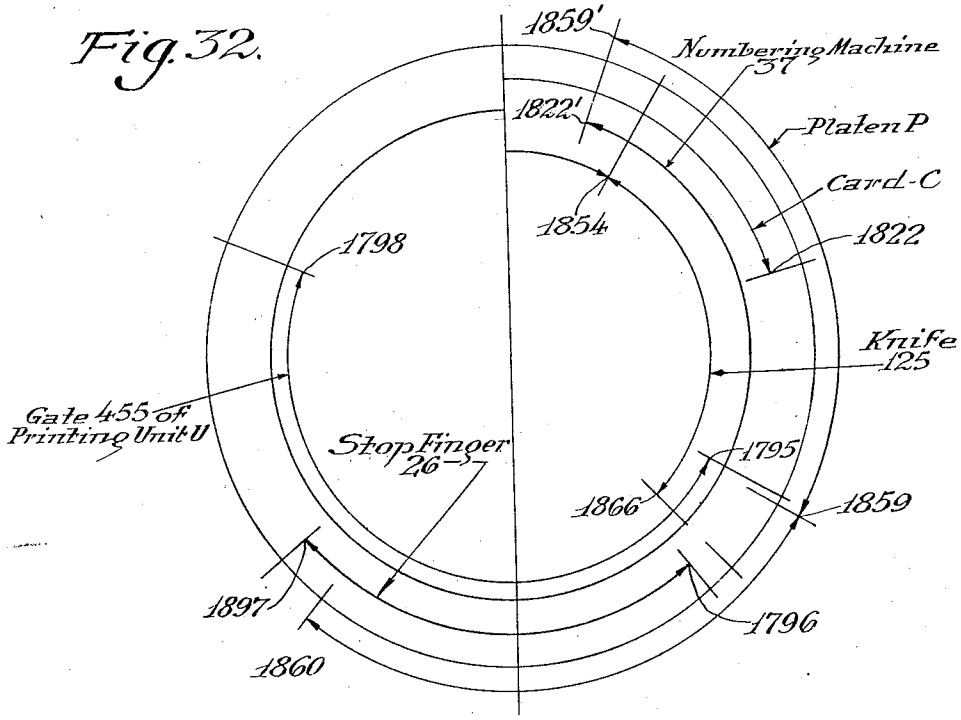
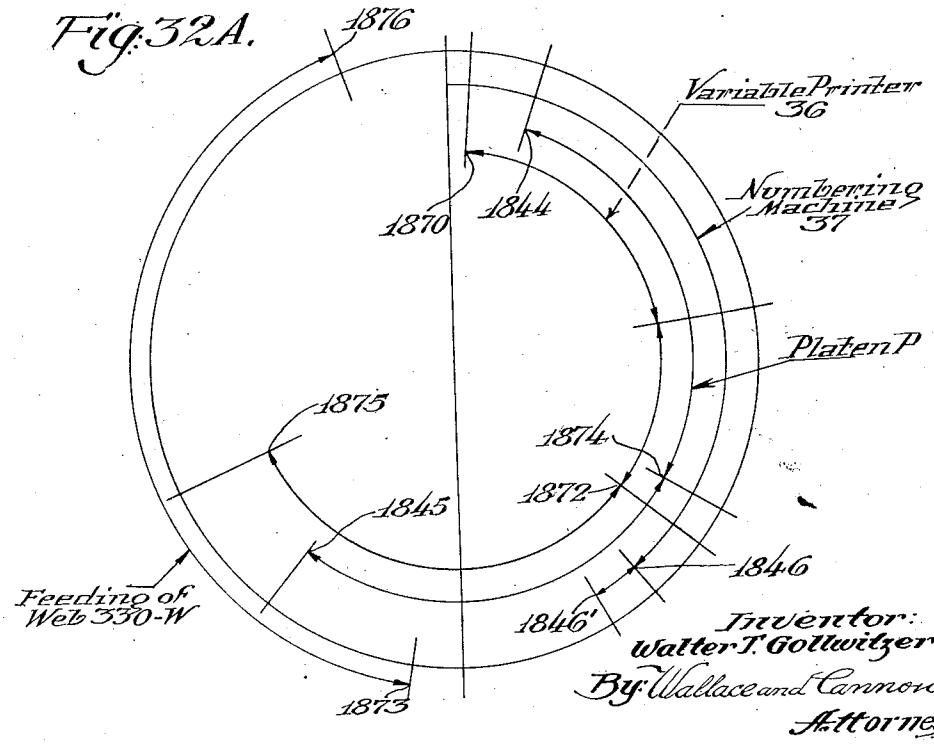


Fig. 32A.



Inventor:
Walter T. Gollwitzer,
By: Wallace and Cannon
Attorneys

Jan. 16, 1945. W. T. GOLLWITZER 2,367,395

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Fig. 33.

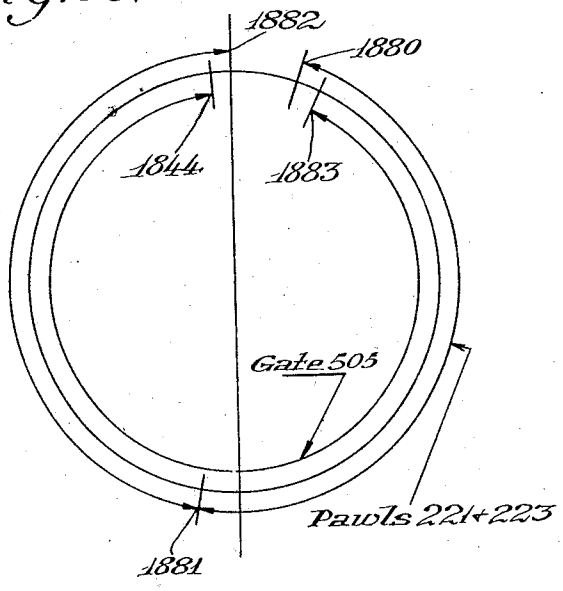
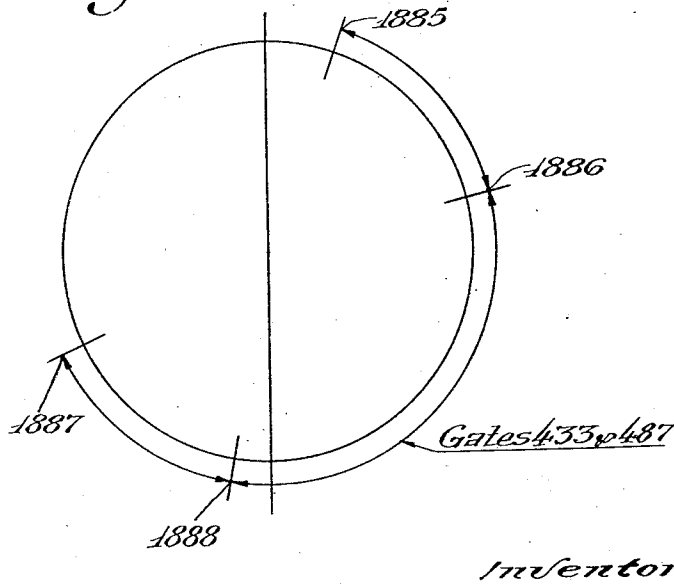


Fig. 33A.



Inventor:
Walter T. Gollwitzer.
By: Wallace and Cannon
Attorneys.

Patented Jan. 16, 1945 2,367,395

UNITED STATES PATENT OFFICE

2,367,395

PRINTING MACHINE

Walter T. Gollwitzer, Euclid, Ohio, assignor to Addressograph-Multigraph Corporation, Wilmington, Del., a corporation of Delaware

Original application July 28, 1938, Serial No. 221,841. Divided and this application October 27, 1941, Serial No. 416,635

10 Claims. (Cl. 235—61.6)

This application is a division of my co-pending application Serial No. 221,841 filed July 28, 1938, now Patent No. 2,296,277, issued Sept. 22, 1942.

This invention relates to printing machines and to mechanisms for use therein and therewith, and more particularly this invention relates to the manner in which the various operative units of such printing machines are constructed and associated to produce the complete machine.

The invention is particularly concerned with printing machines of the type which may be employed to produce business instruments and the like such, for example, as checks, public utility bills, insurance notices, invoices and the like. Exemplifications of printing machines of the kind to which this invention generally pertains are to be found, for example, in United States Letters Patent Nos. 2,041,183 and 2,083,061, and in my co-pending applications Serial No. 65,376 filed February 24, 1936, now Reissue Letters Patent of the United States No. Re. 21,208 patented September 19, 1939, and Serial No. 78,682 filed May 8, 1936, now United States Letters Patent No. 2,132,413 patented October 11, 1938. In machines of this character paper is fed through a printing machine in individual sheets, and such sheets may be pre-cut or may be obtained in connection with the printing machine through withdrawal of paper in suitable lengths from a web, the web being severed to provide sheets, which are then fed through the machine. Regardless of the manner in which such individual sheets are obtained, they are fed through the machine past one or more printing positions whereat impressions are made thereon either directly from printing, printing and control, or like devices that are sequentially fed through the machine, or impressions may be made upon such sheets from suitable printing mechanisms set up under the control of printing and control or like devices or record bearing means such as cards or the like. Furthermore, in printing machines of this kind constantly reoccurring data are printed on the sheets before pre-cut sheets are stacked in the machine or before the sheets are severed from a web, or after such severance, and sometimes such impressions of reoccurring data are made on the sheets both prior to and after severance of the sheets from the web.

The data printed on sheets or business instruments such as those to which reference has been made, other than the constantly reoccurring data, may be conveniently classified as changeable data and variable data. The changeable data are usually those which are directly printed from printing, printing and control, or like devices and usually consist of an identification, such as a name and address, and the variable data are usually numerical accounting data, such as the amount of money to be paid pursuant to a check drawn on a bank or the amount of money due and owing a public utility, an insurance company or the like and also, sometimes, related data.

Various ways have been proposed heretofore for printing both such changeable and variable data on business instruments and among these has been the use of printing devices, from which the changeable data were printed directly, and record cards, usually perforated record cards, under control of which the variable data were printed. In such usages, an example of which will be found in United States Letters Patent 2,083,061, the printing devices and the record cards are sequentially fed through a suitable printing machine wherein the changeable data are printed by making one or more impressions from each printing device on each business instrument and the variable data are printed by making one or more other impressions on each instrument under control of each record card. It is of course essential that the changeable data printed on each instrument from the printing device be related to the data printed under control of the record card, and vice versa, and to this end the printing devices and record cards have been manually compared before being passed through the machine so as to insure that the devices and cards were arranged in corresponding sequences to thereby insure that the changeable and variable data appearing on each instrument relate to the same person or account or the like.

As a further means of assuring that the changeable and variable data printed on each instrument in such usages will be related to each other, that is, will relate to the same person, account or the like, it has been proposed to equip the machines through which such devices and cards are fed with means for comparing each device and card, from which and under control of which impressions are to be made on a particular business instrument, with each other, and this means usually operated to interrupt operation of the machine or to afford other indication when a particular printing device and a particular record card relating to a particular business instrument did not correspond. Inasmuch as, in such usages the sequencing of the printing devices and the record cards was performed manually, the human factor entered into the operations which, o

course, gave rise to error, and where the means in the machine operated to interrupt operation of the machine when a particular card and device did not correspond the productive capacity of the machine was impaired for, obviously, time was lost each time machine operation was interrupted. Furthermore, it is a time consuming task to determine the reason for machine stoppage in such instances and to locate the related printing device and record card which further operated to reduce the productive capacity of the machine.

In view of the foregoing it has also been proposed to provide printing and control devices, an example of which is disclosed in my co-pending application Serial No. 65,377, filed February 24, 1936, now United States Letters Patent No. 2,132,412, patented October 11, 1939. Such printing and control devices included, for example, embossed type characters from which impressions could be made directly and also included a perforated or other area affording control means under control of which the variable data could be printed. The use of such devices eliminates the necessity of comparing printing devices and record cards or the like in order to insure that related changeable and variable data will be printed on the same instrument. However, in those instances heretofore where it has been proposed to employ printing and control devices for producing changeable and variable data on business instruments, the control means provided on the devices were direct representations of the variable data that were to be printed under control thereof. In view of this it was necessary to change the control area of the printing and control devices each time there was a variation in the variable data. This was required not because of any limitation in the printing and control devices but rather by reason of limitations in the machines in which the printing and control devices were employed, which is to say, such machines heretofore have not been equipped to interpolate the data represented in the control area of the printing and control devices or, more specifically, such machines have not been equipped to perform computing operations based upon the data represented in the control area of the printing and control devices.

It will be recognized that machines of the aforesaid character will be called upon to produce a wide variety of business instruments and the like embodying widely varying sizes and locations of printing impressions, and an important object of the present invention is to provide a machine capable of variation in such a manner that sheets, webs and the like of varying size and arrangement may be produced and properly printed therein.

It is particularly important that machines such as those to which this invention pertains be capable of adjustment, as aforesaid, for it is customary and usually required that the machines produce previously designed business instruments and the like and this entails adjustment of the machine to requirements of the instruments. Such adjustment is facilitated by arranging the various mechanisms in the machine that are operative on the sheets, that is, business instruments in whatever form they may assume, in such a way that each mechanism is a complete unit and so to do is one of the more important objects of the present invention, and related objects are to so interconnect such units that adjustment thereof relative to each other may be expeditiously effected; to so connect the units to each other that the interrelation therebetween, once established, may be maintained; and to so mount the units that service, repair and internal adjustment thereof is facilitated.

It will be manifest that in a machine such as that to which the present invention pertains wherein a plurality of operative mechanisms is provided and whose various operations are interrelated in the course of operation of the machine it is essential that the time of operation of the various mechanisms be closely controlled so as to insure, first of all, proper operation of the various mechanisms, and also to enable the various mechanisms to operate in close relation to one another to thereby enable the machine to be operated in a rapid manner. It will be apparent that in such an arrangement it is essential that the timing of the operation of the various mechanisms be accurately controlled and to effectuate this in a novel manner is still another object of this invention, and an object ancillary to this is to provide a constantly operating mechanism in the machine and to time the operations of various operative mechanisms in the machine with respect to the timing of such constantly operating mechanisms as well as to the timing of each other.

Other objects related to the foregoing are to employ novel clutch structures for controlling the operating of various operative mechanisms in the machine; to enable the time of operation of the various clutch structures to be accurately and positively controlled; to arrange the controlling apparatus in such a way that operation thereof is timed with respect to the operation of a particular mechanism in the machine and to accurately, positively and uniformly establish operative relation between such mechanism and the control apparatus; to utilize electrical controls for the various operative mechanisms in the machine and to regulate operation of such controls by timing switches; to so locate the timing switches that the operation of various mechanisms may be made interdependent; and to arrange the timing switches for operation at common points in those instances where accurate interdependence of operation of various mechanisms is essential.

Many other objects and advantages of the present invention will be apparent from the following description in which reference is made to the accompanying drawings wherein

Fig. 1 is a perspective view of the machine embodying my invention;

Fig. 2 is a front elevation of the machine shown in Fig. 1 with the cover plates removed;

Fig. 3 is a top plan view of the machine as shown in Fig. 2;

Fig. 4 is an elevation of a typical printing and control device which may be utilized in the present machine;

Figs. 4A and 4B are fragmentary elevational views of control cards that may be used on the printing and control device shown in Fig. 4;

Fig. 5 is a chart of the code under which perforations are made in the control areas of the printing and control devices such as shown in Fig. 4;

Fig. 6 is an elevation of a typical business instrument produced by the machine of this invention;

Fig. 7 is a fragmentary elevation of a proof sheet such as may be produced in the machine described herein;

Fig. 8 is a view taken substantially on the line

8—8 on Fig. 2 and showing the paper roll support and web feeding, printing, and severing means;

Fig. 9 is a fragmentary front elevation looking in at the right-hand side of Fig. 8;

Fig. 10 is a timing chart of the mechanism shown in Fig. 8;

Fig. 11 is a perspective view of the unit for feeding and guiding sheets through the machine;

Fig. 12 is a fragmentary plan view of the printing position in the manner whereat impressions are made from the printing and control devices;

Fig. 13 is a fragmentary plan view of the mechanism at the right-hand end of the unit illustrated in Fig. 11;

Fig. 14 is a view taken substantially along the line 14—14 in Fig. 2 and illustrating the multiplying unit and its associated mechanism;

Fig. 15 is a vertical sectional view taken along the line 15—15 in Fig. 14 and illustrating further details of the multiplying unit;

Fig. 16 is a horizontal sectional view of the multiplying unit and the associated mechanism taken substantially along the line 16—16 in Fig. 14;

Fig. 17 is a top plan view, with the cover plates and a part of the platen structure removed, of the printing device guideway of the printing device guiding and advancing unit of the machine;

Fig. 18 is a vertical sectional view taken substantially along the line 18—18 in Fig. 17 and illustrating further details of the printing device guiding and advancing unit;

Fig. 19 is a vertical sectional view taken along the line 19—19 in Fig. 17 and further illustrating the details of construction of the printing device guiding and advancing unit;

Fig. 20 is a vertical sectional view taken along the line 20—20 in Fig. 17 and illustrating the construction and arrangement of the units which form the platen and its actuating mechanism;

Fig. 21 is a vertical sectional view taken substantially along the line 21—21 in Fig. 3 and illustrating the variable printer whereby variable data is printed on the proof sheet in accordance with the printing of such variable data on the original sheet or check;

Fig. 22 is a generally similar vertical sectional view of the variable printer which makes impressions upon the proof sheet;

Fig. 23 is a plan section taken along the line 23—23 of Fig. 22;

Fig. 24 is a side elevational view of a pager and proofer which may be used with and as a part of the machine of the present invention;

Fig. 25 is a plan view of the pager and proofer mechanism shown in Fig. 24;

Fig. 26 is a vertical sectional view of the pager and proofer mechanism taken along the line 26—26 in Fig. 25;

Fig. 27 is a view taken substantially along the line 27—27 in Fig. 3 and illustrating the form printing unit and the main control and timing mechanism of the present invention;

Fig. 28 is a detailed view taken substantially along the line 28—28 in Fig. 27;

Fig. 29 is a sectional view of the control clutch taken along the line 29—29 of Fig. 28;

Fig. 30 is a wiring diagram illustrating the electrical control circuits employed in the machine; and

Figs. 31, 31A, 32, 32A, 33 and 33A are timing charts illustrating different cycles of operation of mechanisms of the machine.

Preliminary Description

In the following detail description of a preferred form of my invention as shown in the accompanying drawings, a complete printing machine is first described and thereafter certain additional mechanisms are explained.

The novel machine depicted in Fig. 1 is constructed and arranged to produce dividend checks as S, Fig. 6. Such a dividend check includes constantly reoccurring data F, Fig. 6, which in the present instance is the name and location of the company issuing the check, the words "Check No.", the name of the bank on which the check is drawn, and kindred data imparting characteristics to the check, including the border appearing thereon; changing data A, constituting an identification and characterizing the check and, in the present instance, this is an address comprising a name, street and number, and city and state; variable data V which are the amount for which the check is to be payable; and other analogous data such as a date E, a number N and a signature B. The date and signature are the first data, in the machine as constructed, to be printed; next the variable data V are printed and thereafter the address A and number N; and finally the form F is printed on the check.

The address or changing data A are printed on the check directly from a printing and control device such as the device D, Fig. 4, and the variable data V are printed under control of such printing and control devices for so to do eliminates the necessity of checking printing devices or the like against record cards or the like because the printing and control devices, such as are shown in Fig. 4, include both means from which an impression may be made directly and means under control of which impression or other operations may be performed. It is to be understood, however, that when reference is made hereinafter to a printing and control device, save in those instances where the avoidance of checking is essential, this term is to be considered generic for, as will be apparent to those skilled in the art, many of the mechanisms provided in the present machine may be used with printing devices not equipped with control means as, for example, the novel means, described hereinafter, for advancing the printing and control devices through the machine could be used with any printing devices having notches provided in side edges thereof. Furthermore, the means in the machine which are responsive to the control areas on printing and control devices could be responsive to perforations or other data representing means provided on record cards or the like. Hence in view of this it is to be understood that while the devices will be described as printing and control devices, this term is used in the generic sense hereinafter, particularly in those instances where it is not essential that a printing and control device be employed.

The printing and control device shown in Fig. 4 includes a carrier or, as it is called in the art, frame 1 having, in this instance, a metallic plate 2 removably retained thereon by fixed retaining devices 3, a head 3' at the lower edge of the frame, and yieldable or depressible retaining tongues 4. When one or the other of the tongues 4 is depressed the plate 2 may be slid endwise from the retaining devices 3 and the bead 3'. Type characters T are, in this instance, embossed in the metallic plate 2 so as to appear in relief on one face thereof and in intaglio on the opposite face,

impressions being made from the relief faces of the type characters T when the printing and control device D is fed into printing relation with the platen P, Fig. 1, in the machine. The printing and control device shown in Fig. 4 also bears an identification card 5 on which an impression is made from the type characters T so that the data which may be printed from the type characters T may be read easily, thus facilitating handling of the device D. This card 5 is removably retained on the frame 1 above the plate 2 thereon by suitable retaining devices 7 and a bead 8 at the top of the frame. A control card 6 is retained on the frame 1 at one side of the card 5, by the retaining devices 9, the bead 8, and retaining devices 7' being interposed between the cards 5 and 6. The card 6 and the underlying portion of the frame 1 are adapted to have perforations formed therein in accordance with the code shown in Fig. 5 so as to afford control means or representations of data, and such perforations or control means are utilized in the production of the variable data V on the check S in a manner that will be described hereinafter. The perforations in the control card 6 and the underlying portion of the frame 1 may be conveniently produced in a machine such as that disclosed in my co-pending application Serial No. 210,897, filed May 31, 1938, now issued as Patent No. 2,265,229, patented December 9, 1941.

Hereinafter a more complete description of the manner in which the card 6 and the underlying portion of the frame 1 are perforated is presented but at this time it may be well to note that when data represented by perforations in the card 6 need be changed all that need be done is to remove this card 6 and substitute another unperforated card therefor and this new unperforated card may then be perforated to afford representations of the data that are to be substituted for that which has been previously incorporated in the device D. It may be that in so doing the frame 1 will also be perforated and this will be done in all instances where the newly formed perforations are located differently than the supplanted perforations, the supplanted and unused perforations, in such instances, being covered and rendered ineffective by unperforated portions on the new card 6.

In Fig. 7 a fragment of a proof sheet that may be produced in the machine is illustrated and the characteristics of this proof sheet and the means in which it is produced will be explained more fully hereinafter wherein reference is made to the pager and proofer that may be incorporated in the machine shown in Fig. 1, such a pager and proofer not being illustrated in the general views of the machine, Figs. 1, 2 and 3.

In the embodiment of the invention shown herein, the dividend check or sheet S is severed from a web W, Fig. 1, that is withdrawn from a roll R rotatably supported in the stand 10, which, in the machine as shown in Fig. 1, is provided at the right-hand end of the machine. The web W is led from the roll R to suitable web withdrawing devices contained within the housing 11, such devices being shown in Figs. 8 to 10, inclusive, and during passage of the web through these devices the date E and signature B are printed thereon. Subsequently a portion of the web bearing these impressions is extended beyond a severing device, shown in Figs. 8 to 10, inclusive, and thereupon the check or sheet S is severed from the web to be deposited in a sheet guideway G, Figs. 1 and 3, formed by spaced guide bars 12 and 13.

The sheet guideway G extends along the top or table portion 15 of the web withdrawing mechanism, and the sheet guideway G then extends to the left onto and along a table top 16 which is provided on the top of a main skeleton-like frame 17 of the machine. As the sheets S are fed along the sheet guideway G, the various operations are performed thereon. The advancing movement imparted to the sheets along the guideway G is obtained through the medium of a plurality of friction discs or rollers 18, 19, 20, 21 and 22, which operate so that each sheet is first actuated into contact with a stop finger 25 to be thereby positioned beneath a platen PM of a multiplying mechanism M. The sheet is thus brought to rest so that the platen PM may print variable data V upon the sheet under the controlling action of the multiplier M. The stop finger 25 is then elevated and the sheet is advanced along the guideway G into contact with a stop finger 26 which brings the sheet to a rest position at a second printing station III. At this second printing station the sheet is positioned beneath a platen P which then operates through a printing cycle to print the changeable data A upon the sheet. The stop finger 26 is then raised and the sheet is advanced by the friction rollers 21 and 22 to a form printing unit U which is disposed at the left-hand end of the guideway G. The sheet then passes through the form printing unit U and the form F is printed thereon, after which the completed check is discharged from the form printing unit U into a collector K shown in Fig. 1 of the drawings.

The changeable data A are printed upon the sheet S from the type T of a printing device D located at printing position III beneath the platen P. The printing devices are introduced into a magazine H located on the machine near the rear edge of the table top 16, and the printing devices are withdrawn in succession from the bottom of the magazine and are advanced through the action of the printing device guiding and advancing unit to a plurality of stations, including the printing station III, after which the printing devices are discharged and are refiled in one or the other of two drawers J, the arrangement being such that the drawers J are utilized alternately to receive the printing devices which have been removed therefrom for introduction into the magazine H.

The printing device guiding and advancing unit is illustrated in some detail in Figs. 17, 18 and 19, where it will be seen that the printing device guiding and advancing unit includes a pair of spaced supporting rails 27 and 28 between which a reciprocable carrier bar structure 29 may operate to advance the printing devices D in a step-by-step manner. The advancing movement imparted to the printing devices D by the carrier bar structure 29 is such that the printing devices are withdrawn from station I at the bottom of the magazine H and are first advanced to a sensing station II, after which each printing device is advanced to printing station III beneath the platen P for the performance of a printing operation. The printing device is then advanced forwardly from the printing station III and is dropped in a substantially vertical position downwardly into a drawer selecting mechanism. The drawer selecting mechanism includes a lateral guideway 30 along which the printing devices are moved, and through a suitable gate mechanism the printing devices are dropped into one or the other of the two drawers J.

The variable data V are in the present instance derived from and under the control of control means on the printing and control devices D, this control means in the present instance being provided by the control openings formed in the control card 6. The control means in the control card 6 are sensed by a sensing means 31 while the printing and control device is located at sensing station II, and the sensed control means are effective through Bowden cable connections 33 to set up the multiplying mechanism M. The multiplying mechanism M includes a variable printer 35, the type segments of which are set up under the control of and in accordance with the setting of the multiplier M, and when the platen PM operates it serves to print upon the check the variable data which have thus been derived from the control means of the printing and control device D.

The present machine is adapted to produce a proof sheet such as that shown in Fig. 7, and this is attained through the incorporation of a pager and proofer unit such as that shown in Figs. 24 to 26 hereof. The production of a proof sheet through the use of such a pager and proofer involves the performance of two printing operations from each of the printing devices D, and the machine is therefore constructed and arranged for what is termed duplicate operation in that the printing devices are retained at printing position while two printing impressions are made. One of the printing impressions made from each printing device D is made on the sheet S while the other printing impression from the printing device is made on the proof sheet. As hereinbefore pointed out, the variable data V are printed upon the check or sheet S prior to the time when the sheet reaches printing position beneath the platen P, while the changeable data A and the number N are printed upon the sheet S at printing station III through the action of the platen P. With respect to the proof sheet, however, all of the printing operations are performed by means of the platen P, and a variable printer 36, shown in Figs. 21 to 23 of the drawings, is therefore provided with its settable type segments disposed beneath the platen P and at one side of the printing device guideway. The variable printer 36 is arranged to be set up from and under control of the multiplier M so that the variable printer 36 prints variable data V' on the proof sheet to correspond with the variable data V which have been printed by the variable printer 35 upon the check or sheet S.

In the present instance a numbering machine 37 is also disposed beneath the platen P, this numbering mechanism being interposed between the printing device guideway and the variable printer 36, as will be evident in Fig. 17 of the drawings. The numbering machine 37 is also arranged for duplicate operation in that the numbering wheels thereof are advanced once for every two printing cycles of the platen P. Thus, in one cycle of the platen P the numbering mechanism prints a particular number upon a check S and in the succeeding operation of the platen P the numbering mechanism prints the same number upon the proof sheet.

In attaining the control of the variable printer 36 so as to print variable data V' on the proof sheet which corresponds to the variable data V printed on the sheet S, the present machine employs a variantly settable punching apparatus which is set up by the multiplying mechanism M at the same time that the variable printer 35 is set up, and the card punching mechanism 38 operates to punch coded representations of the variable data which is to be printed by the variable printer 35 onto cards C fed to the card punching apparatus. After the card C has been prepared by the punching mechanism 38, the card C is advanced along a card guideway 39 by means of friction discs or wheels 40. The card C is thus advanced to a sensing mechanism 41, Figs. 3, 21 and 22. The sensing means 41 operates to sense the variable data represented on the card C and to correspondingly set up the variable printer 36 so that this variable printer may, through the intermediary of its hammer mechanism 42, print the correct variable data V' upon the proof sheet.

Thus, the machine produces checks or sheets S properly numbered and bearing changeable data A and variable data V both derived or taken from the same printing and control device D, and a corresponding proof sheet is produced which lists the various classes of data which have been printed upon a series of checks or sheets S.

Interconnection and Control of the Units of the Machine

Printing machines of the kind to which my invention pertains are called upon to handle sheets of a wide variety of sizes, the sheets varying in width and in length. Furthermore the sheets not only vary in size but the various impressions that are made thereon by the various printing mechanisms included in the machine are made at widely varying positions on various sheets.

As an example of the foregoing, the check shown in Fig. 6 is a typical check but by referring thereto it may be quickly ascertained that practically all of the data appearing on this check could be located in positions other than that shown without in any way impairing the utility of the check. The location of the various data on the check is purely a matter of choice but, once a potential user of a printing machine of the kind to which this invention pertains has determined upon a location and arrangement of data, such user usually desires to retain this, and in the vast majority of instances insists that the machine be arranged to produce data in the established arrangement. It will be apparent therefore that it is essential that the various printing mechanisms included in machines of the kind to which this invention pertains be susceptible of making impressions at a wide variety of locations on the sheets.

Furthermore, while the check shown in Fig. 6 is of a typical size, checks both larger and smaller than that there shown are in daily use and here again a potential user of a printing machine of the kind to which this invention pertains insists that sheets of a size to which such user is accustomed be produced. This is not at all an unreasonable requirement for a variation in the size of sheets might require a change in the filing equipment, ledgers, and much of the other equipment possessed by such a potential user.

Moreover, machines of the kind to which this invention pertains are utilized in printing utility bills which are customarily long and narrow and which usually consist of a main body and one or more stubs, such utility bills being long in the line of movement thereof through the machine. Machines of the kind to which this invention pertains are also utilized in the preparation of invoices which, while usually long and narrow, are usually long in a direction trans-

verse to the line of movement thereof through the machine.

Thus in order to arrange printing machines so that they will be amenable to various uses to which they may be put and still be of standard construction, it is necessary that some arrangement be afforded whereby the same machine so far as its operative mechanisms are concerned may be utilized in a wide variety of circumstances. This condition is admirably met by a machine constructed in accordance with my invention wherein the various mechanisms in the machine are arranged in self-contained units, any one of which units may be adjusted relative to one or more of the other units in so far as the location thereof in a particular machine is concerned.

In assembling a machine for a particular use the size and outline of the sheets that are to be handled by the machine is first ascertained and also the desired locations of the various impressions on the sheets are ascertained. Once this has been ascertained it is a relatively simple matter to construct a machine wherein the various units will be properly located with respect to one another. The principal difference in machines constructed to meet such widely varying circumstances will be in the location of the various units relative to each other.

In assembling a machine to meet a particular circumstance the size and outline of the sheets to be handled are first ascertained. Once this has been ascertained the spacing of the bars 12 and 13 of the unit shown in Fig. 11 is determined and these bars are arranged to afford a guideway G through which the sheets may pass. Next the locations where the impressions to be made directly from the printing and control devices are to be positioned on the sheets are ascertained and then the aforesaid guideway is located on the machine so that as the sheets pass through the printing position whereat impressions are made directly from the printing and control devices these impressions will appear at the proper positions on the sheets. When this location of the unit shown in Fig. 11 is determined the stop lugs are properly positioned and secured on the table top 16 as will be hereinafter described.

The web withdrawing and feeding means, sheet severing means and date and signature printing means which constitute the web handling mechanisms are mounted on the frame 10 as described above. A frame 17 has also been referred to and it is in this frame that means are provided, as described hereinafter, for sequentially advancing the printing and control devices D through the machine as well as means for making impressions directly from the printing and control devices. Other operative mechanisms are also carried by this frame 17 and such other operative mechanisms are positioned near the printing position at which impressions are made directly from the printing and control device D. As to such other operative mechanisms, however, the frame 17 affords any adjustment that may be required in the location of these mechanisms so that special provision need not be made therefor insofar as the machine structure as a whole is concerned. The mechanisms carried by the frame 10 and the mechanisms in the frame 15 constitute self-contained units as do the multiplying mechanism M and the printing unit U.

The next step in assembling a machine, after the positioning of the unit shown in Fig. 11 on the unit carried by the frame 17, is to locate the unit carried including the frame 10 in such a position that when a sheet is severed from the web it may be fed in a straight line into the sheet guideway G afforded by bars as 12 and 13. This entails alignment of the line of severance of the sheet from the web in proper relation with the inwardly disposed of the bars 12 and 13, which is the bar 13 in this instance. This entails adjustment of the unit carried by the frame 10 relative to the unit carried by the frame 17 and in order to facilitate such adjustment the interconnection between the frames 10 and 17 is such that this adjustment may be readily effected.

In the present instance such adjustment is afforded by providing a bar 50, Figs. 1, 2 and 8, on the frame 10, this bar in the present instance being connected to an upright 51 which forms part of the frame 10. The bar 50 has a slot 52 therein through which bolts as 53 are passed, said bolts being carried by the upright 51. It is manifest that if the nuts on the bolts are loosened the frames 10 and 17. Tie rods as 55 extend through it is in this way that the line of severance is brought into proper longitudinal alignment with the sheet guideway G afforded by the unit shown in Fig. 11.

The bar 50 is connected to the frame 17, the relative position of the bar 50 and the frame 17 remaining constant so far as the just described adjustment of the frame 10 is concerned. However, it may be necessary, as where sheets are of extraordinary length in the direction of their line of movement, to space the unit carried by the frame 10 away from the unit carried by the frame 17 along the direction of the line of movement of the sheets. Hence the interconnection established between the frame 10 and the frame 17 is as follows.

Bars as 54, Fig. 2, are provided which are tapped at opposite ends. The length of the bars as 54 is determined by the spacing desired between the frames 10 and 17. Tie rods as 55 extend through spacing sleeves 55' between opposite members of the frame 17 at the front and rear sides thereof, nuts as 56 being threaded onto these tie rods at the ends thereof opposite the ends facing the frame 10. Corresponding tapped ends of the bars as 54 are threaded onto the opposite ends of the tie rods as 55. Openings as 57 are provided in the bar 50 and thumb screws as 58 are passed through the openings as 57 and are threaded into the free tapped ends of the bars as 54 and in this way the frames 10 and 17 are secured together.

It has been found to be advantageous to mount the multiplying mechanism M intermediate the point of severance of the sheets in the frame 10 and the printing position III in the frame 17 whereat impressions are made directly from the printing and control devices, first, because this facilitates locating the impressions made from printing means provided in the multiplying mechanism M at desired locations on the sheets and, secondly, and perhaps more important, an arrangement such as this enables the multiplying mechanism to be set up under control of a printing and control device prior to the time this printing and control device attains the above referred to printing position III in the frame 17. Hence an impression may be made on a sheet from the multiplying mechanism under control of a printing and control device before this device attains the printing position in the frame and then by the time this sheet has advanced to such printing position the printing and control device which

was sensed to determine what impression was made on the sheet by the printing mechanism in the multiplying mechanism will have attained this printing position and therefore an impression may be made directly from this printing and control device onto the sheet. This insures that the variable data as V and the changeable data as A printed on a particular sheet will be produced from the same printing and control device.

The multiplying mechanism M is mounted on an angle bracket 59 which has openings therein through which the tie rods as 55 are passed and this angle bracket is clamped in a fixed position by the bars as 54. The multiplying mechanism M is so connected to the angle bracket 59 that it may be mounted in a wide variety of positions longitudinally thereon and in this way the printing mechanism included in the multiplying mechanism may be adjusted transversely with respect to the line of movement of the sheets to thereby insure that impressions made thereby will be located at the proper and required positions on the sheets, the location of a stop finger as 25 enabling variation in the location of such impressions along the line of movement of the sheets.

After the sheets pass from the sheet guideway G afforded by the unit shown in Fig. 11, they pass into the printing unit U. This printing unit U is mounted on bars as 60, Fig. 2, in a fixed position longitudinally of these bars, this being along the line of movement of the sheets. However, to insure that the impressions made by the printing unit U will be located in proper locations transversely of the sheets, the bars as 60 have recesses as 61 provided therein which are adapted to receive a bar 62, said bar 62 being tightly clamped in the recesses as 61 by clamps as 63. The bar 62 is mounted on the frame 17 in a fixed position but, by loosening the clamps as 63, the bars as 60 and therefore the printing unit U may be slid therealong so as to locate the printing unit U in such a position that the impressions made thereby will be located at the required and proper positions on the sheets.

The manner in which impressions made by the printing unit U are located on the sheet longitudinally is that which is customary in the art where machines of this kind are provided and will be explained in further detail hereinafter, this adjustment being afforded by mechanisms inherent in the printing unit U and not requiring any adjustment of this unit with respect to other units in the machine.

The individual units which form the present machine are not only separately formed and individually adjustable, but are also arranged to be driven and controlled in such a manner that the driving and control mechanism is not adversely affected by any such adjustments or repositioning of the units relative to each other. In accomplishing this desirable end, each of the individually formed units of the machine is provided with a constantly driven power source to which the unit may be connected at predetermined times in the operation of the machine as a whole, and the individual connection of each of the units to its constantly operating power source serves to drive the operating mechanism of the particular unit through a single cycle of operation. Each unit contains within itself the requisite means to time the operations of the various elements of the unit, and the units of the machine as a whole are operated in timed relation to each other through a central control means 70, Figs. 3 and 27, which causes the drive of the individual units to be connected at predetermined times in the cycle of operation of the machine, and as a result the several individually driven units of the machine operate in timed relation and cooperate to produce the sheets S and the proof sheet.

While individual drive means such as motors might be provided for each of several units of a machine, I prefer to utilize a single motor 72 mounted in a lower portion of the frame 17 and operating through a belted connection 73 to constantly rotate a main drive shaft 74. The main drive shaft 74 extends longitudinally of the machine and is mounted in the frame 17 so that belted connections may be taken from the drive shaft 74 to constantly rotate driving elements in each of the several units of the machine. The constantly driven elements which form a part of each of the units of the machine will be described hereinafter in connection with the description of each of the units, and these constantly driven elements are in each instance arranged for driving connection with the normally stationary elements of the associated unit through the medium of a suitable one-revolution clutch. The one-revolution clutch of each of the operative units of the present machine is arranged to be electrically controlled from the main control means 70 of the machine. Thus, the several units of the machine may be adjusted with relation to each other and despite such adjustment the main control means 70 will act to produce timed operation of the several units of the machine to thereby cause all of the separately formed units to cooperate in producing the desired business instruments.

The Unit for Feeding and Severing the Web, and for Printing the Date and Signature, Figs. 1, 2, 3, 8, 9 and 10

The web withdrawing and feeding means, sheet severing means, and date and signature printing means are in the present machine included in a unit carried by the frame 10 at the right-hand end of the machine as it is viewed in Fig. 1, but it will be evident that in some embodiments of the invention the means for performing these functions might be constructed as separate units arranged for individual mounting and adjustment and associated with the machine for timed operation in accordance with the principles disclosed herein. The web withdrawing means serve to withdraw the web W from the roll R in such a way that the web feeding means which advance the web past the severing means are relieved of the necessity of overcoming the inertia of the roll R. The severing means then operates to so sever the web that a sheet of the desired width is produced.

The length of the sheet is severed from the width of the web for so to do enables far more sheets to be severed from a web of a given length than could be severed if the length of the sheets were cut from the length of the web. This avoids the necessity of frequently changing the rolls from which webs are withdrawn. After being severed from the web the sheet passes into the machine along the line of movement extending at right angles to the line of advancing movement of the web.

The above described feeding and severing of the web also facilitates accurate orientation of the date E and signature B impressions so that such impressions will properly align with the re-

lated portions of the form F on the checks S, the date and the signature being printed prior to the time the sheets are severed from the web.

The mechanism which enables the foregoing to be accomplished is illustrated in detail in Figs. 2, 3, 8, 9 and 10 to which reference should be made, and as best illustrated in Figs. 1, 2 and 8 a pair of elongated substantially L-shaped foot members 80 and 81 are provided at the lower end of the frame 10 and provide a base, foot members 80 and 81 being interconnected by a tie-rod 82. As best shown in Fig. 2, a sleeve 83 is disposed about the tie rod 82 that extends between upstanding portions of the members 80 and 81 and this sleeve and tie-rod serve to maintain these members in properly spaced relation.

The frame 10 comprises two uprights 50 and 84 which respectively extend upwardly from the members 81 and 80 and side plates 85 and 86 are suitably secured at the upper ends of these uprights. These plates project forwardly and rearwardly of the uprights 50 and 84 and constitute the side frame members for the aforesaid unit consisting of the web withdrawing and feeding means, sheet severing means, and date and signature printing means.

A support for the roll R is so arranged that a roll may be expeditiously arranged into position to have a web withdrawn therefrom, and to this end means including a shaft 87 is maintained in an upper operative position, which is to say, in a position to support the roll R clear of the floor or the like on which the members 80 and 81 rest.

The web withdrawing means are carried by plates 90 and 91 which are respectively connected to the side plates 85 and 86 in such a manner as to permit adjustment of the plates 90 and 91 along the plates 85 and 86 to thereby vary the position of the web withdrawing means with respect to the web feeding means, described hereinafter, that is carried by the side plates 85 and 86. The plates 90 and 91 preferably fit close to the side edges of a web passed to the web withdrawing means, and to this end these plates are supported for adjustment transversely of the line of movement of the web, such support including a bar 92 carried by the plates 85 and 86, and the plates 90 and 91 are fast to this bar by suitable clamping means as 93.

A shaft 95 is journaled in and extends between the plates 90 and 91 near the rear ends and upper edges thereof, and a worm wheel 96 is fast to the shaft 95 outwardly of the plate 90 and meshes with a worm gear 97 on the shaft of the motor 98 that is mounted on the outer face of the plate 90. The motor 98 is in circuit with the main switch 100, Figs. 3 and 30, of the machine so that when the main switch is closed circuit is set up to the motor 98, closure of circuit to this motor being under control of a switching arrangement to be described presently.

As best shown in Fig. 8 a discontinuous roller 102 is fast on the shaft 95, this roller being made discontinuous to enable the sections thereof to be adjusted along this shaft to be disposed in the positions which best effect withdrawal of a web from the roll R for the discontinuous roller 102, when in rotation, serves to withdraw a web W from such roll R. In order to insure that the frictional contact of this roller with the web will be sufficient to insure such withdrawing, which is to say, to insure that the inertia of the roll R will be overcome when the roller 102 is rotating, it is preferable to provide one or more friction surfaces on the periphery of the roller 102 and to this end rubber rings 103 may be disposed about the periphery of the discontinuous roller at suitable intervals to have contact with the web and afford the desired frictional contact between the web and the roller 102.

Aligned slots 104 and 105 are provided in the plates 90 and 91, and a shaft 106 is mounted in these slots for vertical movement therein. A plurality of discs 107 are mounted at spaced intervals along the shaft 106 to afford adjustment upon variations in the width of the web. Still another shaft 108 is journaled in the plates 90 and 91 in alignment with the shaft 95 but this shaft is mounted near the forward edge of the plates 90 and 91. This shaft carries discs 109 similar to the discs 107 on the shaft 106.

As the web is withdrawn from the roll R it is passed over the discontinuous roller 102 and under the roller afforded by the discs 107 and then over the roller afforded by the discs 109 on the shaft 108 so that the roller afforded by the discs 107 forms a loop in the web intermediate the roller 102 and the discs 109.

The web W passes from the just described web withdrawing and looping means to the web feeding means which include a shaft 110 journaled in the plates 85 and 86 and which has a pulley 111 rotatably mounted thereon outwardly of the plate 85. A belt 112, Figs. 2 and 8, is passed about the pulley 111 and a pulley 111' on the main drive shaft 74 so that when the motor 72 is set in operation by closure of the main control switch 100, Figs. 3 and 30, the pulley 111 is caused to rotate. A belt tightener 112', Fig. 8, acts on a pass of the belt 112 between the pulleys 111 and 111' to maintain the belt taut.

The pulley 111 constitutes the driving element of a clutch 113, such as is disclosed in my copending application Serial No. 239,561, filed November 8, 1938, now issued as Patent No. 2,265,133, patented December 9, 1941, to which reference may be had for details of construction and operation. This clutch also includes a driven element 114 that is fast on the shaft 110 and when the two elements of the clutch are allowed to engage by reason of momentary energization of a solenoid 115, the shaft 110 is rotated through a one-revolution cycle, after which rotation of the shaft 60 is terminated by a stop plate 116. It will therefore be apparent that the shaft 110 makes but a single revolution each time the solenoid 115 is energized to set this shaft in rotation.

It is rotation of the shaft 60 that causes the web W to be advanced past the severing means, to be described presently. The web feeding means is afforded by a lower feeding roller (not shown) that is fast to the shaft 110 and opposed upper segmental feeding roller 118, Figs. 3 and 9, fast on another shaft 119 journaled in the plates 85 and 86 above and in vertical alignment with the shaft 110. Meshing gears 120 and 121 fast on the shafts 110 and 119 drive these shafts in synchronism and since it is possible to so adjust the segmental feeding rollers with respect to each other that the leading edges thereof will move into cooperating relation to clamp the web therebetween during but a selected portion of the rotation of the shafts 110 and 119 for the web is advanced or fed only when the peripheries of the segmental rollers are rolling over each other with the web clamped therebetween. The length of this rolling engagement of these two rollers with the web determines the amount of web that will be fed during a single rotation of the shaft 110 and therefore determines the amount of web fed past the severing means.

Each time the shaft 110 is set in operation to feed a portion of the web past the severing means, the web is withdrawn by the segmental rollers from the loop created by the discs on the shaft 106. To insure that an ample supply of web will always be present in the loop, means are provided under control of the vertical position of the shaft 106 for setting the motor 98 in operation to effect withdrawal of the web W from the roll R. In the present instance such means include a pivotally mounted lever 122, Fig. 8, which acts on a switch 123 to close circuit to the motor 98 whenever the shaft 106 has been raised to a predetermined level.

The severing means to which reference has been made includes a movable knife 125 mounted for vertical reciprocation between the side plates 85 and 86 forwardly of the shaft 110. The knife 125 is so mounted and arranged that means fast on the shaft 110 are operable in each one revolution cycle of the shaft 110 to operate the knife 125 through a sheet severing movement. For further details of structure and operation of the sheet advancing and severing means of this unit, reference may be had to my copending application, Serial No. 239,562, filed November 8, 1938.

It is of course advantageous to feed the web and sever the sheet rapidly and to this end the various mechanisms entering into this are timed to operate in close relation, as will now be explained, reference being made to the timing chart, Fig. 10.

At the point 130, Fig. 10, the solenoid 115 will have been energized and the clutch 113 under control thereof will have been engaged so that the shaft 110 will at the point 130 start rotating. At this time the segmental feeding rollers will be in clamping engagement with the web and therefore at the point 130 the web will start to feed forwardly beyond the knife 125 and this feeding movement continues until the point 131 is attained at which point the feed rollers disengage the web. The leading edge of the web will at this time be engaged with the abutment afforded by the bar 13 and since this bar is spaced from the knife 125 a predetermined distance the precise desired width of the sheet is disposed beyond the knife 125. Therefore, at this time when the desired width of sheet is disposed beyond the knife 125, this knife may and does start to move toward its cooperating stationary cutting edge and this is initiated at the point 132.

By the time the point 133 is attained the severing operation of the knife 125 is completed and the sheet has been severed from the web. The sheet which will now be free from the web will be picked up by the feeding means therefor, to be described hereinafter, at the point 134. The shaft 110 is still rotating and at the point 135 the feeding rollers move back into engagement with the web W and clamp it therebetween. Thereafter, the point 130 is reattained so that the parts are in position to start a new cycle of operation.

In the above description reference has been made to the sheet being picked up by the feeding means therefor at the point 134. The means which then picks up the sheet and carries it away includes the roller 18 and its cooperating lower roller, the roller 18 being lowered to clamp the sheet between it and the lower roller by the time the point 134 is attained, such operation of the roller 18 being explained in detail hereinafter.

It has been explained that impressions are sometimes made on the web prior to the time sheets are severed therefrom and this is done in the present machine wherein the date E and signature B are printed on the web W prior to division thereof into sheets. To this end suitable means for printing the date and signature are associated with the shafts 110 and 119.

The sheet clamping and advancing rollers, as 118, are mounted in such locations that the printing mechanisms which print the signature and date may be mounted on the shafts 110 and 119 to the left of the paper feeding rollers, or, more specifically, intermediate the feeding rollers and the side frame member 85.

The impression members of the printing couples that print the date and signature are mounted on the lower shaft 110, so as to print on the lower face of the web W; and the opposed members 140 and 141 of the date and signature printing couples respectively are mounted on the upper shaft 119, as shown in Figs. 3 and 9. Suitable inking means are provided for the date and signature printing couples, so that in each web feeding cycle the date and signature will be printed on the web. The mounting of the elements of the printing couples on these shafts is adjustable so as to permit the impressions made thereby to be properly oriented to appear in proper positions on the sheets upon severance of the sheets from the web. Furthermore, since the printing couples are associated with the web feeding means and operate therewith it follows that impressions are made by these printing couples in every web feeding operation of the web feeding means.

Sheet Feeding and Guiding Unit, Figs. 11, 12 and 13

It has been explained that the severed sheet bearing date and signature impressions is deposited in the sheet guideway G and is picked up by the roller 18 to thereafter be fed through the machine, and as a sheet S passes through the machine movement thereof is interrupted as by stop fingers 25 and 26 at those positions where impressions or other operations are to be made thereon.

Because there are instances where sheets of different sizes will be printed in the same machine and additionally because there are instances where the machine constructed according to my invention may be operated at one time to make but a single impression on one sheet and other times so as to make two or more impressions on each sheet and also because it facilitates servicing the machine and for many other kindred and allied reasons, it is advantageous to arrange the sheet guiding, feeding and stopping means in a unit which may be readily removed from the machine when so desired.

Such a unit is shown in Fig. 11, and is described in detail in United States Letters Patent No. 2,211,772, patented August 20, 1940. The unit illustrated in Fig. 11 is one which enables the various impressions to be made on sheets S fed through the machine, which is to say, by means of the unit shown in Fig. 11 a sheet may be positioned to have variable data V printed thereon and an identification or other changeable data such as the address A printed thereon and also to have the number N printed thereon. It is to be understood, however, that simply by providing additional stopping devices, the unit shown in Fig. 11 could be arranged to enable more than one impression of each of the various types of information to be made thereon. The unit shown in Fig. 11 is typical of such units and comprises the two relatively elongated flat bars 12 and 13

which at intervals throughout their length are interconnected by substantially arcuate cross ties as 143 and in the present instance one such tie is provided adjacent each of the corresponding ends of the bars 12 and 13 and another is provided medially in the extent of such bars. In addition to the bars 12 and 13 the unit shown in Fig. 11 comprises a supporting bar 144, and when this unit is mounted in the machine the bars 12, 13 and 144 rest on the table top 16 in the manner shown in Figs. 2, 3, 8 and 14.

The feeding of the sheets S along the guideway G is accomplished by the feed rollers 18, 19, 20, 21 and 22, and to provide a mounting for these feed rollers the bar 13 and the mounting rail 144 are connected together by bridging structures 146 located at spaced points along the sheet feeding and guiding unit. The bridging structures 146 act as a supporting means for a roller-drive shaft 147 and a cam shaft 148. The several feed rollers are mounted upon the drive shaft 147 by means including bearing blocks 149 and stub shafts 150, and the stub shafts are driven from the drive shaft 147 by the bevel gear connections 151. The roller 18 which initially picks up the sheet S after it has been severed from the web, is arranged normally to rest upon an opposing lower roller 152 located in the sheet guideway G in the general manner illustrated in Fig. 14, such a roller 152 being provided in connection with each of the sheet advancing rollers. When the web is to be fed into the sheet guideway G the roller 18 is lifted to an elevated position by means of a control pin 154, Fig. 9, this control pin being actuated by suitable cam means in the web advancing and severing unit.

After the sheet has been fed beneath the roller 18, the pin 154 is lowered and the sheet is advanced by the roller 18 to the roller 19 and thence to the stop finger 25. At this time the feed roller 19 is elevated so that the sheet may rest properly in the guideway for the performance of a printing operation by the platen PM. Such control of the feed roller 19 is attained by means of a cam 155 mounted on the cam shaft 148. A cam 156 also mounted on the cam shaft 148 controls the stop finger 25 and after the printing operation has been performed the stop finger 25 is elevated and the feed roller 19 is lowered to advance the sheet to the feed roller 20. The feed roller 20 is located at all times in its lower or effective position. The sheet is advanced to the feed roller 21 and into contact with the stop finger 26 and the feed roller 21 is then elevated by its cam 155'. A similar cam means is provided for operating the stop finger 26 and after completion of the printing operations upon the sheet S by the platen P the stop finger 26 is elevated and the feed roller 21 is lowered to thereby advance the sheet to the feed roller 22 which passes the sheet to the form printing unit. The present sheet guiding and advancing unit also includes safety means for detecting presence or absence of a sheet at printing position and this means comprises a pair of detecting fingers 25' and 26' mounted adjacent to the stop fingers 25 and 26, respectively. The detecting fingers 25' and 26' are operated in proper timed relation by means of cams 158 mounted on the cam shaft 148. When a sheet is not present at the adjacent stop finger 25, the detecting finger 25' operates through an arm 159 to close a switch 160. Similarly, the detecting finger 26' operates in the absence of a sheet at the stop finger 26 to close the switch 161. The switches 160 and 161 are incorporated in the control circuit of the machine in a manner which will hereinafter be pointed out. The sheet guiding and advancing unit is such that it may be mounted on or removed from the table top 16 in a relatively simple manner. To this end the unit is secured in position on the table top by means of clamps 162, Fig. 3. In such mounting a beveled gear 165 on the left-hand end of the cam shaft 148 is meshed with a bevel gear 166 mounted on a transverse shaft 167. The transverse shaft 167 is in the present instance mounted on the form printing unit U and is driven by means of bevel gears 168 from a shaft 170 forming a part of the control unit 70.

In the mounting of the sheet guiding and advancing unit on the machine a gear 171 fast on the shaft 147 is meshed with a gear 171' (Fig. 14) mounted in the table top 16 of the machine frame. The gear 171' with which the gear 171 is meshed is constantly driven from the main drive shaft 74 by a belt 172.

It will be apparent that the unit shown in Fig. 11 may be readily lifted from the table top 16 for the driving connection between the shaft 147, and the means in the machine for imparting movement thereto is afforded by the meshing of the gear 171 with a constantly driven gear 171' in the table top, and drive from the cam shaft 148 is afforded by intermeshing the gears 165 and 166 and hence is only necessary to insure intermeshing of these gears to establish a driving connection for the shaft 147 and the cam shaft 148.

However, it will be remembered that the stop fingers and the like driven from the cam shaft 148 must operate in timed relation with other operating mechanisms in the machine. It will also be recognized that when the unit shown in Fig. 11 is removed from the machine in the course of which bevel gears 165 and 166 are demeshed the aforesaid timed relation might be interrupted. To prevent this the bevel gear 165 is mounted on the shaft 148 in a predetermined position and the bevel gear 166 is likewise mounted on the shaft 167 in a predetermined position. Such predetermined positions may be conveniently determined by utilizing the set screws by means of which these gears are fast to the respective shafts on which they are mounted. A convenient way of doing this is to mount the bevel gear 166 on the shaft 167 that when the parts are at rest the set screw connecting this gear to this shaft will be in an upper position. This same arrangement may also be followed out for the mounting of the gear 165 on the shaft 148. In other words, the arrangement is such that the set screw connecting the gear 165 to the shaft 148 is arranged to be in its upper position when the parts under control of the cam shaft 148 are in their at rest positions and by this is meant the positions occupied by the various parts when the machine comes to rest at the end of a normal cycle of operation thereof by disengagement of the main clutch as described hereinafter.

Printing and Control Device Advancing and Collecting Unit, Figs. 2, 3, 17, 18, 19 and 20

While the printing and control device advancing means does not ordinarily require adjustment in adapting the machine for the production of different sizes and types of work, this means is in the present instance constructed and mounted in the machine as a unit so that it may be readily removed therefrom, and this printing and control device advancing and collecting means embodies an individual drive unit 180 which is controlled

by a one revolution clutch 181 governed from the control unit 70 of the machine. The details of the printing and control device advancing unit are disclosed in my copending application Serial No. 415,317, filed October 16, 1941. The rails 27 and 28 of the printing device guideway constitute the primary structural members of the printing and control device advancing and collecting unit, and these side rails 27 and 28 are rigidly connected together at their rear ends by a spacer sleeve arrangement 182. At their forward ends the two rails are connected together by rigidly attaching the same to the opposite sides of an anvil 183, this anvil being so located as to be positioned beneath the platen P. The two rails are also connected together at station II by means of a block 185, and the anvil 183 is arranged to provide rearwardly extending web members 186 having a cross bar element 187 extending therebetween. The cross bar member 187 is arranged to overlie a channel member 188 of the frame 17 and is fixed thereon by bolts 189. The anvil 183 has a downward extension 190 which rests upon a channel member 191 of the frame 17 and is secured thereto by bolts 192. Thus, the supporting structure provided by the rails 27 and 28 is rigidly held in position on the machine frame 17. The magazine H is supported upon the projecting rear end of the rails 27 and 28, while the drive unit 180 is supported beneath the projecting rear ends of the rails 27 and 28 through the medium of a mounting casting 195.

The actuating unit 180 includes a vertical shaft 196 upon which a gear 197 is rotatably mounted, and the gear 197 is constantly driven by a gear 198 mounted in the casting 195. The gear 198 is secured to a pulley 199 which is constantly driven from the main drive shaft 74 by a belt 200. The belt 200 extends from a pulley 201 mounted on the drive shaft 74 and since the pulley 199 is mounted on a vertical axis, the belt 200 is guided by idler pulleys 202 and 203. The gear 197 in the present instance comprises the driving member of the one revolution clutch 181, the driven member of the clutch 181 being mounted on the shaft 196 so as to drive the shaft when the driving and driven members of the clutch are engaged. The clutch 181 of the type disclosed in my co-pending application Serial No. 239,561, filed November 8, 1938, and the engagement and disengagement of the clutch are controlled by a release member 205. The release member is in turn controlled by a solenoid 206 which is momentarily energized when the clutch is to operate the shaft 196 through its one revolution cycle.

At its upper end the shaft 196 has a radial arm 207 fixed thereto and in the rotation of the shaft 196 the arm 207 acts through a slide block 208 to rock an actuating arm 209 about a pivot 210 provided on an extending arm of the mounting casting 195. The arm 209 has a bearing block 211 fixed at its end and this block rides in a transverse guideway 212 provided between the two carrier bars 186. Thus in a rocking movement of the lever arm 209, the carrier bars 186 are actuated first in a rearward direction to the position shown in Fig. 17, after which the lever arm 209 moves forwardly of the machine and the carrier bars are operative to advance the printing and control devices D. Suitable pawls are provided on the carrier bars to engage and advance the printing devices. After a printing and control device has been moved to the sensing position II, the sensing head 31 is actuated during the return or rearward stroke of the carrier bars. This is accomplished by a cam lobe 212 fixed on a cam disc 213 and secured to and rotated with the shaft 196. The cam lobe 212 acts upon one end of a lever 214, the other end of which is connected by means of at least one vertical link 215 to the sensing head 31.

After the printing and control devices have been advanced from the printing position III and have been dropped into the transverse guideway 38, lateral shifting movement is imparted to the printing and control devices in the guideway 38 by an arm 217 pivoted at 218 on the mounting bracket 195. The arm 217 has a rearwardly projecting portion 218 with a cam roller thereon engaging the edge of the cam disc 213 and in the rotative movement of the shaft 196 the arm 217 is operated in a horizontal plane in a downward direction as viewed in Fig. 17. In such movement a feeding arm 220 is actuated along the guideway 38. A tooth 221 on the arm 220 engages the printing device which is located in the guideway 38 directly beneath the rails 27 and 28, and the stroke of the arm 217 is such that this printing device is advanced to a position over the nearest one of the collecting drawers J. If a gate 222 which forms the bottom of the guideway 38 over the nearest one of the collecting drawers J is closed, the printing device remains in position in the guideway 38 until the next feeding cycle, at which time the printing device is engaged by a tooth 223 to be advanced to a position over the most remote of the collecting drawers J. Means is provided operating under the control of the actuating means on the shaft 196 for operating the gates to drop the printing and control devices into one or the other of the two drawers J. The arrangement of this mechanism is fully described in my co-pending application Serial No. 403,272, filed July 21, 1941, and the arrangement is such that after a particular drawer J has been filled, one of the pair of indicating lights 225R and 225L is lighted and the gate mechanisms are operated to deposit the printing devices in the other one of the drawers. This means includes a sensing arm 226 operating in each cycle of operation of the machine to sense one of the printing devices located in the transverse guideway 38. The last one of the printing devices in each of the drawers is provided with a tab at a particular position thereon which is sensed by the sensing element 26. This sensing element is in the nature of a switch and when the sensing of a tab indicates that the last printing device from a particular drawer has been sensed, this switch is closed and a solenoid 227 is energized. This solenoid controls a reversing mechanism 228 which causes the action of the gate mechanism to be reversed. The reversing mechanism 228 also serves to operate a reversing switch means 230 which controls the signal lamps 225R and 225L to indicate which of the drawers has been filled and is to be removed and replaced. The reversing means 228 derives its power from the main drive shaft 74 through belted drive 331, Figs. 2 and 17.

The printing device advancing and collecting unit is set in operation each time after the machine has completed the production of a sheet S and a portion of the proof sheet pertaining to a particular printing and control device, such initiation of a cycle of operation of the unit is attained through energization of the solenoid 206 to thereby cause engagement of the one revolution clutch 181, and such controlling operation with respect to the unit is attained through con-

nection with the control unit 70 as will hereinafter be described.

THE PLATEN P AND ITS OPERATING MECHANISM, FIGS. 1, 2, 3, 17, 18, 19 AND 20

The platen P is constructed and arranged to be mounted upon the printing device guideway formed by the rails 27 and 28, and the construction and arrangement of this platen structure is fully disclosed in my co-pending application, Serial No. 416,548 filed October 25, 1941. Briefly, it will be observed that the platen mechanism P comprises a pair of U-shaped frames 240 held in spaced-apart relation by sleeve and bolt structures 241, and the intermediate portions of the two U-shaped members have knife edge support members 242 thereon adapted to rest in complemental knife edge bearing members 243 provided on the upper edges of the two rails 27 and 28. The platen face 244 is carried between the upper arms 240 so that when the frame formed by the U-shaped member 240 is rocked the platen face 244 is moved downwardly into printing cooperation with the type T of a printing device located at station III. An ink ribbon IRb is interposed between the sheet and the type T to thereby cause printing impressions to be made from the type T.

The lower arms of the two U-shaped frames 240 have a connecting bar 246 therebetween and it is to this connecting bar that an actuating force is applied in the present instance to operate the platen P through a printing operation. The platen P is normally urged to an elevated or inactive position by return springs 247. The platen P is in the present instance actuated by what might be termed a yielding force so that the projecting portions 248 on the lower arms of the frames 240 are forced downwardly into abutment with the upper edge of the frame member 191. When the parts 248 are thus in abutment with the frame member 191 the platen face 244 has reached a predetermined printing position.

The platen actuating means in the present instance is hydraulic in character, and a piston 250 is therefore mounted in a vertically extending cylinder 251 formed in the anvil 183 so that the lower end of the piston 250 may act downwardly against the cross bar 246 of the platen supporting frame. Hydraulic liquid under pressure is fed into the upper end of the cylinder 251 when the platen P is to be operated through a printing cycle.

The supply means for forcing such hydraulic liquid is best shown in Fig. 20 of the drawings which illustrate a metering pump 255 supported by a bracket 256 from the forward spacing sleeve 55' of the frame 17. The metering pump 255 has a piston 256 forced in an upward or intake direction by a spring 257, the piston 256 being reciprocable in a cylinder 258. The cylinder 258 has an outlet connection 259 with the upper end of the cylinder 251 so that when the piston 256 is operated through its pumping stroke, hydraulic liquid from the cylinder 258 is forced into the cylinder 251 to thereby operate the platen through a printing stroke. When the abutments on the frames 240 stop the movement of the platen P the piston 256 is arranged to operate through a slight additional stroke and during this additional stroke the liquid from the cylinder 258 is discharged past a constant pressure relief valve 260 to a liquid supply sump 261 formed about the outside of the cylinder 258. When the piston 256 moves through its intake stroke, the liquid from the cylinder 251 is returned through the connection 259 to the cylinder 258, and at the upper end of the stroke of the piston 256 the cylinder 258 is placed in communication with the sump 261 through ports 263. Thus the cylinder 258 is completely filled in each pumping operation.

To prevent offsets upon the platen P in the event that a sheet is not present beneath the platen, a safety sheet detector 264 is mounted on the platen P and this detector is arranged when a sheet is not present beneath the platen to close a safety switch 265. The safety switch 265, as shown in Fig. 30, is in circuit with a solenoid 266 which controls a relief valve mechanism 267 provided in communication with the upper end of the cylinder 251. The detected absence of a sheet at printing position III causes the solenoid 266 to be energized to thereby relieve the pressure in the hydraulic system and prevent completion of the printing stroke of the platen P.

The detecting means 264 will, of course, operate in each cycle of operation of the platen P, but since the detecting means 264 is intended only to detect the absence of a sheet S, this means must be rendered inoperative in those cycles of operation in which the proof sheet printing operations are performed. Thus, the circuit to the safety switch 265 includes a cam operated switch 268 which is closed by a cam of the main control means 70 only in alternate cycles of operation of the machine. Hence, in those cycles of operation when the platen is to print upon the proof sheet the safety detecting means 264 is ineffective even though it does at this time close the switch 265.

The hydraulic system shown in Fig. 20 also includes an air bleed line 270 leading from the upper end of the cylinder 251 and discharging into the sump 261, this line including a valve mechanism 271 which is described in detail in my aforesaid copending application Serial No. 416,548 filed October 25, 1941.

The piston 257 of the metering pump 255 is operated by a cam 273 mounted on a shaft 274 and acting upon a roller 275 carried on the piston 256 to operate the piston 256 through its pumping cycle each time the shaft 274 is operated through a one revolution cycle. The shaft 274 has a pulley 276 rotatable thereon and this pulley is constantly driven by a belt 277 connected to the main drive shaft 74. The pulley 276 is adapted to be connected to the shaft 274 through a one revolution clutch 278 of the general character disclosed in my copending application Serial No. 239,561, filed November 8, 1938, this clutch being controlled by a solenoid 280. When the solenoid 280 is energized the clutch 278 is allowed to close so as to drive the metering pump 255 through a platen actuating cycle, and in those cycles of operation of the machine in which the sheets or checks S are to be printed, such energization of the pump control solenoid 280 is effected by one of the elements of the switch 268. It will be recalled that the switch 268 is closed only in those cycles of machine operation when the sheet S is being printed, and other means being provided for causing energization of the pump control solenoid 280 in those cycles of machine operation when the proof sheet is to be printed. This additional means is in the present instance incorporated in the variable printer 36 and comprises an operating disc 281 which rotates through one revolution in each cycle of operation of the variable printer 36, this

disc 281 having a pin 282 thereon which serves to close a switch 283. The switch 283 forms a shunt around the switch 268 to the solenoid 280, thereby to cause energization of the solenoid 280 whenever the variable printer 35 is operated through its printing cycles as will be hereinafter described.

THE UNIT INCLUDING THE MULTIPLYING MECHANISM M, THE VARIABLE PRINTER 35, AND THE CARD PUNCHING MEANS 38, FIGS. 1, 2, 3, 14, 15 AND 16

Since the variable printer 35 and the card punching unit 38 are set up under direct control of the multiplier M, these mechanisms are in the present instance included in a unitary structure. The multiplying mechanism is included between a pair of parallel plates 300 which, by means of spacer structures 301, are connected to a pair of spaced side plates 303 between which most of the mechanism of the variable printer 35 is mounted. The card punching structure 38 is mounted by means of plates 304 upon the edge of the variable printer opposite from the edge upon which the multiplying mechanism M is mounted. As hereinbefore pointed out, the multiplying mechanism M is supported upon the bracket 59 of the frame 17, and it will be observed in Fig. 2 of the drawings that such support is afforded by resting the lower edges of the side plates 303 of the variable printer upon the bracket 59. The arrangement is such that the platen PM is pivotally connected at 305 to the variable printer frame at its upper rear edge, and when the assembly is moved forwardly into the frame 17 and in position on the supporting bracket 59, the arm upon which the platen PM is thus supported and pivoted moves into a slot 306 formed in the rear edge of the table top 16. Thus when the multiplier and the variable printer have been moved into position on the frame 17, the rear end portion of the multiplier extends beyond the rear edge of the machine thereby to facilitate connection of the Bowden cables 33 of the set-up mechanism from sensing position to the multiplier M. The details of structure and operation of the multiplying mechanism M need not be described in detail herein, since reference may be had to my copending application Serial No. 313,146, filed January 9, 1940, to obtain such information. For present purposes it may be pointed out that when the sensing head 31 moves downwardly through a sensing operation, it is operable by means of pins 308 to actuate Bowden cables 33 which have the ends thereof aligned with the pins 308 beneath sensing position. These Bowden cables 33, when actuated, are operable to control set-up mechanism 309—U, 309—T and 309—H whereby set-up movement of settable members included in the multiplying mechanism M is controlled. In accordance with the setting of these settable members, summation means including summation elements 310 are operable to manifest the product of the factor which has been sensed from a particular printing and control device when multiplied by a certain fixed factor which has been embodied in the settable members of the multiplier. As explained in detail in my aforesaid copending application Serial No. 313,146, the multiplying mechanism includes carry-over mechanism whereby carries from order to order are effected. When the manifesting or summation members 310 have been shifted to their operative positions so as to manifest a product, the product which is thus manifested is sensed by sensing elements 311 which in the present instance are embodied in the variable printer 35. The sensing elements 311 are operable through racks 312 and segments 313 to set up type segments 314 in the variable printer so that when the platen PM is actuated, the variable printer 35 will operate to print the product manifested by the multiplier M as the variable data V upon the check or sheet S.

The sensing elements 311 are in the present instance operable to set up the punches of the card punching device 38 at the same time that the type segments 314 are set up, and hence the card punching apparatus 38 may be operated to punch a coded representation of such variable data in a card C.

The various elements of the multiplying mechanism M, the variable printer 35 and the card punching mechanism 38 are operated in timed relation through means carried on or associated with a cam shaft 315, this cam shaft in the present instance being incorporated in the variable printer so as to extend through the two side plates 303 thereof. The cam shaft 315 is normally stationary and carries a constantly driven pulley 316, there being a drive belt 317 extending over an idler pulley 318 and to the main drive shaft 74 as shown in Fig. 2 of the drawings. The cam shaft 315 may be connected to the pulley 316 by means of a one revolution clutch 320 which is of the type disclosed in my copending application Serial No. 239,561, filed November 8, 1938, now issued as Patent No. 2,265,133, patented December 9, 1941. This one revolution clutch is controlled by a solenoid 321 which is energized each time the aforesaid mechanism is to be operated through a cycle. The manner in which the solenoid 321 is controlled and energized will be described in detail hereinafter.

PAGER AND PROOFER UNIT, FIGS. 24 TO 26

In instances where, for example, as in the present instance, checks are being printed and in many other operations, it is desirable to preserve a record of what has been printed on sheets as S and to this end what is known as a proof sheet is prepared. Such proof sheet is usually prepared in the form of a web and this web is subsequently divided at predetermined intervals to afford sheets or pages of uniform size that may be conveniently bound as in loose leaf binders or the like to thereby afford a permanent record of what is printed in the course of a run of the machine. Mechanisms which so print on webs and which divide the webs into pages affording proof sheets have come to be known as pagers and proofers and such mechanism may be included in the present machine.

A pager and proofer is not utilized in all instances and may therefore be viewed as an attachment, and for this reason the pager and proofer is not shown in the general views, Figs. 1, 2 and 3. The pager and proofer is eliminated from these views not only because it may be considered to be an attachment but for the additional reason that the illustration of this mechanism would have concealed other of the operative portions of the machine and more would have been lost by illustrating the pager and proofer in these general views than would have been gained by such illustration. However, it will be understood that the pager and proofer, in the present instance, is arranged in such a manner that impressions are made on the web

handled thereby by the platen P and by referring to the general views to determine the general location of the platen P it may be determined at what position in the machine the pager and proofer would be provided.

The pager and proofer unit in the present instance is generally indicated by 325 and operates to produce a proof sheet such as is fragmentally illustrated in Fig. 7 and which is indicated by 330, this proof sheet passing through the machine in the form of a web 330—W.

In the present instance the web 330—W, Fig. 24, is withdrawn from a roll 330—R which is rotatably mounted in a stand 331 located back of the machine frame 17.

In the present instance the web 330—W is withdrawn from the roll 330—R and passed about a roller 333 in the stand 331 and from this roller the web is led across the bottom of the machine to a roller 334 secured to the lower forward portion of the frame 17. From the roller 334 the web passes to a roller 335 mounted between side plates 336 which depend from the side plates 337 of the pager and proofer unit, the roller 335 being part of a web looper such as is disclosed in Fig. 26. The looper includes a vertically shiftable roller 337 and an upper guide roller 338, the vertically shiftable roller 337 being operable through a lever 339 when the loop of paper reaches a predetermined minimum to close a switch 340. The switch 340 controls a motor 341 which is mounted at one end of the looper mechanism, the motor 341 being connected by a worm and worm wheel gearing arrangement 342 so as to drive the roller 335 and thus feed paper to the looper mechanism.

The web of paper is fed from the looper mechanism in a rearward direction over a roller 343 and thence beneath the platen face 244. The web is then led upwardly about two guide rollers 345 and thence in a forward direction through a slot 346 in the platen. The web is then introduced into a web advancing means 348 and thence to a web severing means 349. The web advancing means and the web severing means are mounted in a frame provided by two side plates 350 beneath which the looper mechanism is suspended. The advancing means 348 includes a lower guide roller 351 and an upper advancing roller 352 both of which are mounted between the two plates 350. Pressure roller 353 serves to hold the web in firm frictional engagement with the roller 352. The web then extends in a forward direction so as to be fed past a knife 354 which forms part of the severing mechanism. Since the pager and proofer is in the nature of an attachment, a separate drive motor 360 is mounted beneath the frame provided by the two side plates 350, and a belt 361 from the motor serves to drive a pulley 362 mounted outside of one of the side plates 350. The pulley 362 drives a pinion 363 which is meshed with a gear 364 rotatably mounted on a cross shaft 365. The cross shaft 365 is utilized to actuate the advance mechanisms of the pager and proofer and when such actuation is required, the gear 364 is clutched to the shaft 365 by means of a one revolution clutch 366 which may be of the type disclosed in my copending application Serial No. 239,561, filed November 8, 1938, now issued as Patent No. 2,265,133, patented December 9, 1941. When the clutch 366 is to be engaged a solenoid 367 is energized as will hereinafter be described.

At its other end the cross shaft 365 has an arm 368 fixed thereto and this arm has a link 369 connected eccentrically thereto. At its other end the link 369 is connected to a rocking arm 370 rotatable about the axis of the roller 352. A pawl 371 carried on the rocking arm 370 is spring-biased into engagement with a ratchet 370 which is fixed to the roller 352. Thus in each revolution of the cross shaft 365 the ratchet and pawl mechanism is operated to advance the feed roller 352 through a web advancing movement.

After a predetermined number of impressions have been made upon the web W, the knife 354 may be operated to sever the web to thereby form a sheet which is deposited in a collector 375. This end is attained by utilizing the rotative movement of the cross shaft 365 in a particular cycle of operation of the web advancing means. To this end the knife 354 is operatively associated with one arm of a bell crank 376, the other arm of which carries a cam follower 377 which bears upon a cam 378. The cam 378 is loosely mounted on the shaft 365 and when the knife 354 is thereby actuated through a web severing cycle, the arm 378 is clutched to the shaft 365 for rotation therewith. To this end a one revolution clutch 380 is interposed between the cross shaft 365 and the cam 378. This clutch may be of the kind disclosed in my copending application Serial No. 239,561 filed November 8, 1938, now issued as Patent No. 2,265,133, patented December 9, 1941, and when the clutch 380 is to be engaged a control solenoid 381 is energized.

Since a predetermined number of impressions are to be made upon each sheet, means is provided for counting such impressions, and this counting means is arranged to control the energization of the solenoid 381, thereby to cause the sheet severing means to operate after a predetermined number of printing impressions have been made. Thus a ratchet wheel 385 is mounted adjacent to the arm 368. This ratchet wheel 385 has a rocking arm device 386 associated therewith so that the rocking arm device is actuated by the arm 368 in each revolution of the cross shaft 365. A pawl 387 on the rocking arm structure 386 actuates the ratchet in a predetermined angular amount each time the cross shaft 365 is operated. After a predetermined number of sheet advancing movements, a pin 388 on the ratchet wheel 385 acts to close a control switch 390 which is in circuit with the control solenoid 381. As shown in Fig. 30 of the drawings, such closure of the switch 390 merely conditions the solenoid 381 for operation and such operation takes place only when the circuit to the sheet advancing control solenoid 367 takes place. The operation of the sheet advancing means is controlled by a cam closed switch 391 operated by a cam forming a part of the main control unit 70, as will be described hereinafter. A test circuit including a switch 393 is provided in shunt across the switch 391 for operation by a manual control button 394 in the event that an operator wishes to test the pager and proofer unit.

The pager and proofer unit is mounted on the machine by resting the rear end thereof on the forward edge of the table top 16 and since the pager and proofer unit projects in an overhanging relation, a bracing means is provided. This means comprises a pair of arms 350' connected to the upper rear edges of the side plates 350 and extending rearwardly therefrom. At their rear ends the arms 350' are connected to the side rails 27 and 28 of the printing device guideway by bolts 305''.

CONTROL CARD FEEDING MECHANISM, FIGS. 1, 2, 3, 21 AND 22

After the punching apparatus has prepared a control card under the governing action of the multiplier M, this control card is released for movement along the card guideway 39 under the influence of the constantly driven advancing rollers 40. The advancing rollers 40 are driven by a belt 395 which engages pulleys on the mounting shafts of the rollers 40, there being suitable idling rollers 396 disposed at suitable points along the path of the belt 395. The belt 395 engages the pulley 397, Fig. 3, mounted on a shaft 398 extending rearwardly into the machine, and at its rear end the shaft 398 has a pulley thereon about which the belt 172 is passed. Thus, the belt 172 serves to drive the feed rollers of the main guideway G as well as the advancing rollers of the card guideway 39.

A stop finger 400 disposed in the card guideway 39 at the punching mechanism 38 serves originally to hold the card against advancing movement and after the preparation of the card has been completed, the stop finger 400 is elevated by means of a pin 401, Fig. 16, disposed beneath the stop finger 400 outside of the card guideway. A cam 402 on a cam shaft 403 serves to elevate the stop finger 400 in timed relation with the card punching apparatus 38. The cam shaft 403 is operated from the main drive shaft 315 of the multiplier through means which includes an intermediate connecting shaft 404.

Upon release of the completed card by the stop finger 400, this card is advanced to the sensing means 41 of the second variable printer 36, the proper location of the card at the sensing means being attained by a stop finger 405 which is operated in timed relation to the operation of the variable printer 36, as will now be described.

THE VARIABLE PRINTER AND ACCUMULATOR, FIGS. 21, 22 AND 23

The variable printer 36 is constructed as a unit with most of the mechanism thereof carried between a pair of side plates 410 which are held in proper spaced relation by spacer devices 411. The mechanism carried between or on the two side plates 410 is mounted in position on the frame 17 by placing the same upon the mounting bar structure 412 suspended in the machine frame 17. The variable printer may be secured in this position by means of bolts 413.

The variable printer 36 includes a plurality of sensing bars 416 operable under the control cam means carried on a main operating shaft 417 which extends through and is mounted in the side plates 410. The sensing bars 416 are operable through a rack and segmental connection 418 to control the setting movement of type segments 419 whereby shiftable type carried by the type segments 419 are disposed in set positions beneath the platen P. After the type have been set the hammers 42 are operated through the medium of control mechanism associated with the main operating shaft 417 of the variable printer 36.

The control shifting movements of the sensing members 416 may also be utilized to operate an accumulator mechanism 420, this accumulator mechanism being operated by means associated with the main operating shaft 417 and being controlled in certain operations of the machine as, for example, in the taking of a total, through the medium of a control key 418.

The main operating shaft 417 is adapted to be actuated from a constantly driven gear 420 mounted on said shaft, the gear 420 being meshed with a pinion 421 which is connected to a pulley 422 so as to be driven thereby. The pulley 422 is engaged by a belt 423 which extends to a pulley 424 fast on the main drive shaft 14. Thus, the gear 420 is constantly driven and when the variable printer is to be operated through a cycle, the gear 420 is clutched to the shaft 417 by operation of a one revolution clutch 425 which may be of the kind disclosed in my copending application Serial No. 239,561, filed November 8, 1938. The clutch 425 is governed by a control solenoid 426 which is energized each time the variable printer 36 is to be operated through a cycle.

When the variable printer is operated so as to sense a card located at sensing station 41, this card is maintained stationary through the action of the stop finger 405 until the sensing operation is completed, and at that time the finger 405 is elevated by a pin 430, Fig. 22. The pin 430 is operated at the proper time in the cycle of operation by a cam 431 fixed on a cam shaft 432. The cam shaft 432 is driven in timed relation to the shaft 417 by means including bevel gears 433 and a connecting shaft 434.

FORM PRINTING UNIT—FIGS 1, 2, 3, 27, 28 AND 29

Constantly reoccurring data such as the form F on the sheet S, Fig. 6, may be printed on the sheets in a wide variety of ways and, for example, this might be done in a printing mechanism such as disclosed in United States Letters Patent No. 1,955,814, or in a printing mechanism such as is shown in the copending application of Horace P. Brownsey, Serial No. 74,044, filed April 13, 1936, now U. S. Letters Patent No. 2,165,535, patented July 11, 1939, but in the present instance I have employed a well-known printing unit, one form of which is indicated at U, Fig. 1, and which is illustrated in sufficient detail for the purpose of the present description in Figs. 2, 3, and 27 to 29. Reference may be made to, for example, United States Letters Patent 816,311; 970,441; 990,207; 1,031,311; 1,094,065; 1,148,940; and 1,647,560 for a disclosure of the full details of a printing unit such as the unit U.

The unit U, as has been described hereinabove, is mounted on bars as 60 in a fixed position longitudinally of these bars which have recesses as 61 provided therein to receive a bar 62, this bar being tightly clamped in the recesses by clamps as 63. The bar 62 is mounted on the left-hand upright of the frame 17 in a fixed position and, by loosening the clamps as 63, the bars as 60 and, therefore, the printing unit U, may be slid therealong to properly locate the printing means in the printing unit U to make impressions on the sheets at the proper and required positions thereon. The printing unit U is prevented from pivoting about the bar 60 by a brace 449 that depends from the frame thereof and which engages the adjacent end of the frame 17 as shown in Figs. 1, 2 and 27.

The unit U, as shown, comprises a pair of side plates 450 and 451 which are tied together in a suitable manner to be maintained in predetermined spaced apart relation. The printing means of the printing unit U includes a rotatable drum 453 which, in the manner described, for example, in United States Letters Patent No. 816,311, patented March 27, 1906, has suitable impression means or printing members secured on the periphery thereof. Such printing members may be located on the periphery of the drum 453 as required and in the present instance are located

on the periphery of the drum in such positions that when sheets are admitted into the bite between this drum and its cooperating platen roller 454, the form F will be printed on the checks or sheets S at the proper and required positions thereon. This of course entails locating the impression means on the periphery of the drum in such locations that as the drum starts from its at rest position and a sheet starts to pass thereto from a given position, the leading edge of the sheet will engage the bite between the drum 453 and the platen roller 454 at a time when the leading impression means on the drum is spaced from the bite in the same amount as the portion of the sheet that is to receive such impression, all of the foregoing being standard practice in the art and for further description reference may be made to United States Letters Patent 816,311 or 990,207.

Sheets are admitted into the bite between the drum 453 and the platen roller 454 from the aforesaid given position, by a gate generally indicated by 455 and the arrangement is such that a sheet passes from the guideway G into engagement with the gate 455 when the stop finger 26 is retracted from stopping position with respect to the leading edge of a sheet disposed beneath the platen P.

It will be manifest from the foregoing that the gate 455 must operate in properly timed relation with the rotation of the drum 453 in order to insure that sheets stopped by the gate will be admitted into the bite between the drum 453 and the platen roller 454 at the proper time and to this end a cam 457 is fast to one end of the drum 453. This drum 453 is mounted on a shaft 458 that is journaled in the side plates 450 and 451 and which is rotated in the manner now to be described.

A gear 459 is fast to one end of the drum 453 and meshes with a pinion 460 that is mounted on a stub shaft 461 carried by one of the arms 60. The pinion 460 in turn meshes with a pinion 462 rotatably mounted on a shaft 463 fast in the arms 60. A pulley 464 is also rotatably mounted on the shaft 463 and is interconnected with the pinion 462 in such a way as to enable adjustment of the position of the pulley 464 along the shaft 463 without interrupting driving connection between the pinion 462 and this pulley. An endless belt 465 is passed about the pulley 464 and over guide pulleys 466 and 467, Figs. 2 and 27, mounted on a bracket 468 carried by the adjacent upright of the frame 17, and from the guide pulleys 466 and 467 the belt passes to and about a pulley 469 fast on the main drive shaft 74. It will therefore be seen that the drum 453 is driven, as are other operative mechanisms in the machine, from the main drive shaft 74.

The drum 453 is rotated continuously whenever the main drive shaft 74 is in operation and therefore the cam 457 fast on this drum also rotates continuously. Means including a lever 472 operates to raise the gate 455, and such elevation of the gate releases a sheet engaged therewith into the bite between the drum 453 and the platen roller 454.

The shaft on which the platen roller 454 is mounted is eccentric so as to support the platen roller 454 for movement toward and away from the periphery of the drum 453. Movement is imparted to this shaft through the cam and link arrangement illustrated in Fig. 2 to prevent the formation of offsets on the platen roller, this being standard construction in printing units of this kind and being described in detail in United States Letters Patent 1,148,940 and 1,647,560; and inking means is also provided in a manner well understood in the art. a detailed description of an inking means suitable for this purpose being set forth in United States Letters Patent 1,031,311.

It will be noted that, of the various operative mechanisms provided in the machine, the only one which is constantly operated when the machine is in operation is the printing unit U and, more specifically, the drum 453 and its associated mechanisms in this unit. This drum rotates at a constant given speed which is selected according to the productive capacity desired of the machine. For example, if it should be desired that one hundred sheets, such as the checks S, Fig. 6, each bearing but a single impression of changeable data, are to be produced per minute, then the drum 453 is rotated at a speed of 100 revolutions per minute. In any event, however, the speed of rotation of the drum 453 is such that the drum will make a complete revolution each time the platen P is to be operated to make an impression so that if, for example, as in the present instance, the drum 453 is operated at the rate of 100 revolutions per minute and a sheet as the check S receives an impression only in every other operation of the platen P, then the productive capacity is fifty sheets per minute in the condition where the drum is rotating at this speed of 100 revolutions per minute. This same thing would be true if two impressions were made on this sheet and if in this instance the speed of the drum 453 were maintained at 100 revolutions per minute the productive capacity of the machine would again be fifty sheets per minute. By way of further example, if four impressions were made on each sheet and the drum speed were 100 revolutions per minute, then the productive capacity would be twenty-five sheets per minute.

From the foregoing it will be apparent that the productive capacity of the machine in so far as the number of sheets produced is concerned, is based upon the speed of rotation of the drum 453, and it is therefore advantageous to operate this drum at as high a speed as possible consistent with the production of satisfactory work in the printing unit U.

If the machine of the present invention only printed sheets such as the checks S and no proof sheet were produced therein and but one impression of changeable data were made from each printing and control device fed into printing position below the platen P, the machine, in the nomenclature of this art, would be set for consecutive work. However, if two impressions were made on each sheet such as the check S from each printing and control device or if, as in the present instance, one impression is made from each printing and control device onto sheets S and another impression is made onto a proof sheet such as 330, then in this instance the machine is set for what is known as duplicate work. In other words, the number of impressions that are to be made from each printing and control device fed into printing position below the platen P determines whether the machine is to be set for consecutive, duplicate, triplicate, quadruplicate or other type of work, and in the present instance where two impressions are made from each printing and control device that comes to rest above the anvil 183 the machine is set for duplicate work. This means that the drum 453, in the present instance, makes two revolutions for each sheet ejected from the machine but nevertheless, as will

always be the case, the drum 453 makes one revolution for each impression operation of the platen P.

Thus in order to insure that sheets will pass through the machine and have operations performed thereon in such a way that sheets will be produced consistent with the type of work being performed, that is, consecutive, duplicate, triplicate, and so forth, the various mechanisms in the machine are timed to operate in accordance with the speed of rotation of the drum 453 and, in order that this may be effected, the devices which control operation of the various mechanisms in the machine are placed under control of the drum 453 and mechanisms associated therewith.

In connection with the foregoing it should be noted that in most instances heretofore where printing machines, of the class to which this invention pertains generally, were arranged to operate under conditions of consecutive, duplicate, triplicate and similar work, variations in the operative speed of the machine and variations in the time of operation of various mechanisms provided in the machine were usually accomplished by altering gear ratios for usually the various operative mechanisms in machines of this type were operated from a common source and in timed relation with each other by geared interconnections employed to insure the maintenance of proper timed relation. In contradistinction to this, in the present machine the various operative mechanisms in the machine while in most instances deriving power from a common source are not interconnected by gear interconnections. Instead of resorting to such a construction, each of the various operative mechanisms has an independent control for connecting the operative portions in the mechanism with the source of power and in this connection it should be noted that if so desired a separate source of power could be provided for each and every one of the various operative mechanisms in the machine, the utilization of a main drive shaft such as the main drive shaft 74 merely being an expeditious way of affording a source of power.

Since, in the present machine, the various operative mechanisms receive power through suitable controls, and more specifically clutches, provided in each of the mechanisms and since these clutches are electrically controlled, by means of solenoids, it is possible to associate the regulating means for the controls or clutches of the mechanisms to be timed relative to a common control means such as the printing unit U, or in other words, directly with the printing unit U, these regulating means being in the form of switches for controlling circuit to the solenoids of the clutches. To this end the control shaft 170 which forms part of the control unit 78 is journaled in suitable bearings provided on the outer face of the side plate 451. This shaft has a bevel gear 480 thereon that meshes with a bevel gear 480 fast to a gear that meshes with a pinion 477 rotatably mounted on the shaft 458 to which the drum 453 is fast. Cam discs 482, 483, 485 to 487 and 487S are fast on the shaft 170 to be rotatable therewith. These cam discs, as will be explained in further detail hereinafter, operate the switches that control operation of various operative mechanisms in the machine.

In the present instance where the machine is set for duplicate work as has been explained hereinabove, the ratio between the gears 477 and 481 is two-to-one and, since the ratio between the bevel gears 480 and 479 is one-to-one, the shaft 170 and the various discs fast thereon make one revolution for each two revolutions of the drum 453 and its shaft 458.

It will be remembered that the gate 455 in the printing unit U is moved to and from sheet stopping position under control of a cam 457 fast to the drum 453 and it will therefore be understood that the gate 455 is opened at predetermined times in the course of rotation of the drum 453. Now in order that sheets passing from the sheet guideway G to the gate 455 will be fed into engagement with this gate when it is in sheet stopping position, so that when the gate is elevated a sheet may be fed into the bite between the drum 453 and the platen roller 454 at the proper time, it is of course essential that the means controlling the feed of sheets to the gate 455 be operated in timed relation with the operation of this gate and it will be manifest that it is essential that such timed relation be maintained, it also being understood that the various operating mechanisms in the machine are timed to operate in definite timed relation with the means which feed or release the sheets for passage to the gate 455.

Therefore, in order to insure that definite timed relation between the operation of the gate 455 and the various other operating mechanisms in the machine will be assured, an arrangement is provided such that the angular relation between the shaft 488 and the drum 453 will always be the same at the beginning and at the end of a complete rotation of shaft 488, which is to say, such that there will exist a definite relation between a given point on a member fixed on the shaft 488 and given point on the drum 453 and, by way of further example, the angular relation between the lobe or lobes on the cam discs 482, 483, 485 to 487 and 487S, and the inclination adjacent the rise on the cam 457 will have a fixed value at the beginning of each and every 360 degrees of rotation of shaft 170.

This is accomplished in the present instance by providing a clutch generally indicated by 488, Figs. 27 to 29, which functions in such a manner that the shaft 170 is always connected to the shaft 458 in an identical manner. The clutch 488 is of the one revolution type shown in my copending application Serial No. 239,563, filed November 8, 1938. The engagement of the clutch 488 is controlled by a solenoid 499 which is energized during operation of the machine by means to be hereinafter described, so that the clutch 488 remains engaged so long as the machine is to operate. The clutch 488 in the present instance includes the gear 477 which, as stated heretofore, is rotatably mounted on the shaft 458, this gear including a hub 489 having clutch teeth thereon that urge toward clutch teeth on a collar 492 fast on the shaft 458. Springs 493 are disposed between a disc 495 and the gear 477 and serve to urge the clutch members into engagement.

Urging of the clutch members toward each other does not necessarily promptly connect the gear 477 with the shaft 458 for, as has been explained heretofore, it is essential that the angular relation between the shaft 458 and the shaft 170 be maintained. In view of this the clutch teeth are provided on but one-half of the end of the hub 489 and likewise the clutch teeth are provided on but one-half of the adjacent face of the collar 492. The remaining portions of the adjacent faces of the hub and collar are flat and, until each and every one of the clutch teeth of the two clutch members are aligned, the flat faces on the hub and collar prevent the clutch teeth

from interengaging. When the clutch teeth are all aligned the shaft 170 is connected to the shaft 458 to rotate therewith. This can only occur at one point in the revolution of the shaft 458 and, therefore, each time the clutch 488 is engaged to establish interconnection between the shafts 458 and 170, these shafts are interconnected in the same angular relation and, since the angular relation between these shafts is maintained constant, it follows that the timing of the mechanisms under control of the cam discs 482 to 487 fast on the shaft 170 is always in the same relation with the operation of the gate 455.

It has been explained hereinbefore that the sheet guiding and advancing unit shown in Fig. 11 includes a cam shaft 148 and that this cam shaft is driven from the shaft 170, as hereinabove explained, in such a manner that the angular relation between the cam shaft 148 and the shaft 170 will be maintained constant. Thus the operative devices under control of the cam shaft 148 are also operated in timed relation with the drum 453, which is to say, the gate 455.

It is to be noted that the only geared interconnection between operative devices in the machine and the drum 453 is that established with the cam shaft 148 and therefore when the machine is initially placed in operation, which is to say, when the main motor 72 is set in operation, this motor need only pick up the drum 453. Moreover, when the clutch 488 is closed it only picks up the shaft 170 and the shafts 167 and 148, all of which parts are relatively light, and from the foregoing it will be seen that shocks incident to placing the machine of this invention in operation are reduced to a minimum, which is in contradistinction to arrangements that have heretofore been resorted to in printing machines of the type to which the invention pertains and wherein geared interconnections were established between various operative mechanisms in the machine for it will be appreciated that there is considerable shock incident to the picking up of a plurality of operative mechanisms interconnected by geared interconnections.

Electrical Connections, Fig. 30, and Safety Devices

The operation of the machine is under control of a main switch 100, Figs. 3 and 30, which, as stated hereinabove, when closed closes circuit to the line wire 526. As can be ascertained on the wiring diagram, Fig. 30, the various electrically operated mechanisms in the machine are connected between this line wire 526 and the other line wire 527.

Thus when the main switch 100 is closed circuit is closed from the line wire 526 through the conductor 1610 to one terminal of the motor 72 which drives the main drive shaft 74, the other terminal of this motor being connected to the line wire 527 through a conductor 1611. Closure of the main switch 100 also closes circuit to one terminal of a motor as 360, of a pager and proofer unit, when such a unit is employed in the machine, one terminal of this motor 360 being connected to the line wire 526 through a conductor 1612, the other terminal of this motor being connected to the line wire 527 through a conductor 1613. Furthermore, when the main switch 100 is closed circuit is also closed to a conductor 1614 which leads to one terminal of the motor 341, Figs. 26 and 30, which when set in operation withdraws the web 330—W from the roll 330—R of a pager and proofer unit, the other terminal of the motor 341 being connected by a conductor 1615 to one blade of the switch 340, while a conductor 1616 connects the cooperating switch blade to the line wire 527. Closure of the main switch 100 also applies potential on the conductor 1617 which interconnects the line wire 526 with one blade of the switch 123 that controls withdrawing of the web W from the roll R, a conductor 1618 leading from the other blade of this switch 123 to one terminal of the motor 98 and the other terminal of this motor being connected through a conductor 1619 to the line wire 527. Thus, closure of the main switch 100 either sets the various motors in the machine in operation or prepares the motors which operate to withdraw webs for operation, circuit being closed through these motors under control of the loop formed in the web withdrawn thereby in the manner hereinabove described.

It will be remembered that energization of the solenoid 206, Figs. 18 and 30, engages the clutch 181, Fig. 19, and that thereby the shaft 196 of the printing device feeding unit is set in operation. The solenoid 206 may be energized to effect such an operation in any one of three ways. For example, when the machine is initially placed in operation it is necessary that a printing and control device D be advanced into position II before automatic operation of the machine can continue and to this end a switch, generally indicated by 1620, Figs. 3 and 30, is provided which is under control of a push button 1621 which when pushed downwardly engages a contact on the blade 1622 with a contact on the blade 1623 of the switch 1620, these contacts being normally disengaged. Upon the engagement of these contacts circuit is closed from the line wire 526 (provided the switch 100 is closed) through conductors 1624 and 1625, the switch blades 1623 and 1622, conductors 1626 and 1627 to one terminal of the solenoid 206. Through a conductor 1628 that leads to the switch blade 1629 of the switch 1630, Figs. 28 and 30, and through switch blade 1631 of this switch and a conductor 1632 the other terminal of the solenoid 310 is connected to the line wire 527. The switch 1630 is a safety switch which is closed only after the multiplying mechanism M has been fully restored. Thus it will be seen that by depressing the push button 1621 when the contacts on the blades 1622 and 1623 are engaged the solenoid 310 may be energized to effect the advancing of a printing and control device. In event the multiplying mechanism has not been fully restored, the pin 1633 does not engage the contacts on the blades 1629 and 1631 so that the switch 1630 remains open and it will therefore be seen that the provision of the switch 1630 affords a safety device inasmuch as it prevents operation of the printing and control device feeding means when the receivers as 1141 of the multiplying mechanism M are not in their upper or at rest positions.

In normal operation of the machine circuit is closed to the solenoid 206 under control of a cam 482 on the cam shaft 170, Fig. 27, a rise on this cam engaging the blade 1634 of the switch 1635 at a predetermined time in the cycle of operation of the machine, explained in detail hereinafter, to engage a contact on this blade with a contact on the blade 1636 of this switch. Thereupon circuit is closed from the line wire 526 (since the main switch 100 is closed when the cam shaft 170 is operating) through a conductor 1637, the then closed switch 1635, the conductor

1627, solenoid 286, and through the switch 1630 and the conductor 1628 to the line wire 527.

In some instances it may be desirable to make a test operation to operate the multiplier and in such an operation the switch 1638, Figs. 3 and 30, may be closed by pressing down on the push button 1639 to engage a contact on the blade 1640 with a contact on the blade 1641, this closing circuit from the line wire 526 (if the main switch 100 is closed) through the conductors 1624 and 1642, switch 1638 and conductor 1643 to the conductor 1627 and thence through the solenoid 286, conductor 1632, switch 1630 and conductor 1628 to the line wire 527.

In addition to feeding a printing and control device into position II, when the machine is initially set in operation it is necessary that a sheet S be fed into association with the stop finger 25 pertaining to the multiplying mechanism M. To this end a switch 1644, Figs. 3 and 30, is provided which includes blades 1645 and 1646 having contacts thereon that may be engaged when the push button 1647 is pushed downwardly, this closing circuit from the line wire 526 (when the main switch 100 is closed) through conductors 1624 and 1648, switch 1644 and conductor 1649 to terminal 1650, and thence, through conductor 1651, winding of the solenoid 115 and conductor 1652, circuit is closed to the line wire 527 and thereupon the web withdrawing and sheet severing unit is set in operation to sever a sheet S from the web W which is then picked up by the sheet feeding means shown in Fig. 11 and fed into association with the stop finger 25, if, when and as such means are in operation.

In automatic operation of the machine circuit is closed to the solenoid 115 through a switch generally indicated by 1653, Figs. 14, 16 and 30. Contacts on the blades 1654 and 1655 of the switch 1653, in the automatic operation of the machine, are closed by a rise on a cam 1656, Fig. 16, on the shaft 404 which, as explained hereinabove, is rotated to make one revolution each time the multiplying mechanism M is set in operation, and the engagement of these contacts closes the switch 1653 whereupon circuit is closed from the line wire 526 through a conductor 1657, switch 1653, conductor 1658 to terminal 1650 and thence through conductor 1651, winding of solenoid 115, and conductor 1652 to the line wire 527.

The multiplying mechanism M is set in operation by energizing the solenoid 321, Figs. 15 and 30, and this may be done in one of several ways.

It has been stated hereinabove that when the push button 1639 engages the contacts on the blade 1640 and 1641 that this sets the multiplying mechanism M in operation, and the same means which sets the multiplying mechanism M in operation upon pressing of the push button 1639 also sets the multiplying mechanism M in operation in the course of automatic operation of the machine and this is effected by engaging contacts on the blades 1659 and 1660 of a switch 1661, Figs. 19 and 30, this being effected by engagement of an arm 1662 at the lower end of the shaft 196 with the blade 1660 of the switch 1661 and the engagement of this arm with this blade engages contacts on the blades 1659 and 1660 with each other whereupon the following circuit is closed:

From line wire 526 through conductors 1624 and 1625 to the blade 1623 and through a contact on this blade to a contact on the blade 1663, these contacts normally being engaged and only being separated in a manner that will be described presently. Circuit is closed from the blade 1663 through a conductor 1664 and through closed switch 1661 and conductor 1665 to terminal 1666 and conductor 1668 to line wire 527.

The contacts on the blades 1623 and 1663 are only separated when the push button 1621 is pushed downwardly, in which event it is desirable that only the printing and control device feeding mechanism be operated. Normally, whenever the printing and control device feeding mechanism is set in operation, the arm 1662 engages the contacts on the blades 1659 and 1660 and this should prevail when the push button 1621 is pushed downwardly. When the push button 1621 is pushed downwardly, a pin 1669 thereon engages the forward end of the blade 1663 and separates the contact on this blade from the cooperating contact on the blade 1623 wherefore circuit from line wire 526 is opened and thus even though the arm 1662 engages contacts on the blades 1659 and 1660 the solenoid 321 is not energized.

When it is desired to manually set the multiplying mechanism M in operation the push button 1670 is pushed downwardly to engage a contact on the blade 1671 with a contact on the blade 1672 of the switch 1673, Figs. 3 and 30. The engagement of these contacts closes circuit from the line wire 526 (if the main switch 100 is closed) through conductors 1624 and 1674, switch 1673, conductor 1675 to terminal 1666 and thence through conductor 1667, winding of solenoid 321, and conductor 1668 to line wire 527.

It may be desirable to operate the platen P other than in a normal operation of this platen in the course of automatic operation of the machine and to this end a switch 1676, Figs. 3 and 30 is provided. The switch 1676 includes a push button 1677 which when pushed downwardly engages a contact on the blade 1678 with a contact on the blade 1679 and thereupon a circuit is closed from the line wire 526 (if the main switch 100 is closed) through conductors 1624 and 1680, switch 1676 and conductor 1681 to terminal 1682 and thence through conductor 1683, winding of solenoid 280, and conductor 1684 to line wire 527.

In the present machine wherein two impressions are to be made by the platen P from each printing and control device D fed into printing position therebelow and when one such impression is to be made on a sheet S and the other impression is to be made on a web as 330—W of a pager and proofer, two switches are provided for closing circuit to the solenoid 280 which brings about operation of the platen P. One of these switches, generally indicated by 1685, Figs. 27 and 30, is in the present instance, closed by a rise on the cam 433 on the cam shaft 170. If two impressions were to be made on each sheet S, rather than one on the sheet S and another on a web as 330—W, the cam 433 would include two lobes or rises so that the switch 268 would be closed twice each time a printing and control device D was moved into printing position beneath the platen P. However, in the present instance, where one of the two impressions made from each printing and control device is to be made on a web 330—W of a pager and proofer, the solenoid 280 is energized in one operation by closure of the aforesaid switch 268 and in another operation by closure of the switch 283, Fig. 30, included in the variable printer 36 from which an impression is made on the web 330—W of the pager and proofer.

In the course of automatic operation of the

machine the solenoid 280 is once energized by closure of the switch 268 and this is effected by engagement of the lobe on the cam 483 with a switch blade 1687 whereupon a contact on this blade is engaged with a contact on the blade 1688 and thereupon circuit is closed from the line wire 526 through conductor 1690, switch 1685 and conductor 1692 to terminal 1691 and thence through conductor 1689, terminal 1682, conductor 1683, winding of solenoid 280, and conductor 1684 to line wire 527.

Also in the course of operation of the machine the pin 282, Fig. 30, engages the contacts of the switch 283 and thereupon circuit is closed from line wire 526 through conductor 1693, the switch 283, conductor 1694 to terminal 1691 and thence through conductor 1689, terminal 1682, conductor 1683, winding of solenoid 280, and conductor 1684 to line wire 527.

When the solenoid 280 is energized by closure of the switch 268, the resulting operation of the platen P is to make an impression on a sheet S but when the solenoid 280 is energized by closure of the switch 283 an impression is to be made on the web 330—W of the pager and proofer. It will be recalled that a pin 264 is associated with the platen P so that, in the course of downward movement of the platen P, if a sheet S does not lie therebelow, this pin closes a switch 265, thereby to close circuit to the solenoid 266 to disable the hydraulic system, which applies pressure on the platen P, the action being such that printing pressure is not applied by the platen. It will be recognized, however, that when an impression operation is made by the platen P on the web 330—W a sheet S will not lie beneath the platen P and that therefore the pin 264 will act to close the switch 265. In this instance, however, circuit to the solenoid 266 is not to be closed because so to do would prevent the platen P from making an impression on the web 330—W.

In view of the foregoing circuit is established through the switch 265 only when an impression is to be made on a sheet as S so that if the pin 264 engages the contacts on these blades in any other impression operation of the platen P the solenoid 266 will not be energized to increase the capacity of the hydraulic system and prevent a printing operation of the platen P. The manner in which this is accomplished can best be ascertained by reference to the wiring diagram, Fig. 30, and it is as follows:

The switch 268, Fig. 30, includes a third blade 1686 and when the cam 483 acts to engage contacts on the blades 1687 and 1688 to close circuit to the solenoid 280 circuit is also closed from the line wire 526 through conductor 1690, the contacts on the blades 1688 and 1687 to a contact on the blade 1686 and thence through a conductor 595 to one blade of the switch 265. The dwell on the cam 483 is of sufficient length that it maintains the various contacts on the blades of the switch 268 engaged until after the platen P should have made an impression from a printing and control device D on the anvil 183 and hence, if the pin 264 closes the switch 265, when circuit is closed thereto by switch 268, as just described, then circuit is closed through a conductor 594, the winding of the solenoid 266 and a conductor 593 to the line wire 527. Thereupon in the manner above described the capacity of the hydraulic system is increased and the platen P is prevented from making an impression, it being understood that the pin 264 closes the switch 265 and the solenoid 266 energizes prior to the time the platen P has attained impression making position with respect to the printing and control device on the anvil. It will, of course, be understood that if two impressions were to be made on a sheet as S then both of the two lobes that would be provided on the cam 483 in this instance would be sufficiently prolonged to enable the just described operation of the solenoid 266.

When the detector switch 226, Fig. 30, seats on a tab Y, the switch is closed to thereby close circuit from the line wire 526 through conductor 1695, switch 226, conductor 1696 to a terminal 1697 and thence through conductor 1698, winding of solenoid 227, and conductor 1699 to line wire 527. Thereupon the disc 412 is set in rotation to extinguish one lamp as 225R and illuminate the other lamp as 225L. This same operation may be brought about manually by closing the switch 1700, Figs. 3 and 30, this being effected by pushing down the push button 1701 to engage a contact on the blade 1702 with a contact on the blade 1703 to close circuit from the line wire 526 (if the main switch 100 is closed) through conductors 1624 and 1704, closed switch 1700 and conductor 1705 to terminal 1697 and thence through conductor 1698, winding of solenoid 227, and conductor 1699 to line wire 527.

It has been explained that the auxiliary printing mechanism 36 is set in operation by energization of the solenoid 426 and this may be effected manually by closing the switch 1706, Figs. 3 and 30, this being effected by depressing the push button 1707 to engage a contact on the blade 1708 with a contact on the blade 1709 and thereupon circuit is closed from the line wire 526 (if the main switch 100 is closed) through conductor 1710, through conductor 1713, winding of solenoid 426, and conductor 1714 to line wire 527.

In the course of automatic operation of the machine the solenoid 426 is energized by the engagement of a lobe or rise on the cam 485, Figs. 27 and 30, with a blade 1715 of a switch 1716 whereupon a contact on this blade is engaged with a contact on the blade 1717 of this switch and thereupon circuit is closed from the line wire 526 through a conductor 1718, closed switch 1716 and conductor 1719 to terminal 1712 and thence through conductor 1713, winding of solenoid 426, and conductor 1714 to the line wire 527.

The numbering mechanism 37 is operated in the manner hereinabove described in each cycle of operation of the machine in such a way that an impression may be made therefrom each time the platen P makes an impression from a printing and control device D fed into printing position therebelow and to this end a cam 486, Figs. 27 and 30, is provided on the cam shaft 170. When the parts are at rest a relief on the cam 486 engages the blade 1720 of a switch 1721 so that a contact on this blade is disengaged from a contact on the blade 1722. However, in the course of rotation of the cam shaft 1078 the dwell on the cam 1086 engages the blade 1720 to close the switch 1721 and when this occurs circuit is closed from line wire 526 through conductor 1723, closed switch 1721 and thence through conductor 1724, winding of a solenoid 662, and conductor 1725 to line wire 527. The solenoid 622 is operable when energized to advance the numbering machine 37 to print the next higher number.

When a pager and proofer is employed it may be desirable to make a test operation thereof and to this end means are provided for manually energizing the solenoid 367 which controls operation

of the pager and proofer and to this end the switch 393, Figs. 3 and 30, is provided, and when the push button 394 of this switch is forced downwardly a contact on the blade 1728 is engaged with a contact on the blade 1729 and thereupon circuit is closed from the line wire 526 (if the main switch 100 is closed) through conductor 1730, closed switch 1726 and conductor 1731 to terminal 1732 and thence through conductor 1733, winding of solenoid 367, and conductor 1734 to line wire 527. In automatic operation of the machine the solenoid 367 is energized by engagement of a lobe on the cam 487, Figs. 27 and 30, on the cam shaft 170, with a blade 1735 of a switch 391, Figs. 27 and 30, this engaging a contact on the blade 1735 with a contact on the blade 1737 and thereupon circuit is closed from the line wire 526 through conductor 1738, closed switch 391 and conductor 1739 to terminal 1732 and thence through conductor 1733, winding of solenoid 367, and conductor 1734 to line wire 527.

It has been explained hereinabove that at predetermined times in the course of operation of the machine a pin 388, Figs. 26 and 30, on the ratchet 385 closes the switch 390 and when this occurs in the course of operation of the machine circuit is closed from line wire 526 through conductor 1738, closed switch 391, conductors 1739 and 1740, winding of solenoid 381, conductor 1741, closed switch 390, and thence through conductor 1742 to the line wire 527 whereupon the solenoid 381 is energized to operate the severing means of the pager and proofer.

After a printing and control device D has been fed into position II and a sheet has been severed into the web and fed into engagement with the stop finger 25, automatic operation of the machine may be commenced and this is done by pushing down on the central push button 1743, of the start-stop switch SS, Figs. 3 and 30, whereupon a contact on the blade 1744 of the switch 1745 is engaged with a contact on the blade 1746 of this switch. At this time a contact on the blade 1747 of the switch 1748 is engaged with a contact on the blade 1749 of the switch 1748 and thereupon (if the main switch 1700 is closed) circuit is closed from the line wire 526 through a conductor 1750, the contact on the blade 1749, a contact on the blade 1747, which blade is in electrical connection with the blade 1744, and thence, through a contact on the blade 1744 engaged with a contact on the blade 1746, circuit is closed through the conductor 1751 to a terminal 1752 and thence through conductor 1753, winding of the relay 1754, and conductor 1755 to blade 1756 and a contact thereon which is normally engaged with a contact on the blade 1757 associated with the relay 1758 and a conductor 1759 to line wire 527. Thereupon the relay 1754 is energized to attract the armature 1760 of this relay into engagement with the contact 1761 and the armature 1762 of this relay into engagement with the contact 1763.

The engagement of the armature 1762 with the contact 1763 closes circuit from the line wire 526 through a conductor 1764, armature 1762 and contact 1763, conductor 1765, and thence through the winding of the solenoid 499 and conductor 1766 to line wire 527 whereupon the solenoid 459 is energized to cause the single position clutch 488 to engage at the predetermined time hereinabove described, to set the cam shafts 170 and 148 in rotation.

As soon as the relay 1754 is energized the push button 1743 may be released for a stick circuit, described in detail hereinafter in connection with the safety devices, is established through the winding of this relay to maintain it energized and therefore the solenoid 499 is maintained energized. When, however, circuit is broken to the relay 1754 by disengaging the contact on the blade 1747 from the contact on the blade 1749 by pushing down on the shell 1767 of the start-stop switch SS, circuit to the winding of relay 1754 is opened and thereupon the solenoid 499 deenergizes with the result that the main clutch 488 disengages to stop rotation of the cam shafts 170 and 148.

Hereinabove it has been explained that the reversing switch 230, Figs. 17 and 30, is reversed to selectively illuminate one of the lamps 225L and 225R and extinguish the other. The circuit in this instance is through conductor 528 from line wire 526, a contact on blade 529 to a contact on blade 532, and thence through conductor 534, filament of lamp 525 and conductor 535 to line wire 527, or from a control on blade 529 through a contact on blade 531, conductor 536, filament of lamp 225R, and conductor 537 to line wire 527.

Whenever circuit is closed to conductor 1626, Fig. 30, potential is applied on terminal 1626' and conductor 1627' to thereby apply potential on one terminal of the solenoid 1628', Fig. 30. The core 1629' of this solenoid is connected as indicated at 1630', Fig. 14, to the rockers 1589 and 1596 which carry the pins 1590 and 1599 that operate, when the solenoid 1628' is energized, to restore the Bowden cables 33. Whenever the printing and control device feeding means are manually set into operation, as by pushing down on the push button 1621, Fig. 30, the shaft 196 is set in operation and, furthermore, the detector or sensing means 31, Fig. 19, pushes the Bowden cables 33. In such an operation the push button 1621 should be held down long enough to enable the arm 1662' on the shaft 301 to act on the blade 1660' so as to close the switch 1660'. When this is done, circuit is closed from line wire 526, through conductors 1624 and 1625, blades 1623 and 1622, and conductor 1626 to terminal 1626', and thence through conductor 1627', winding of solenoid 1628', conductor 1665', blades 1659' and 1660', and conductor 1664' to line wire 527, which energizes the solenoid 1628' to thereby restore the Bowden cables pushed as aforesaid.

It will be recalled that when it is desired to perform a total taking operation from the accumulator included in the auxiliary printing mechanism 36, the key lever 418, Figs. 21 and 22, is depressed and that thereupon the adjusting screw 872, Fig. 22, acts to engage a contact on the blade 873 with the contact on the blade 875 to thereby close the switch 874. By referring to the wiring diagram, Fig. 30, it will be seen that the effect of this is to close a circuit from the line wire 526 through the conductor 1718', closed switch 874, and conductor 1719' to the conductor 1713' and thence through the winding of solenoid 426 and conductor 1714 to line wire 527. Thereupon the solenoid 426 is energized with the effect hereinabove described of setting the auxiliary printing mechanism 36 in operation, in the course of which operation a total is printed, all of this having been described hereinabove. It is because it is essential that the platen P move into printing position in a total taking operation that the pin 282, Fig. 30, is included in the auxiliary printing mechanism 36 so that in a

total taking operation a contact on the switch 283 will be closed to close circuit to the solenoid 280 and effect an operation of the platen P so that the platen will move into position to serve as a backing member in a printing operation incidental to the total taking operation.

It will be remembered that if a sheet does not move into engagement with the stop finger 25 the sensing finger 25', Fig. 13, acts to close the switch 160 and in this manner circuit controlled by the switch 160, Fig. 30, is closed. A similar switch 161, Figs. 12 and 30, is associated with the stop finger 26. The switches 160 and 161 are normally open but potential is supplied to one of the blades of each of these switches through a conductor 1772 that leads from the line wire 526. A conductor 1777 is connected to the other blade of the two switches, and at its other end is connected to the relay 1758. Thus whenever the fingers as 203 indicate the absence of a sheet in association with either the stop finger 25 or the stop finger 26, either the switch 160 or the switch 161 is closed and thereupon potential is supplied to the wire 1777 from the line wire 526 and thence through the winding of relay 1758, and conductor 1778, and circuit is closed through the winding of said relay 1758, whereupon the contact on the blade 1756 is separated from the contact 1757 and in this way circuit to the line wire 527, from the winding of relay 1754, is broken, whether this be the hereinafter described stick circuit or the cricuit closed to the relay 1754 by pressing down of the push button 1743.

In event the arm 217, Fig. 17, does not return to its normal at rest position, which is indicative of jamming in the printing and control device feeding mechanism, a contact on the blade 1779, Figs. 17 and 30, is not engaged with a contact on the blade 1780 and thereupon the stick circuit for the relay 1754 is opened for at this time the rise on the cam 1087s, Figs. 27 and 30, will be engaging the block 1781 on the contact 1782 of the switch 1783, and thereupon through the posts 1784 a contact on the blade 1785 is separated from a contact on the blade 1786. So long as the contacts on either the blades 1786 and 1785 are engaged or on the blades 1780 and 1779 are engaged, a stick circuit is established to the winding of the relay 1754 as follows:

From the line wire 526 through conductor 1750, a contact on blade 1749, a contact on blade 1747, conductor 1787 to terminal 1788. When the machine is at rest potential is applied on the contact 1761 so that a stick circuit will be established when the armature 1760 engages the contact 1761 in the following manner:

Either from terminal 1788 through conductor 1789, contact on blade 1786, contact on blade 1785, conductor 1790, terminal 1791 and conductor 1792 to contact 1761 or from terminal 1788 through conductor 1793 to a contact on blade 1779, a contact on blade 1780 to terminal 1791 and thence through conductor 1792 to contact 1761. Hence, when the push button 1743 is pushed downwardly to energize the relay 1754 to attract the armature 1760 into engagement with the contact 1761, circuit is established through the conductor 1794 to the terminal 1752 and thereupon a stick circuit is established to the winding of the relay 1754.

However, prior to the time the printing and control device feeding means come to rest in a cycle of operation of the machine, the arm 217 should engage and close circuit through contacts on the blades 1779 and 1780 and at this time the rise on the cam 1087s will engage the block 1781 and separate the contacts on the blades 1785 and 1786. If the arm 373 is in its at rest position this will not open the stick circuit for the relay 1754 but if the arm 373 is not in its at rest position at this time the stick circuit will be opened. It will be recognized that at all times in the course of operation of the machine, except at the time the rise on the cam 1087s engages the block 1781, the contacts on the blades 1785 and 1786 are engaged and hence a stick circuit for the relay 1754 is established.

The arrangement including the blades 1779 and 1780 and 1785 and 1786, which is to say, the provision of parallel circuits, is typical of other safety devices that could be associated with parts in the machine that are to attain a definite at rest position. Additional blades as 1778 and 1780 would be provided, in such an instance, as well as additional blades 1785 and 1786. The time of separation of blades as 1785 and 1786 would be the time at which the part with which the contacts on the blades as 1779 and 1780 cooperate should be in its at rest position.

It will be understood that in the complete machine many other safety devices would be provided, the need for the provision of such safety means being understood in the art. Among such other safety devices may be cited a switch in association with the magazine H to interrupt operation of the machine at the end of a cycle of operation following that in which the last printing and control device is fed from the magazine. Another safety could be provided in association with the drawers J to prevent the passage of more printing and control devices into a drawer than such drawer is adapted to contain, the need for such safety means arising in event a full drawer is not removed and another substituted therefor after a change from one drawer to another has been effected, in the manner described herinabove, and the drawer which remains, but which should have been removed, is entirely filled with printing and control devices. Many other safeties for kindred purposes could be provided in the machine and it will be recognized that all such safeties would not need to be timed to operate at some particular time in the course of operation of the machine and such safeties would be connected to open the circuit through the relay 1758 to prevent improper operation of the machine.

Operation of the Machine

Preliminary description

Before presenting a detail description of typical operations in the machine, as thus far described, a brief résumé of the manner in which the machine is arranged in order that it will perform the desired work is presented.

The dimensions of a sheet to be produced are first ascertained and a sheet feeding arrangement such as shown in Fig. 11 is provided and the bars as 12 and 13 are spaced apart to locate the slots therein in such spaced apart relation that the proper edges of a sheet as S, Fig. 6, will pass therebetween and these parts are then secured together to afford a unit like that shown in Fig. 11. This unit is then located on the table top 16 relative to the printing position below the platen P. The unit carried by the frame 10 is next positioned and a stop bar as 13' is aligned with the bar as 13 to insure that a sheet severed from the web and fed forwardly will properly pass into the guideway G in position to have the impression made thereon faced properly on the sheet.

It is also ascertained what data are to be printed in the printing means carried by the frame 10 and the printing cylinders and their cooperating impression or platen cylinders are arranged to cooperate to produce impressions such as the date E and signature B and sometimes, as explained hereinabove, the number N, at proper locations on the sheets, these impressions being made prior to severance of the sheets from the web. It will of course be understood that the sheet feeding rollers as 118 are adjusted on the shafts 110 and 119 to feed the web in the proper amount, this insuring that the knife 125 will sever the desired width of sheet from the web.

The multiplying mechanism M is mounted in position and is located transversely of the line of travel of the sheets in such position that the variable data V or the like printed therefrom will be printed at the proper position transversely across the sheet, a stop finger as 25 being provided and adjusted to insure proper location of the impression made by the impression means of the multiplying mechanism M at the desired position longitudinally of the sheet.

A stop finger as 26 is next positioned to properly locate the sheet with respect to the devices from which impressions will be made by the platen P and in the present instance this stop finger would be located to insure that the address A would be printed on the sheets S at the position desired. Furthermore, a numbering machine as 37, if such a device is to be utilized, is adjusted relative to the anvil 183 to insure that the number N will be printed on the sheets S at the desired position. Likewise the position of an auxiliary printing mechanism as 36 is adjusted to insure production of impressions at desired locations.

In addition to the foregoing, the impression or printing members which print the form F on the sheets as S are properly located on the drum 453 of the printing unit U to print the form F at the proper positions on the sheets S, the manner in which such impression means would be located and secured being, for example, that which is disclosed in the United States Letters Patent No. 816,311.

If as in the present instance it is desired to produce a proof sheet as 330, a pager and proofer unit such as is disclosed in Figs. 24, 25 and 26, is associated with the machine in proper location to receive impressions upon operation of the platen P, this arrangement having been described in full detail hereinabove.

If, as in the present instance, two impressions are to be made from each printing and control device D fed into printing position, the machine is to be arranged for duplicate work, as has been explained hereinabove, and in such an instance the ratio between gears as 477 and 481 is two-to-one so that the shaft 170 will make one revolution for each two revolutions of the drum 453 which, as has been explained hereinabove, is the part of the machine that is constantly operated in the course of operation of the machine.

With the machine arranged as above, a roll of paper R, of a width equal to the length desired of the sheets S, is mounted in the frame 10 and the web W is withdrawn therefrom and passed about the various feed and guide rollers and thence through the bite between the feed rollers as 118 which are then rotated into cooperating relation to clamp the leading edge of the web therebetween.

Where a pager and proofer is employed, a roll of paper as 330—R is mounted in the stand as 331 and a web as 330—W is withdrawn therefrom and led about the guide rollers as 333 and 334, Fig. 24, and over the roller 335, and under the roller 337 and over the roller 338 and the guide roller 343, thence over the impression face 244 of the platen P and over the rollers 345 and through slot in the platen mounting and thence about the rollers 351 and 352 and then through the bite between the rollers 352 and 353 to be in a position to pass to the knife 354 so that pages cut therefrom will be collected in the page collector 375.

With the machine so arranged a supply of printing and control devices D is introduced into the magazine H and the drawer from which these devices were removed is placed in either the right or left-hand position, Fig. 2, as indicated by the illumination of the lamps 225R or 225L, Fig. 3.

The machine is now ready to be set in operation and this is done by closing the main switch 186. Next the push button 1621, Fig. 30, is pushed downwardly to close the switch 1620, with the effect hereinabove described, to cause the leading printing and control device D, which will be at position I, Fig. 17, to be advanced to position II. Furthermore, the button 1647, Fig. 30, is pushed to cause the web W to be advanced past the knife 125 whereupon a sheet S is severed from the web and such sheet is fed into position to be engaged with the stop finger 25.

The key lever 418 is depressed to bring about a total taking operation of the accumulator included in the auxiliary printing mechanism 36 whereby the accumulator wheels thereof are returned to zero position.

The machine is now ready to be operated automatically as will now be described, reference being made to first, second, third and so on cycles of operation, which, it will be understood, refer to rotations of the drum 453, the constantly operating part of the machine when the machine is in automatic operation, this also causing continuous rotation of the cam shaft 170, Fig. 27, and the cam shaft 148, Fig. 11. In the early operations of the machine certain of the operative mechanisms will be set in operation, but such operation will be idle since no sheet or printing and control device, for example, will be in operative relation therewith. Hence, in the following description only those operations which are actually effective in a particular cycle of operation are described and the idle operations are disregarded.

In this description of operation reference is made to the timing charts, Figs. 31 to 33A, each of which depicts a particular cycle of operation as will be explained presently. In these timing charts, as in the description of the various cycles, only those operations which are actually effective are shown and the idle operations are disregarded. Furthermore, if an operation in a particular cycle is identical with an operation in a preceding cycle, it is omitted in the chart, and in the following description reference will be made back to the chart in which such additional operations are to be found.

Each cycle of operation will now be explained separately with reference to the separate illustration of the particular cycle being described.

First cycle

The first cycle of operation of the machine, which is to say, the first rotation of the drum 453, is shown in Fig. 31 and by referring thereto it will

be seen that no operations are illustrated as occurring in this cycle for the reason, as explained above, that while various operative mechanisms may function in this cycle of operation, the resulting operations are idle. What operative mechanisms there are that do function in this cycle of operation will appear when corresponding cycles of operation are explained hereinafter.

It is to be noted that in this first cycle of operation and until later in the course of automatic operation of the machine, as will be explained it will be necessary to manually hold the bar 26', Fig. 11, upwardly, to prevent the contacts under control of this bar from being closed and energizing relay 1758 inasmuch as at this time no sheet S is disposed below the platen P.

Second cycle

The second cycle of operation is shown in Fig. 31A and there it will be noted that the first operations after the start of this cycle relate to the sensing head 31, Fig. 19, and the carrier bars 29, Fig. 29. The sensing head 31 starts to move toward the control area or card 6 on the printing and control device D disposed at detecting position II, Fig. 17; this operation being indicated as being initiated at the point 1804, Fig. 31A.

The first printing and control device to pass through the machine is that shown in Fig. 4 which it will be seen is perforated to represent shareholdings of 999 so that the Bowden cables 33, Fig. 3, for the digit 9 in the units, tens and hundreds orders of the multiplier will be pushed in this operation of the sensing head 31. Such pushing of the Bowden cables and resultant operation of the associated set-up means will be completed at the point indicated at 1805.

Simultaneous with the initiation of movement of the head 31, the carrier bars 29 start to move rearwardly, the initiation of such movement being indicated at the point 1804'. The carrier bars attain their rearwardmost position, without having moved the printing and control devices, at the point 1803 but in the meantime other operations are effected.

As stated above, the set-up means of the multiplier M will be actuated by the time the point 1805 is attained in the second cycle of operation. Shortly after this, at the point 1805', the settable members of the multiplier mechanism M start their swinging movement or setting movement and by the time the point 1809 is attained the settable members will have been properly positioned.

Hence at the point 1810, the summation means are set in operation, and this operation is completed by the time the point 1811 is attained, the settable members remaining in their set-up position from the point 1809 to the point 1829 in the second cycle of operation and the operation of the summation means, which takes place between the points 1810 and 1811, and which is controlled by the set-up of the settable members is therefore completed while the settable members are set up.

The set-up of summation means is completed by the time the points 1811 and 1811' are attained and at the point 1811' the sensing bars 311 are set in operation, the set-up of these bars being completed by the time the point 1812' is reached. During the movement of the sensing bars 311 intermediate the points 1811' and 1812', the type segments 314 and the associated punch slides are set up, these type segments and punches being fully set up in operative position by the time the point 1812' is attained.

Thus, at the point 1851, in this second cycle of operation, the punch mechanism starts its operation and by the time the point 1851' is attained a card C will have been punched. By the time the point 1852' is attained the punches will be restored. After the punches are restored at the point 1852', and at the point 1820, the card stop finger 400, Fig. 3, raises and during the interval between the points 1820 and 1826 the stop finger 400 moves up and down and releases the punched card C. At the time the stop finger 400 starts upwardly at the point 1820 the punched card C, at the point 1817', starts to move forwardly and this card is free to move until a point in the third cycle of operation, as will be explained, it being noted that no arrow is provided, at the end of the cycle in Fig. 31A, on the chart line pertaining to such card movement and this indicates that the operation is not yet completed.

Intermediate the points 1812' and 1817, in the second cycle of operation, the type segments 314, Fig. 14, remain in printing position and it is during this time that the platen PM makes the impression V on the sheet S engaged with the stop finger 25. Thereafter, at the point 1820' the stop finger 25 starts to raise and does not return to its completely lowered position until the point 1826' and during the interval between points 1820' and 1826' the sheet S that has been engaged with the stop finger 25 moves forwardly into engagement with the stop finger 26 to be positioned relative to the platen P. At the time a sheet S attains this position the safety sensing bar 26' may be released for if it is lowered at this time it will engage the sheet S engaging the stop finger 26 and it will therefore be prevented from closing circuit to the magnet 1758, Fig. 30, to interrupt operation of the machine.

At the time the carrier bars attain their rearwardmost position at the point 1803 they start to move forwardly and hence intermediate the points 1803 and 1846 the carrier bars 29 advance the printing and control device that has been in position II, Fig. 17, to position III and they also advance the printing and control device which has been in position I to position II. It will be noted that the printing and control device which has been in detecting position II and which controlled set-up of the multiplying mechanism M is now in printing position III above the anvil 183. Likewise, the sheet which was printed in the multiplying mechanism M is now in position above the anvil 183 so that upon the next operation of the platen P an impression will be made on the sheet or check S from the printing and control device under control of which the multiplying mechanism M was set up to print the variable data V on the check. The variable data V printed from the type segments 314 by the platen PM in this second cycle of operation pertain to the amount of money to be paid pursuant to the check. It is to be noted particularly that the point 1846, by which time the carrier bars 29 attain their forward position, is located at the 360 degree point in the second cycle of operation.

By the time the point 1817 is attained cards C will have been punched and the sheet S will have been printed and therefore intermediate the points 1817 and 1814' the sensing bars 311, the type segments 314 and the associated punch slides are restored, this restoration being completed by the time the point 1814' is attained. Moreover, at the point 1812 by which time the sensing bars 311, type segments 314 and punch slides will be

substantially in their at rest positions, the summation means starts to restore and this is completed by the time the point 1814 is attained.

It will be recalled that a switch 1653, Fig. 14, is provided in the multiplying mechanism M to close circuit to the solenoid 115 that sets the mechanisms carried by the frame 10 in operation. When these devices are set in operation the web W starts to feed forwardly and this is initiated in the second cycle of operation at point 1848' and the web continues to move forwardly until the point 1849 is attained. By the time the point 1815 is attained the knife 125 may start downwardly to sever the sheet. It should be noted that the knife 125 has not completed its function at the end of the second cycle, this being completed in the third cycle.

The card C comes to rest in engagement with the stop finger 405 at the point 1822 in the third cycle of operation to be ready for use in the fourth cycle of operation.

It will, of course, be understood that during the time the web W is being fed intermediate the points 1848' and 1849 a date E and a signature B are printed on the web W. It is also to be understood that when the sheet was advanced into position in the multiplying mechanism M manually, as hereinabove described, the machine was turned over at least twice to insure that the first sheet disposed in the multiplying mechanism M bore such date and signature impressions, any sheet fed into the multiplying mechanism M in such operations and not bearing signatures being manually removed from the machine. It will also be understood that in automatic operation each and every sheet which attains printing position in the multiplying mechanism M will bear signature and date impressions and in those instances where a number N is also printed on the sheets in this position this impression would likewise appear on the sheet.

The foregoing completes the operations which take place in the second cycle of operation and at this time it should be noted that similar operations take place in every even cycle of operation of the machine as well as additional operations, that are idle in this second cycle, as will be described hereinafter.

Third cycle

In the third cycle of operation, which is shown in Fig. 32, at the point 1859' the platen P starts downwardly and at the point 1859 the platen will be in printing position.

Furthermore, at the point 1822' the numbering machine 37, Fig. 17, starts upwardly and has accumulated and is in printing position by the time the point 1859 is attained.

Thus when the platen P attains its lowermost or printing position at the point 1859 it operates to print the number N, which in this instance is "2370," on the first check S and at the same time the platen operates to print from the type characters T on the plate 2 of the first printing and control device D and thereupon the address A is printed on the first check S.

The platen P starts upwardly at the point 1859 and attains its upper position at the point 1860 in the third cycle of operation. Furthermore, at the point 1796 the stop finger 26 starts upwardly and remains in its upper position until the point 1797 is attained in this third cycle of operation.

At the point 1795 the gate 455 on the printing unit U is lowered to sheet stopping position whereupon the first sheet S, which fed toward the form printing unit U upon the raising of stop finger 26 at point 1796, will be stopped by the gate 455 on the printing unit U. At point 1798 the gate 455 is retracted to its normally open position, whereupon the first sheet S passes into the bite between the drum 453 and the platen roller 454 and the form F is printed on this sheet which then passes to the sheet collector K, Fig. 1.

In the third cycle of operation at the point 1854 the knife 125 attains its lowermost position to complete the severing of the second sheet S from the web W and the knife 125 is returned to its upper position by the time the point 1866 is attained. After the second sheet is severed from the web W the roller 18, Fig. 11, lowers into engagement therewith and feeds it forwardly into engagement with the stop finger 25.

The foregoing are typical of the odd cycles of operation of the machine and every odd cycle is identical with this third cycle, it of course being remembered that, while the above described mechanisms functioned in the first cycle of operation, the operations were idle and were not therefore discussed in the description of the first cycle of operation and are not shown on the chart pertaining to this first cycle.

Fourth cycle

The fourth cycle of operation is shown in Fig. 32A and by the time the point 1870 is attained in this cycle the auxiliary printing mechanism 36 will have been set in operation. When the auxiliary printing mechanism 36 is set in operation at the point 1870 the sensing bars 416 start cooperating with the cards C, which will have been engaging the stop finger 405 at the point 1822 in the third cycle of operation, and by the time the point 1871 is attained the type segments 419 of the auxiliary printing mechanism 36 will have been set up.

It is a switch 282, Fig. 30, in the auxiliary printing mechanism 36 that closes circuit to the solenoid 280 that sets the platen P in operation. Hence at the point 1844 the platen P starts to move downwardly.

Furthermore, the numbering machine 37 is still elevated so that by the time the platen P attains its downward position at the point 1874 the number N, the variable data V' and the address A from the first printing and control device, that is now on the anvil 183, will be printed on the web 330—W that is to be divided into proof sheets or pages as described hereinabove, it, of course, being understood that the hammers 42, Fig. 21, operate to produce the impression V'.

The type segments 419 remain set up until the point 1872 is attained at which time the sensing bars 416 start to return to their initial or at rest position and in so doing the amount of the variable data V and V' is entered on the accumulator wheels, the variable printer 36 being restored to at rest position by the time the point 1875 is attained. Furthermore, the platen P starts to raise at the point 1874 and attains its upper position at the point 1845. Likewise, at the point 1846 the numbering machine 37 starts to lower and is returned to its lowered position by the time the point 1846' is attained.

Additionally at the point 1873 the web feed of the pager and proofer is set in operation and as a result during the fourth cycle of operation the web 330—W advances, this web coming to rest at the point 1876.

In these respects the fourth cycle is identical with all other even numbered cycles of operation

except the second cycle for in the second cycle of operation the just described operations are idle. Furthermore, as will be explained presently, another operation might be initiated in an even cycle of operation, but this will not occur in the second cycle of operation inasmuch as it will not appear until a predetermined number of impressions have been made on the web 330—W.

In the course of the fourth cycle of operation it will be understood that the third printing and control device is advanced from position I to position II, the second printing and control device is advanced from position II to position III and the first printing and control device near the end of this fourth cycle of operation is moved from position III and dropped down through the printing and control device discharge chute to the transverse guideway 30. It will also be understood that the second printing and control device which was so advanced from position II to position III is that which controls the set up of the multiplying mechanism M to print the variable data V on the second of the sheets S, such second of the sheets S now being in printing position with respect to the platen P and the first of the sheets will now be engaging the gate 455 of the printing unit U.

Fifth cycle

In the fifth cycle of operation the address A and number N are printed on the second sheet S inasmuch as the second printing and control device is now in printing position. Likewise, the other operations which occur in the third cycle of operation are effected in this fifth cycle of operation.

Sixth cycle

The sixth cycle is identical with the fourth cycle except that at the point 1880 the pawls 221 and 223 start moving to their advanced position, which is attained at point 1881, and during the interval between the point 1881 and the point 1882 the pawls return to their retracted position and in so doing the first printing and control device is advanced from position IV to position V. It will, of course, be understood that the gate 505 between the main guideway and the transverse guideway 30 was closed when the first printing and control device moved to position IV, as above described, but this gate opened at the point 1883 and closed at the point 1884 and it will therefore be seen that this gate opened shortly after movement of the pawls 221 and 223 was initiated and closed shortly before this operation was ended. In these respects the sixth cycle of operation corresponds to other even cycles of operation of the machine except the second and fourth, which are described hereinabove.

Eighth cycle

The seventh cycle is identical with the fifth cycle and for this reason no chart thereof is shown but in the eighth cycle of operation gates 433 and 487 (which are located in the guideway 30 above the left and right-hand drawers J, respectively) start opening at the point 1885, these gates attaining open position at the point 1886, and remaining open until the point 1888 is attained whereupon they start closing and they attain closed position at the point 1887.

Severing of web 901—W

It will be recalled that at the point 1876 in the fourth cycle of operation the web 330—W ceases advancing movement and if the number of impressions determined by the teeth on the ratchet 385 have been made so as to close the switch 390, Fig. 26, then the severing means of the pager and proofer, which is to say, the knife 354, are set in operation at point 1876 to sever the web, it being recalled that the knife 354 is not to be set in operation until the web 330—W has completed its movement.

Summary of operation

Thus, to summarize what has been stated hereinabove, in so far as operations of the mechanisms are concerned, the first cycle of operation is idle but in the second cycle of operation the variable data V are printed on the first check or sheet S, the date and signature having been printed on this sheet prior to the time it passed into printing position in the multiplying mechanism M. Likewise, in this second cycle of operation the severance of the second sheet from the web was initiated. Furthermore, the first printing and control device, which had been advanced to position II, was advanced to position III and the second printing and control device advanced to position II.

Then in the third cycle of operation the number N and the address A are printed on the first sheet S which passed into printing position below the platen P during the second cycle of operation. After these impressions have been made the first sheet advances to the gate 455 of the printing unit U by reason of elevation of the stop finger 26 and in this cycle of operation the gate 455 on the printing unit U opens and the first sheet has the form F printed thereon whereupon this completely printed sheet passes into the sheet collector K, Fig. 1.

Then in the fourth cycle of operation the variable data V are printed on the second sheet S after which this sheet passes to printing position below the platen P and engages the stop finger 26. Likewise, the first printing and control device is advanced from position III to position IV, the second printing and control device is advanced from position II to position III, and the third printing and control devices advance to position II. Also in this fourth cycle of operation and prior to the printing devices advancing as just described, the address A', the variable data V' and the number N' were printed on the web 330—W that is to be divided into pages affording proof sheets, and after this impression was made the web 330—W advanced to dispose the succeeding portion thereof in printing position beneath the impression face 244 of the platen P.

In the fifth cycle of operation the address A, number N and form F are printed on the second sheet.

In the sixth cycle of operation the variable data V are printed on the third sheet or check S. The address A', variable data V' and number N' are printed on the proof sheet to afford impressions pertaining to the second sheet. Furthermore, in this cycle of operation the fourth printing and control device attains position II, the third printing and control device attains position III, the second printing and control device attains position IV and the first printing and control device attains position V where it remains to be advanced to position VI in the eighth cycle of operation so that when the gate 487 opens in the tenth cycle of operation this printing and control device will fall into the right-hand drawer J.

It will be apparent from the foregoing that the various operative functions of the machine are timed to occur in such manner that the produc-

tion of business instruments in a rapid yet accurate manner is assured.

Summary

It is believed that it will be apparent from the foregoing description that the machine of the present invention represents a marked advance over previous machines, examples of which are shown in United States Letters Patents Nos. 2,041,183 and 2,183,061 and in my co-pending applications Serial Nos. 65,376 and 78,682, all of which have been referred to hereinabove.

In connection with the description of this machine it is to be noted that while the machine has been described as severing sheets from the web W and feeding these sheets through the machine, preprinted sheets could be used and in such an event it would not be necessary to rely upon printing means such as are included in the unit carried by the frame **10** nor would a printing unit such as the printing unit U be employed. Previously printed and cut sheets of this type would be stored on a rack to be withdrawn therefrom by suction means and fed to a roller as the roller **18** in the present machine. For a more detailed description of the manner in which this could be accomplished attention is directed to, for example, United States Letters Patent No. 2,002,773.

Furthermore, it is to be understood that the form printed on the sheets in this instance could be printed thereon in a printing mechanism such as that shown in United States Letters Patent No. 2,041,183 prior to the time the sheets are severed from the web although, as will be recognized, the printing means in the present instance which operate on the web prior to its division into sheets are of more simple construction than that shown in the last mentioned patent.

In event preprinted and pre-cut sheets were employed and it was desired to print data such as the date E and the signature B on the sheets, suitable means for this purpose could be associated with the platen P, just as the numbering device **37** is associated therewith, such an arrangement being common in the art and for that reason not being further described.

It will be manifest from the foregoing description that the severance of sheets from the web is under control of operation of the multiplying mechanism M so that each time this mechanism is operated a sheet is severed from the web and fed forward into position in this mechanism. It should be noted that if desired severance of the sheet from the web could be placed under control of a cam on the control cam shaft, such as the cam shaft **170**, Fig. 27. In fact all operative mechanisms in the machine could be placed under control of cams on this shaft and, if desired, the control of the platen P in the operation of producing a proof sheet could likewise be controlled from a cam on this cam shaft although, for reasons hereinabove set forth, such as is the case in a total taking operation wherein an accumulator is included in an auxiliary printing mechanism such as the auxiliary printing mechanism **36**, it is advantageous to control a proof sheet impression making operation of the platen from a means such as the auxiliary printing mechanism **36**.

It will be manifest also that the provision of controls in a separate control unit such as the control cam shaft **170** enables positive timed relation to be maintained between various operative mechanisms in the machine without resorting to geared interconnections between the various operative mechanisms. This is advantageous because it materially reduces the inertia that must be overcome when the machine is initially placed in operation and it avoids overloading of the driving motor which, of course, will be sufficiently powerful to insure that it will care for the maximum load that will be impressed thereon, which is to say, this motor is of sufficient power to insure proper driving of all mechanisms that may be simultaneously connected to a main drive shaft such as the main drive shaft **74**.

While I have illustrated and described a preferred form of my invention, it is to be understood that this is capable of variation and modification and I therefore do not wish to be limited to the precise details set forth, but desire to avail myself of such changes and alterations as fall within the purview of the following claims.

I claim:

1. A machine for producing business instruments or the like comprising a plurality of functioning units each including an operative mechanism and an independent drive shaft for each unit, each such mechanism being operable for at least one cycle of operation in the course of production of each business instrument or the like in the machine, a driving source, means for operating each drive shaft at a speed related to the time required for a cycle of operation of the associated mechanism and including a flexible connection to said driving source, an electromagnetically controlled clutch interposed between each drive shaft and the associated operative mechanism and engageable to cause such mechanism to be operated, and a control element for said machine and operable through a cycle of operation in the course of the production of each business instrument or the like in the machine, a plurality of switches controlled by said element, each of said switches being arranged to control the operation of one of said clutches, and said switches being related one to the other to effect operation of said clutches in a predetermined sequence in the course of the production of each business instrument or the like in the machine.

2. A machine for producing business instruments or the like comprising a plurality of functioning units each including an operative mechanism and an independent drive shaft for each unit, each such mechanism being operable for at least one cycle of operation in the course of production of each business instrument or the like in the machine, a driving source, means for operating each drive shaft at such a speed that one revolution thereof takes place within the time required for a cycle of operation of the associated mechanism and including a flexible connection to said driving source, an electromagnetically controlled one-revolution clutch interposed between each drive shaft and the associated operative mechanism and engageable to cause such mechanism to be operated, and a control element for said machine and operable through a cycle of operation in the course of the production of each business instrument or the like in the machine, a plurality of switches controlled by said element, each of said switches being arranged to control the operation of one of said one-revolution clutches, and said switches being related to one to the other to effect closure of said clutches in a predetermined sequence in predetermined time relation to each other in the course of the

production of each business instrument or the like in the machine.

3. A machine for producing business instruments or the like comprising a plurality of functioning units each including an operative mechanism and an independent drive shaft included in each unit for driving the operative mechanism thereof, each such mechanism being operable for at least one cycle of operation in the course of production of each business instrument or the like in the machine, a driving source, means for operating each drive shaft at a speed related to the time required for a cycle of operation of the associated mechanism and including a flexible connection to said driving source, a normally disengaged electromagnetically controlled clutch in each unit interposed between the drive shaft thereof and the associated operative mechanism and engageable to cause such mechanism to be operated, and a control element for said machine and operable through a cycle of operation in the course of the production of each business instrument or the like in the machine, a plurality of switches controlled by said element, each of said switches being arranged to control the operation of one of said clutches, and said switches being related to one to the other to effect operation of said clutches in a predetermined timed sequence in the course of the production of each business instrument or the like in the machine.

4. In a machine for producing business instruments or the like comprising a printing or like device advancing unit including a magazine into which printing or like devices may be introduced to be sequentially withdrawn therefrom, a guideway for the devices, means for advancing the devices from the magazine through the guideway and into and from a predetermined position in the machine whereat printing or like operations may be effected on the devices, and a drive shaft for operating the advancing means; a platen unit for effecting operations on the devices when such devices are disposed at said predetermined position and including an operative member, means for actuating such member, and a drive shaft for operating the actuating means; each of said units being operable for at least one cycle of operation in the course of production of each business instrument or the like in the machine; a driving source; means for operating each of said drive shafts at a speed related to the time required for a cycle of operation of the unit in which the drive shaft is included and embodying a flexible connection to said driving source; an electromagnetically controlled clutch interposed between each drive shaft and the means operated thereby and engageable to cause such means to be operated; a control element for said machine operable through a cycle of operation in the course of the production of each business instrument or the like in the machine; and a plurality of switches controlled by said element; each of said switches being arranged to control the operation of one of said clutches; said switches being related one to the other to effect operation of said clutches in a predetermined sequence in the course of production of each business instrument or the like in the machine.

5. In a machine for producing business instruments or the like comprising a printing or like device advancing unit including a magazine into which printing or like devices may be introduced to be sequentially withdrawn therefrom, a guideway for the devices, means for advancing the devices from the magazine through the guideway and into and from a predetermined position in the machine whereat printing or like operations may be effected on the devices, and a drive shaft for operating the advancing means; a platen unit for effecting operations on the devices when such devices are disposed at said predetermined position and including an operative member, means for actuating such member, and a drive shaft for operating the actuating means; a unit for supplying business instruments to said machine and including an actuating means and a drive shaft for operating such means; each of said units being operable for at least one cycle of operation in the course of production of each business instrument or the like in the machine; a driving source; means for operating each of said drive shafts at a speed related to the time required for a cycle of operation of the unit in which the drive shaft is included and embodying a flexible connection to said driving source; an electromagnetically controlled clutch interposed between each drive shaft and the means operated thereby and engageable to cause such means to be operated; a control element for said machine operable through a cycle of operation in the course of the production of each business instrument or the like in the machine; and a plurality of switches controlled by said element; each of said switches being arranged to control the operation of one of said clutches; said switches being related one to the other to effect operation of said clutches in a predetermined sequence in the course of the production of each business instrument or the like in the machine.

6. In a machine for producing business instruments or the like comprising a printing and control or like device advancing unit including a magazine into which printing and control or like devices may be introduced to be sequentially withdrawn therefrom, a guideway for the devices, means for advancing the devices from the magazine through the guideway and into and from a predetermined position in the machine whereat printing or like operations may be effected on the devices, and a drive shaft for operating the advancing means; a platen unit for effecting operations on the devices when such devices are disposed at said predetermined position and including an operative member, means for actuating such member, and a drive shaft for operating the actuating means; a calculating unit operable under control of said devices and including means for printing data on said instruments, an actuating means, and a drive shaft for operating such means; each of said units being operable for at least one cycle of operation in the course of production of each business instrument or the like in the machine; a driving source; means for operating each of said drive shafts at a speed related to the time required for a cycle of operation of the unit in which the drive shaft is included and embodying a flexible connection to said driving source; an electromagnetically controlled clutch interposed between each drive shaft and the means operated thereby and engageable to cause such means to be operated; a control element for said machine operable through a cycle of operation in the course of the production of each business instrument or the like in the machine; and a plurality of switches controlled by said element; each of said switches being arranged to control the operation of one of said clutches; said switches being related one to the other to effect operation of said clutches in a predetermined sequence in the course of pro-

duction of each business instrument or the like in the machine.

7. In a machine for producing business instruments or the like comprising a printing and control or like device advancing unit including a magazine into which printing and control or like devices may be introduced to be sequentially withdrawn therefrom, a guideway for the devices, means for advancing the devices from the magazine through the guideway and into and from a predetermined position in the machine whereat printing or like operations may be effected on the devices, and a drive shaft for operating the advancing means; a platen unit for effecting operations on the devices when said devices are disposed at said predetermined position and including an operative member, means for actuating such member, and a drive shaft for operating the actuating means; a calculating unit operable under control of said devices and including means for printing data on said instruments, an actuating means, and a drive shaft for operating such means; a unit for supplying business instruments to said machine and including an actuating means and a drive shaft for operating such means; each of said units being operable for at least one cycle of operation in the course of production of each business instrument or the like in the machine; a driving source; means for operating each of said drive shafts at a speed related to the time required for a cycle of operation of the unit in which the drive shaft is included and embodying a flexible connection to said driving source; an electromagnetically controlled clutch interposed between each drive shaft and the means operated thereby and engageable to cause such means to be operated; a control element for said machine operable through a cycle of operation in the course of the production of each business instrument or the like in the machine; and a plurality of switches controlled by said element; each of said switches being arranged to control the operation of one of said clutches; said switches being related one to the other to effect operation of said clutches in a predetermined sequence in the course of production of each business instrument or the like in the machine.

8. In a machine for producing business instruments or the like comprising a printing or like device advancing unit including a magazine into which printing or like devices may be introduced to be sequentially withdrawn therefrom, a guideway for the devices, means for advancing the devices from the magazine through the guideway and into and from a predetermined position in the machine whereat printing or like operations may be effected on the devices, and a drive shaft for operating the advancing means; a platen unit for effecting operations on the devices when such devices are disposed at said predetermined position and including an operative member, means for actuating such member, and a drive shaft for operating the actuating means; each of said units being operable for at least one cycle of operation in the course of production of each business instrument or the like in the machine; a driving source; means for operating each of said drive shafts at a speed related to the time required for a cycle of operation of the unit in which the drive shaft is included and embodying a flexible connection to said driving source; an electromagnetically controlled clutch interposed between each drive shaft and the means operated thereby and engageable to cause such means to be operated; a printing mechanism operated from said driving source and operable through a cycle of operation in the course of production of each business instrument or the like in the machine; a control element operated in sequence with said printing mechanism; and a plurality of switches controlled by said element; each of said switches being arranged to control the operation of one of said clutches; said switches being related one to the other to effect operation of said clutches in a predetermined sequence in the course of production of each business instrument or the like in the machine.

9. In a machine for producing business instruments or the like comprising a printing or like device advancing unit including a magazine into which printing or like devices may be introduced to be sequentially withdrawn therefrom, a guideway for the devices, means for advancing the devices from the magazine through the guideway and into and from a predetermined position in the machine whereat printing or like operations may be effected on the devices, and a drive shaft for operating the advancing means; a platen unit for effecting operations on the devices when such devices are disposed at said predetermined position and including an operative member, means for actuating such member, and a drive shaft for operating the actuating means; a unit for supplying business instruments to said machine and including an actuating means and a drive shaft for operating such means; each of said units being operable for at least one cycle of operation in the course of production of each business instrument or the like in the machine; a driving source; means for operating each of said drive shafts at a speed related to the time required for a cycle of operation of the unit in which the drive shaft is included and embodying a flexible connection to said driving source; a printing mechanism operated from said driving source and operable through a cycle of operation in the course of production of each business instrument or the like in the machine; feeding means for feeding business instruments from the instrument supply unit through said predetermined position and to said printing mechanism; a control element operated in sequence with said printing mechanism; a plurality of switches controlled by said element; each of said switches being arranged to control the operation of one of said clutches; said switches being related one to the other to effect operation of said clutches in a predetermined sequence in the course of production of each business instrument or the like in the machine; and stop means operated in timed relation with said control element for interrupting feeding of said business instruments by said feeding means when the operative member of said platen unit is effecting an operation on a device disposed at said predetermined position.

10. In a machine for producing business instruments or the like comprising a printing and control or like device advancing unit including a magazine into which printing and control or like devices may be introduced to be sequentially withdrawn therefrom, a guideway for the devices, means for advancing the devices from the magazine through the guideway and into and from a predetermined position in the machine whereat printing or like operations may be effected on the devices, and a drive shaft for operating the advancing means; a platen unit for effecting operations on the devices when such devices are disposed at said predetermined position and includ-

ing an operative member, means for actuating such member, and a drive shaft for operating the actuating means; a calculating unit operable under control of said devices and including means for printing data on said instruments, an actuating means, and a drive shaft for operating such means; a unit for supplying business instruments to said machine and including an actuating means and a drive shaft for operating such means; each of said units being operable for at least one cycle of operation in the course of production of each business instrument or the like in the machine; a driving source; means for operating each of said drive shafts at a speed related to the time required for a cycle of operation of the unit in which the drive shaft is included and embodying a flexible connection to said driving source; a printing mechanism operated from said driving source and operable through a cycle of operation in the course of production of each business instrument or the like in the machine; feeding means for feeding business instruments from the instrument supply unit through the printing means in said calculating unit and said predetermined position and to said printing mechanism; a control element operated in sequence with said printing mechanism; a plurality of switches controlled by said element; each of said switches being arranged to control the operation of one of said clutches; said switches being related one to the other to effect operation of said clutches in a predetermined sequence in the course of production of each business instrument or the like in the machine; and stop means operated in timed relation with said control element for interrupting feeding of said business instruments by said feeding means when the printing unit in said calculating unit is functioning and when the operative member of said platen unit is effecting an operation on a device disposed at said predetermined position.

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