

Oct. 10, 1933.

J. R. PEIRCE

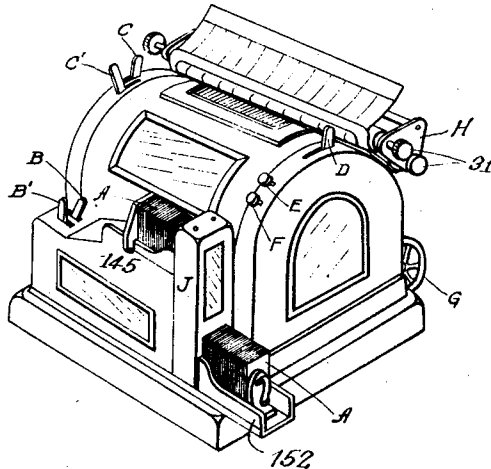
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30 Sheets-Sheet 1

Fig. 1.



John Royden Peirce INVENTOR
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Fig. 2.

A

1755807	40225	16140	3002	250
POLICY NO.	KIND STATE YEAR DIST.	AGE M S	DISABILITY	
3500	125.55	40.25	40.25	3
AMOUNT OF INSURANCE	PREMIUM	DEFERRED PREM	PAYABLE PREM.	P

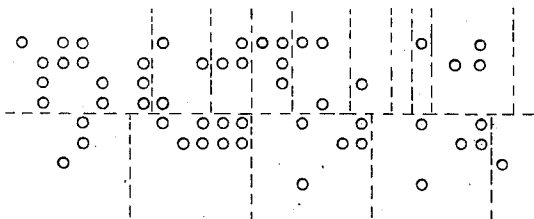


Fig. 3.

0	1	2	3	4	5	6	7	8	9

John Royden Pearce (INVENTOR.)
BY *Anthony Maria* ATTORNEY

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Fig. 4. (Listing Sheet)

POLICY NO.	NO. OF POLICIES	DISABILITY	AMT. OF INSURANCE	PREMIUM	DEFERRED PREM.	PAYABLE PREM.
1755807	1	2.50	3500	125.55	40.25	40.25 Q
1755425	1	1.30	1500	60.15		60.15 A
1755100	1	4.20	1200	50.25	25.16	25.16 S
4021630	3	8.00	6200	235.95	65.41	
1755007	1	1.50	5000	235.00	25.00	25.00 S

Fig. 4a (Summary Sheet)

KIND	YEAR	AGE	NO. OF POL.	DISABILITY	AMT. OF INS.	PREMIUM	DEFERRED PREM.	ANNUAL PREM.	SEMI. ANNU. PREM.	QUARTERLY PREM.
402	16	30	3	8.00	6200	235.95	65.41	60.15	25.16	40.25

Total Line

John Royden Peirce
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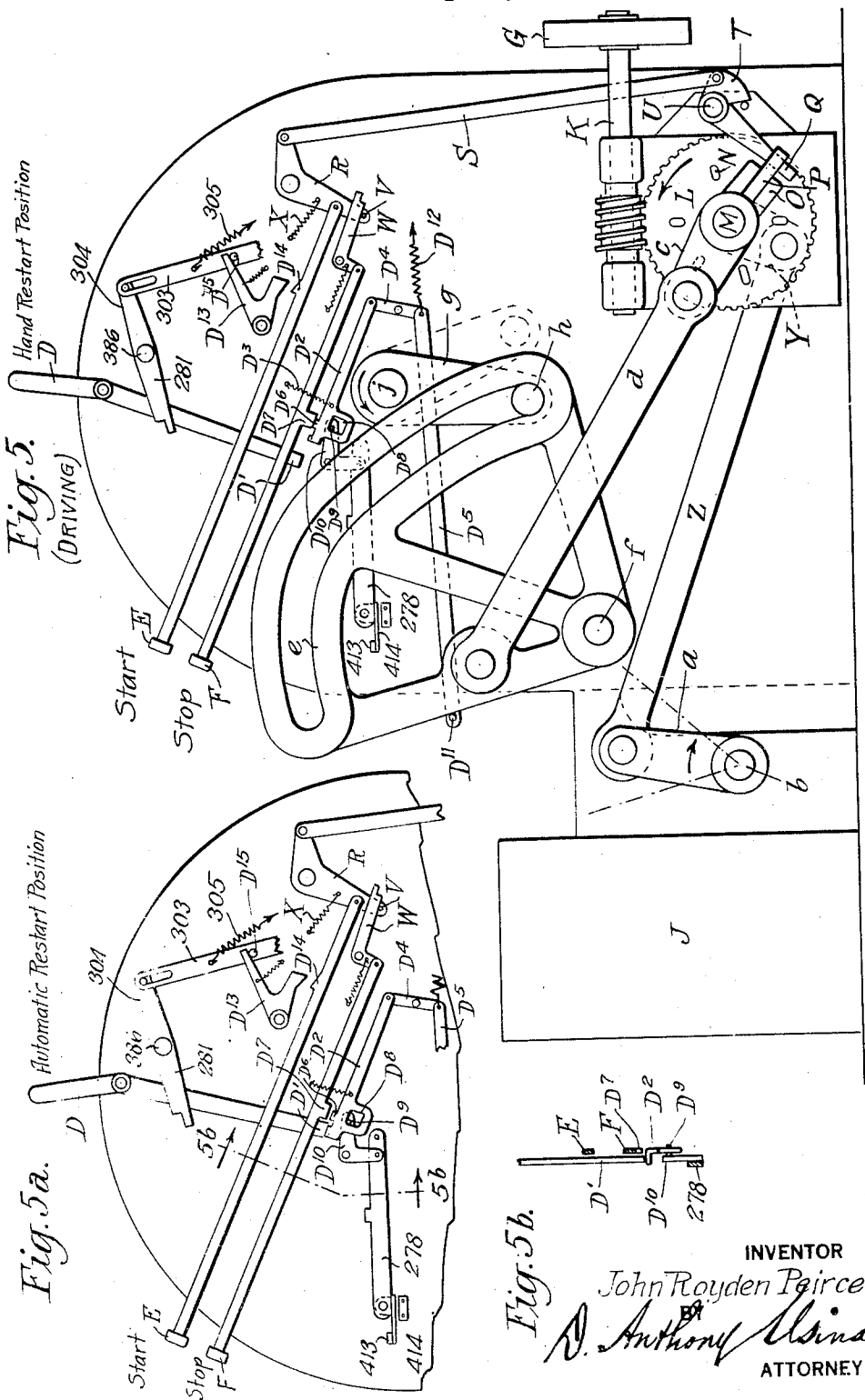
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INVENTOR

John Royden Peirce

Anthony Alsina

ATTORNEY

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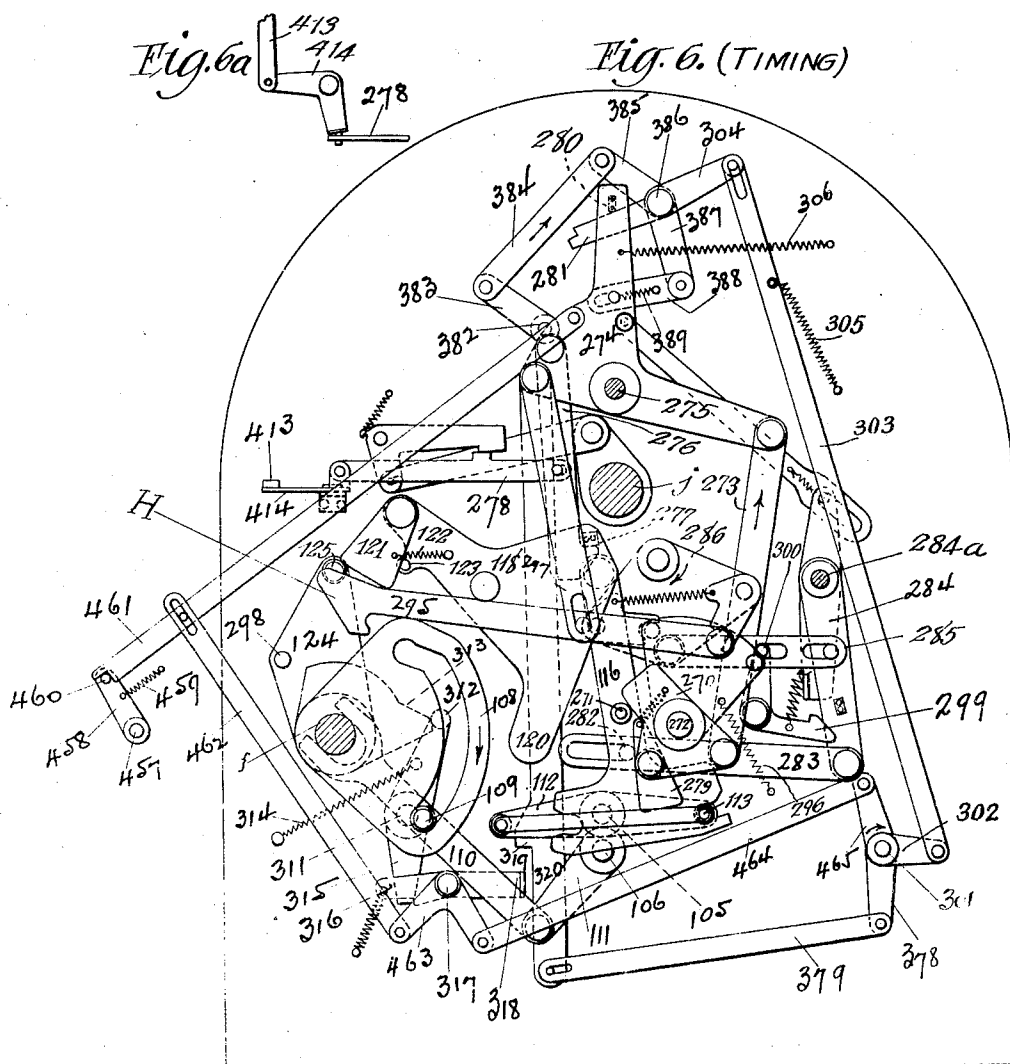
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John Royden Peirce INVENTOR.
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Fig. 7. (TIMING OF TOTALS)

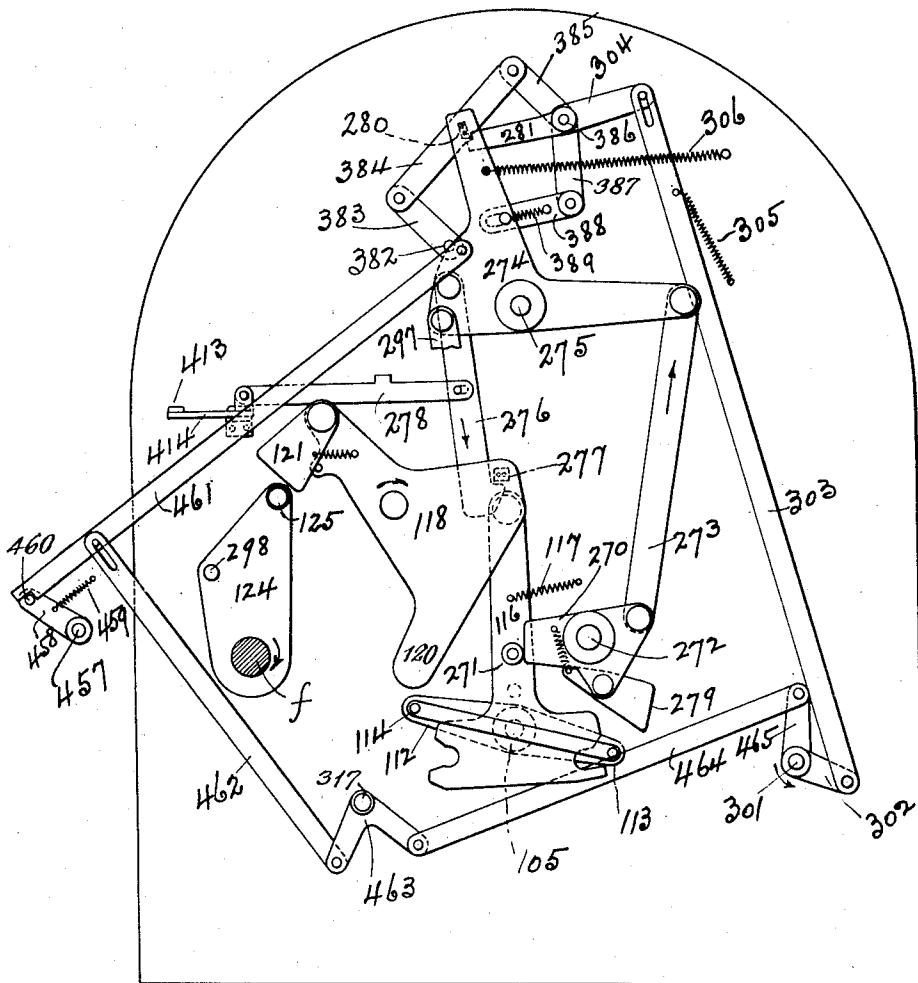
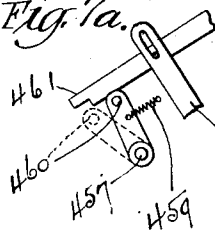


Fig. 7a.



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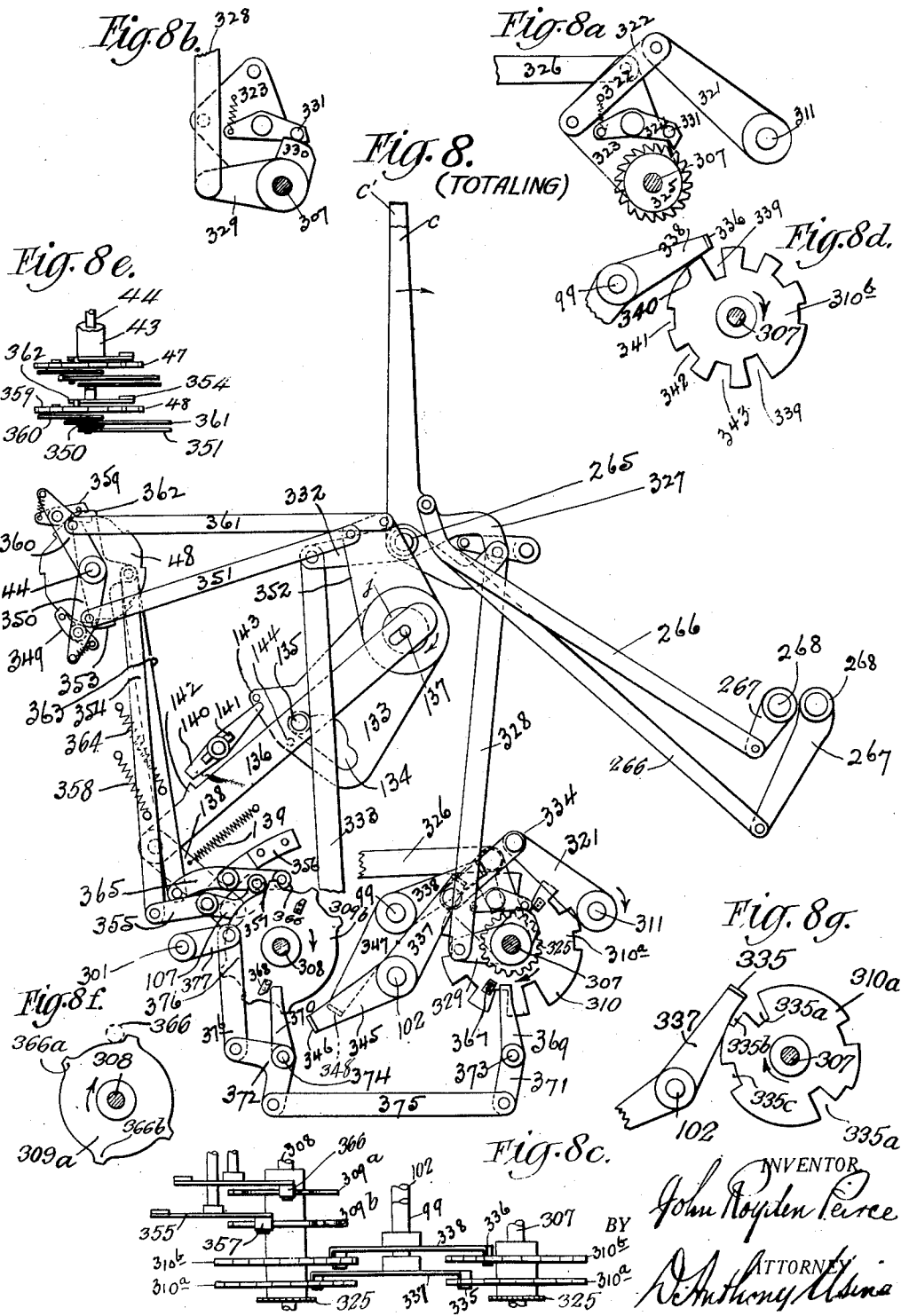
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Fig. 13.

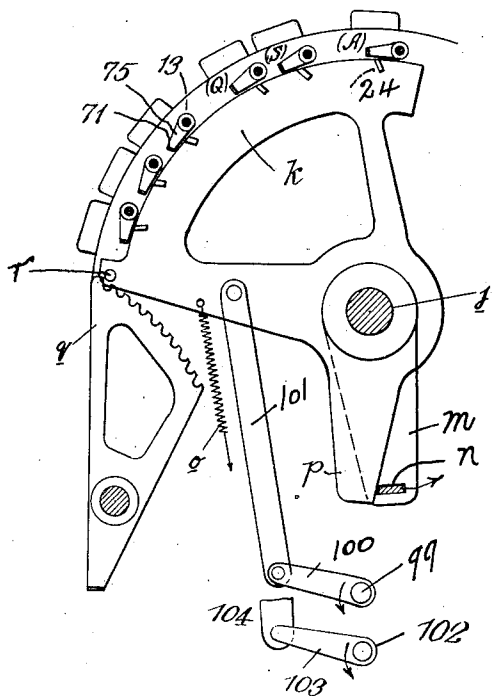
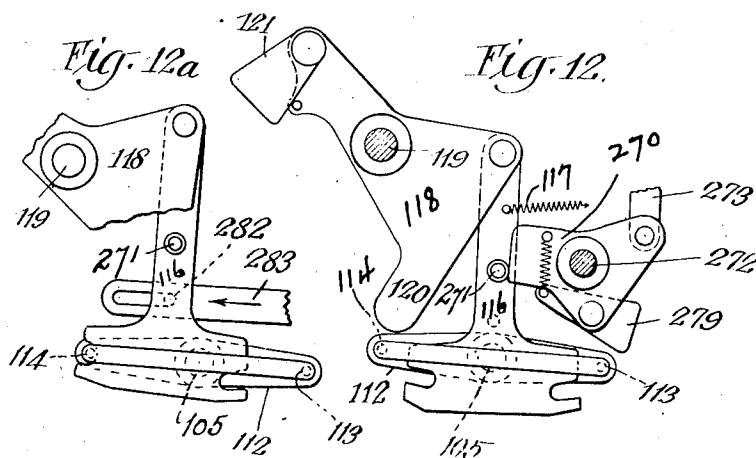


Fig. 12a

Fig. 12.



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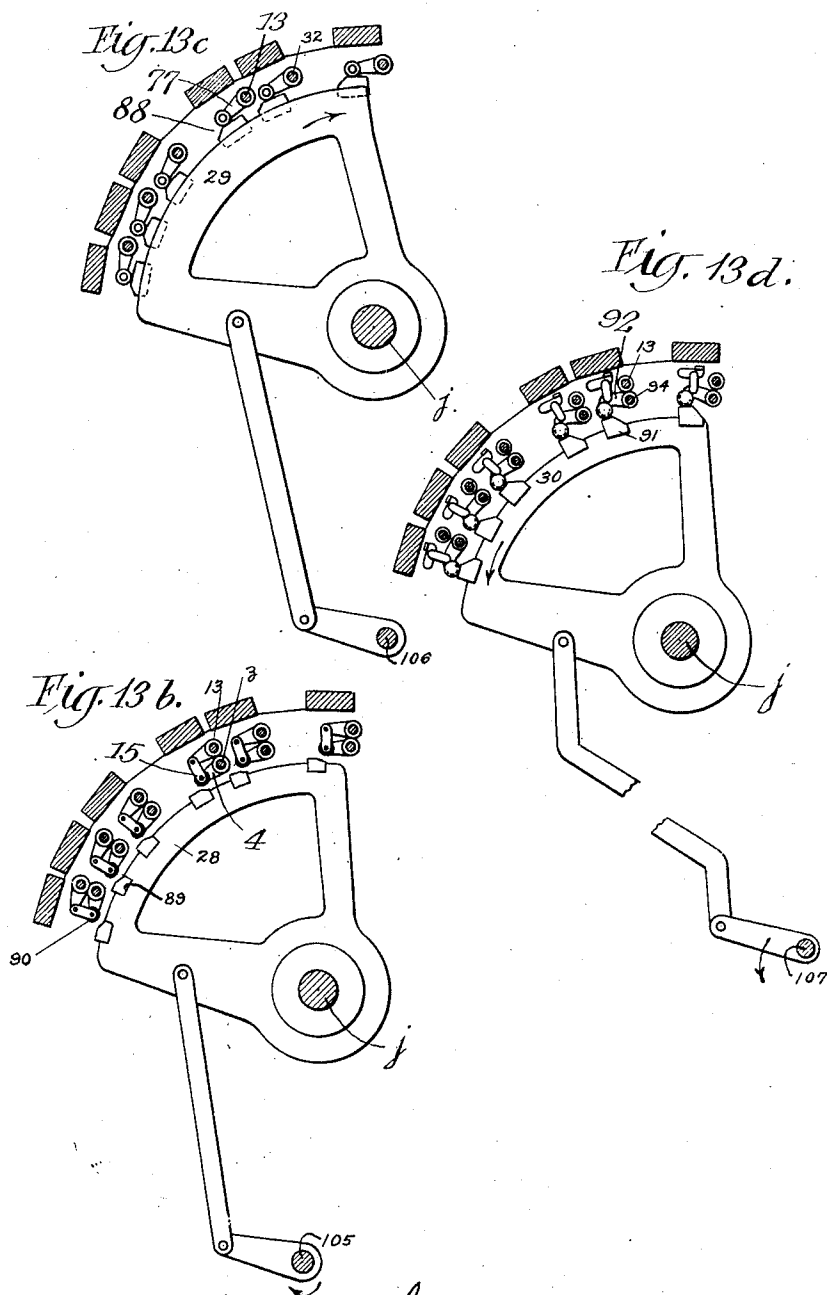
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Fig. 14a

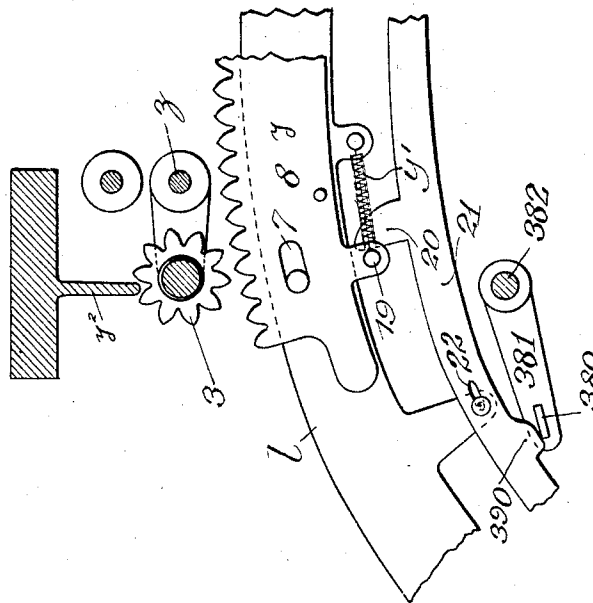
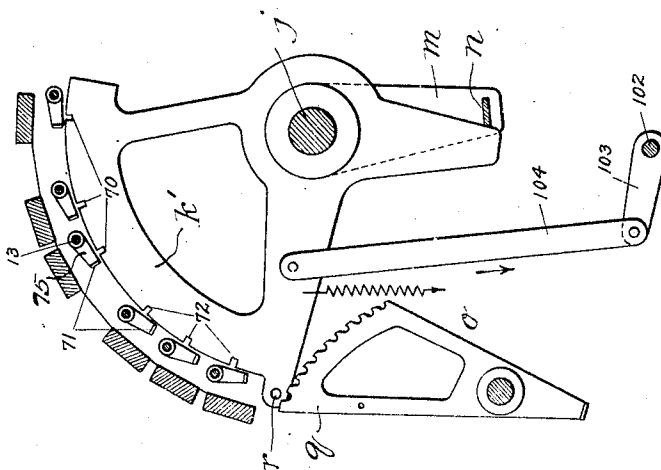


Fig. 13a.



John Royden Peirce INVENTOR.
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V. Anthony Maria, ATTORNEY

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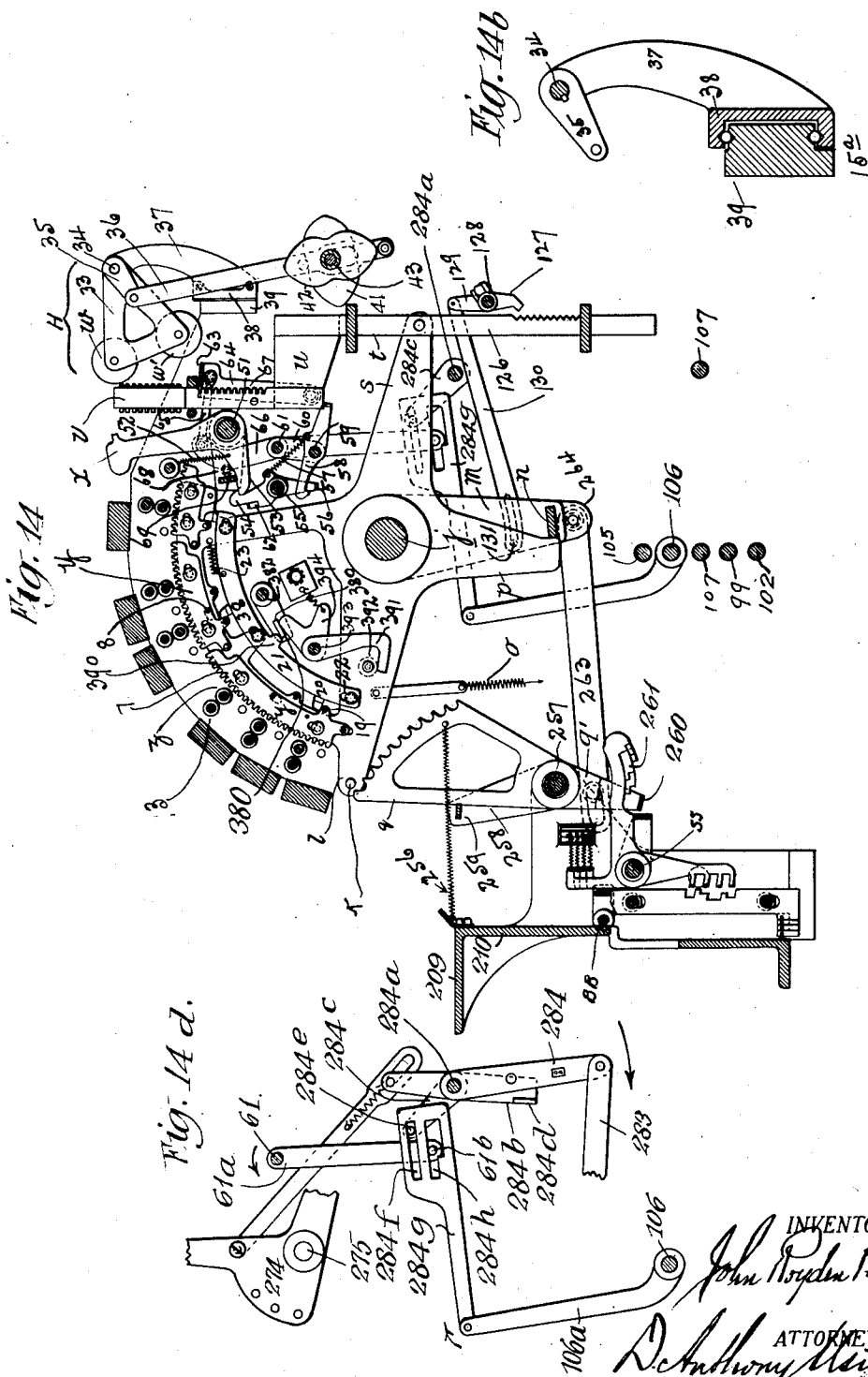
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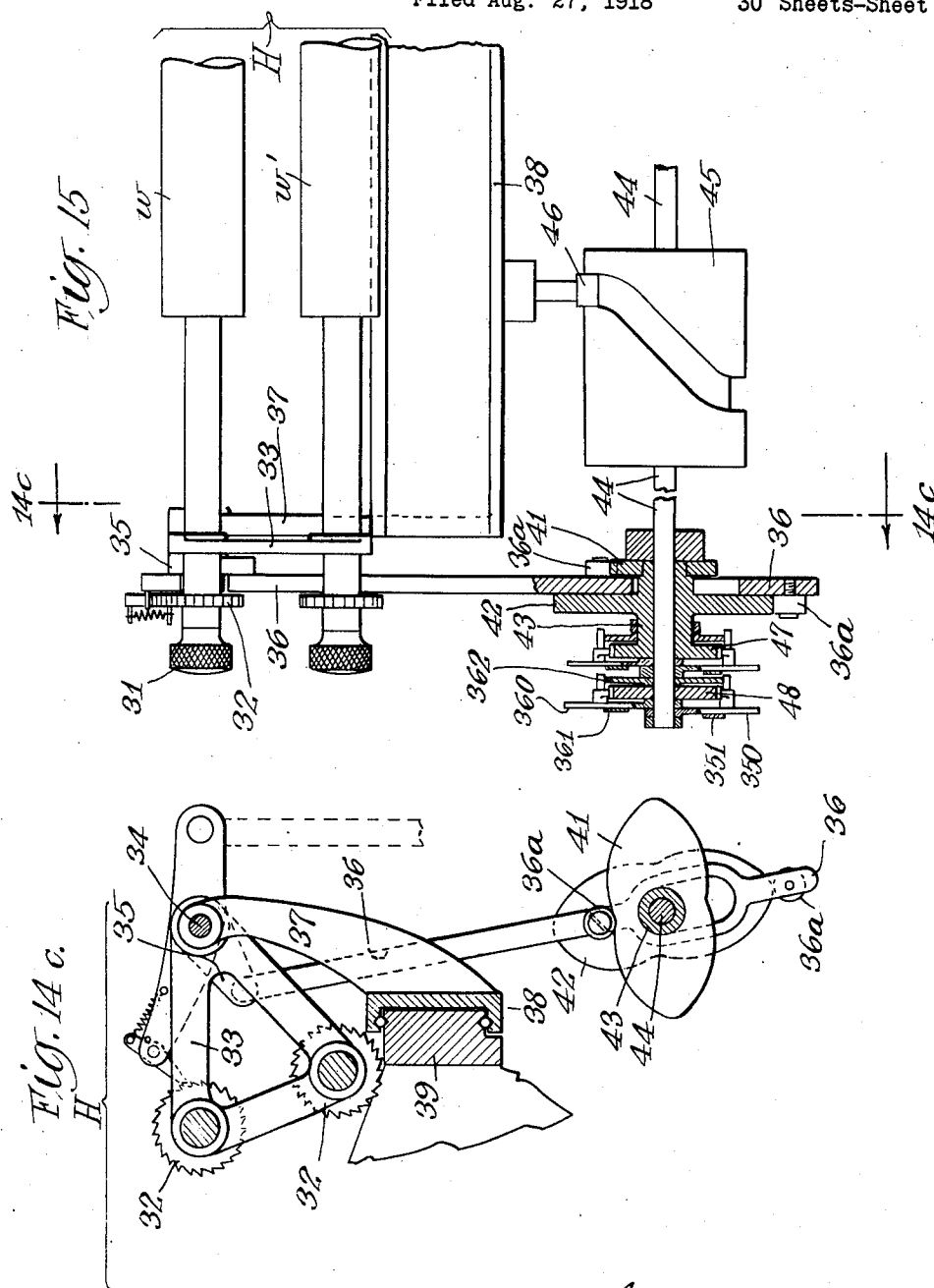
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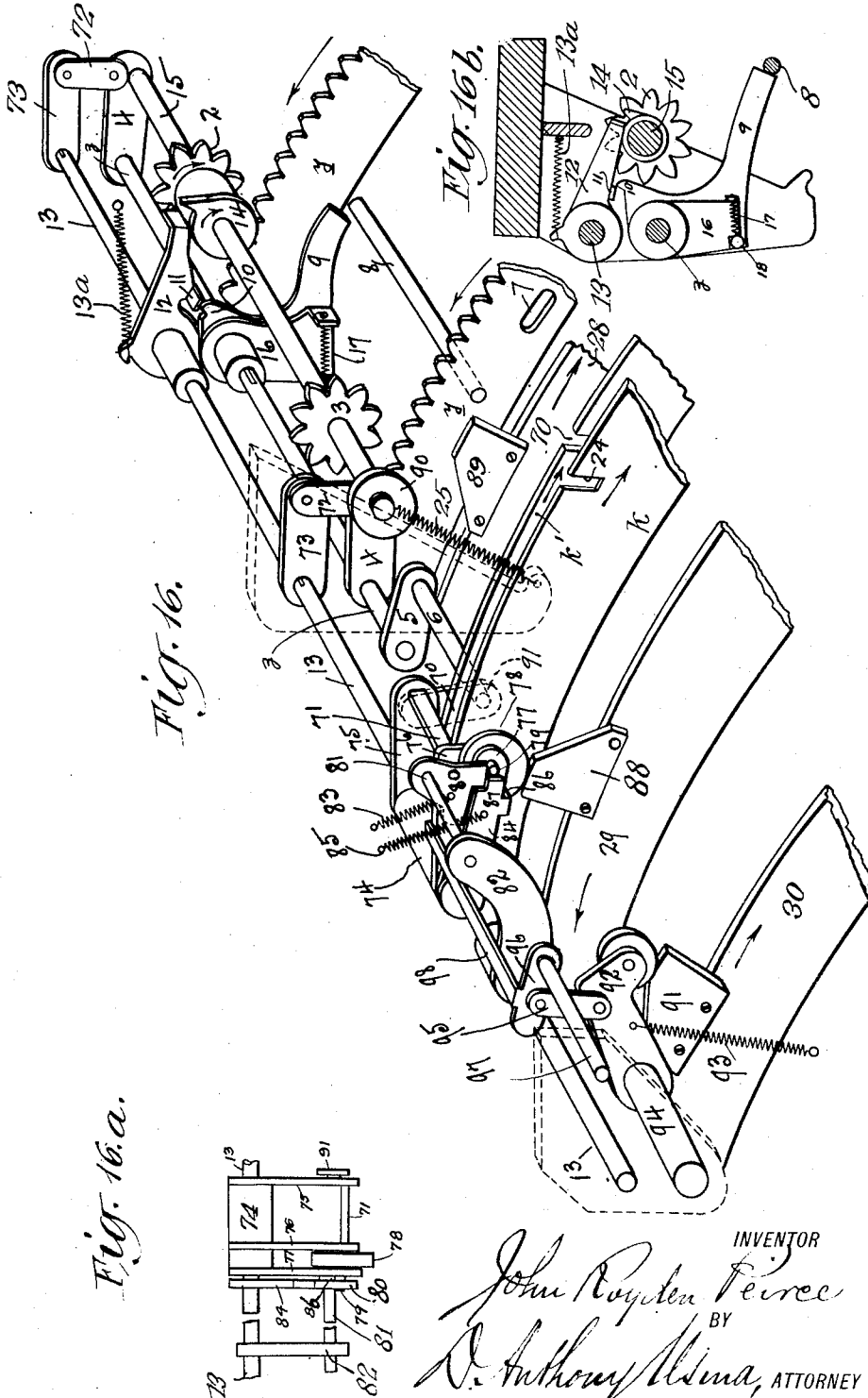
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INVENTOR
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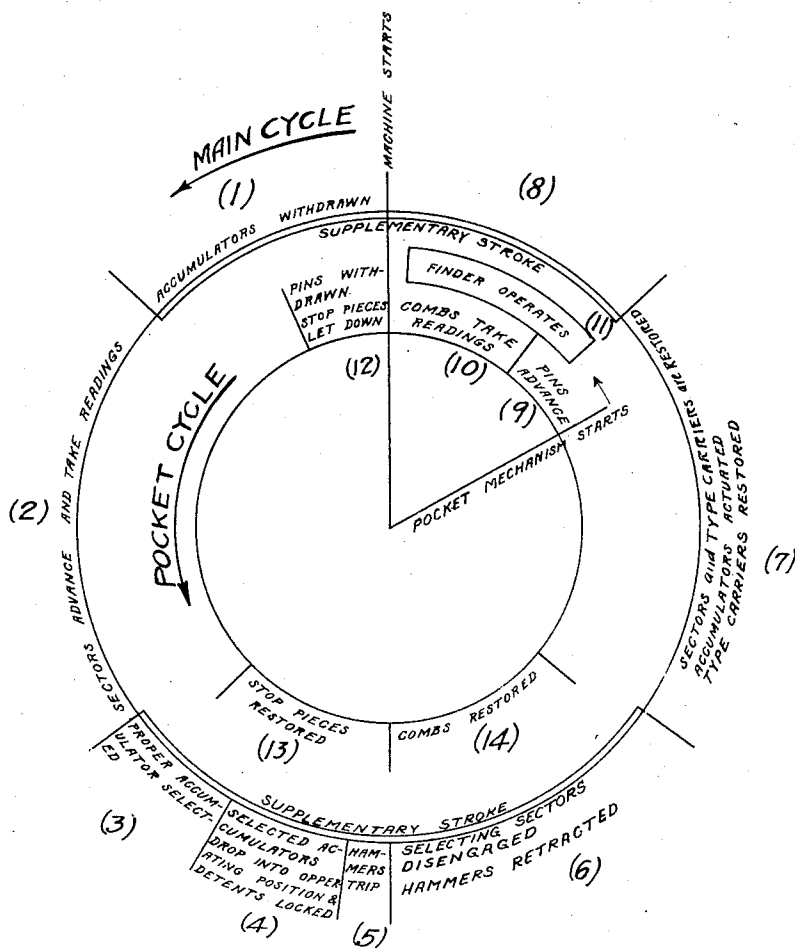
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Fig. 18. (Listing Operation)



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Fig. 21.

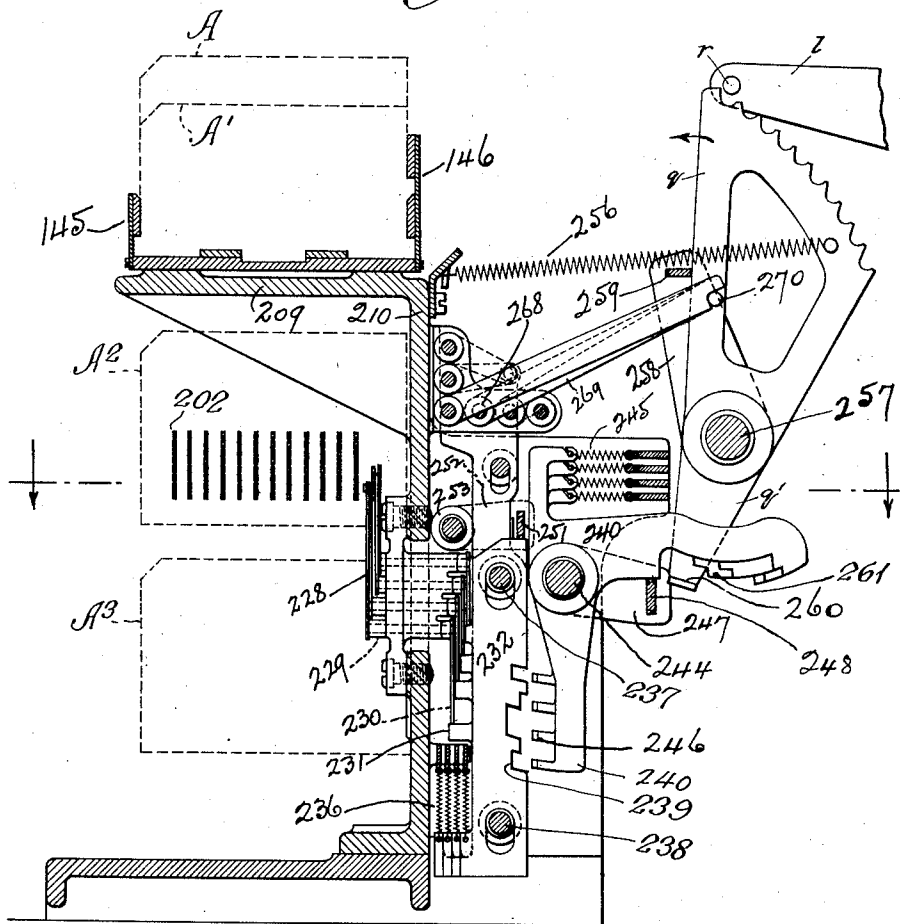


Fig. 21a.

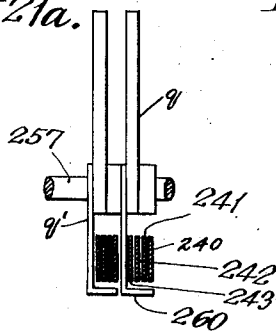
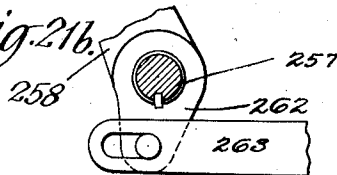


Fig. 21b.



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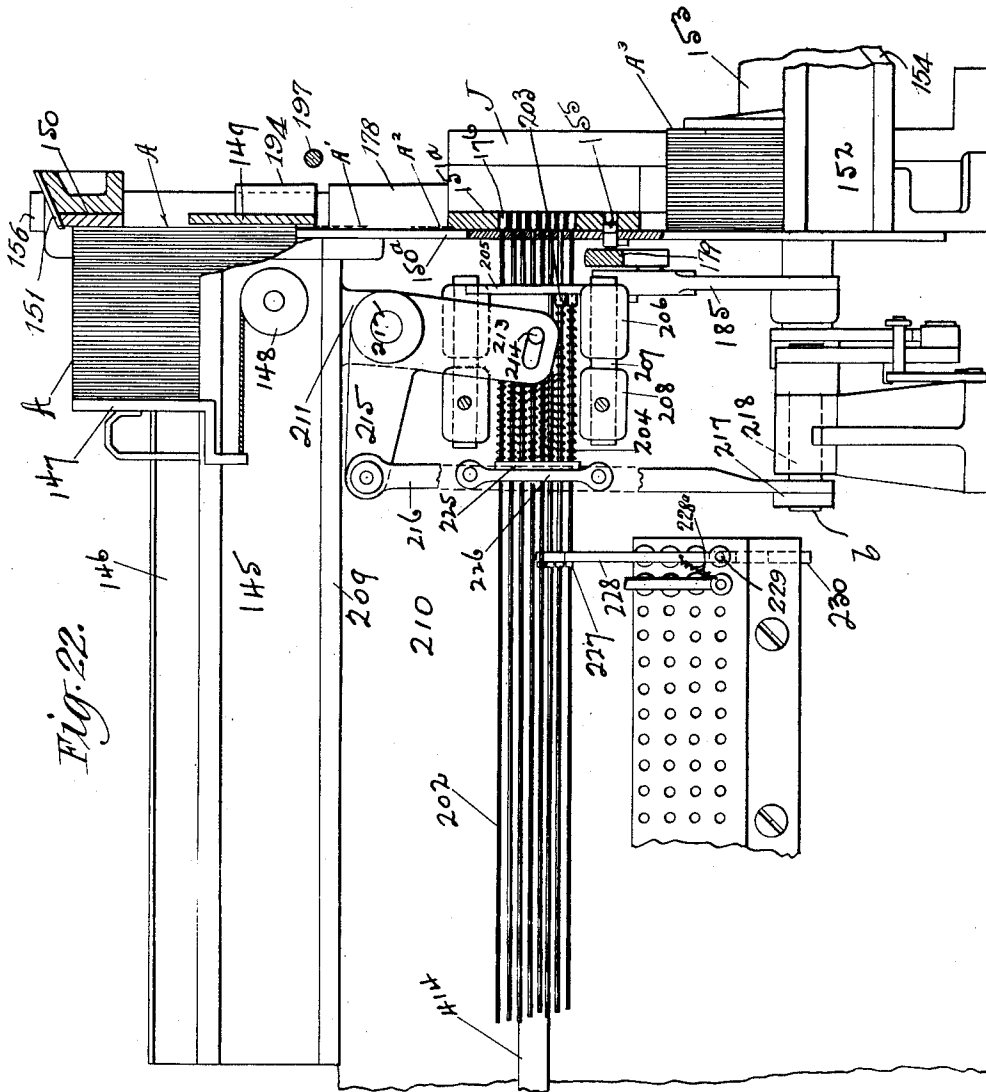


Fig. 22.

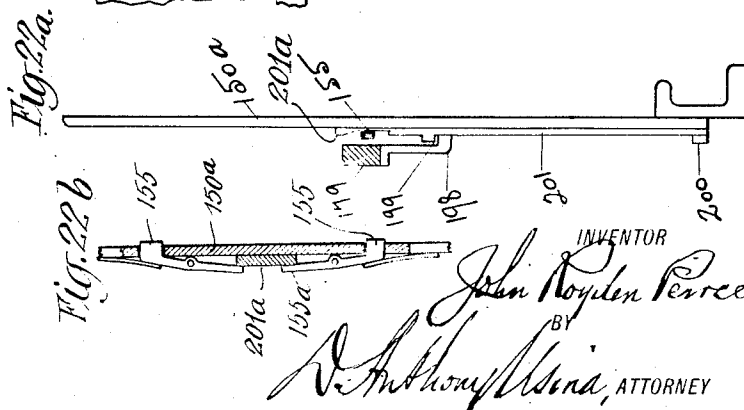


Fig. 22a.

Fig. 22b.

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D. Anthony Medina, ATTORNEY

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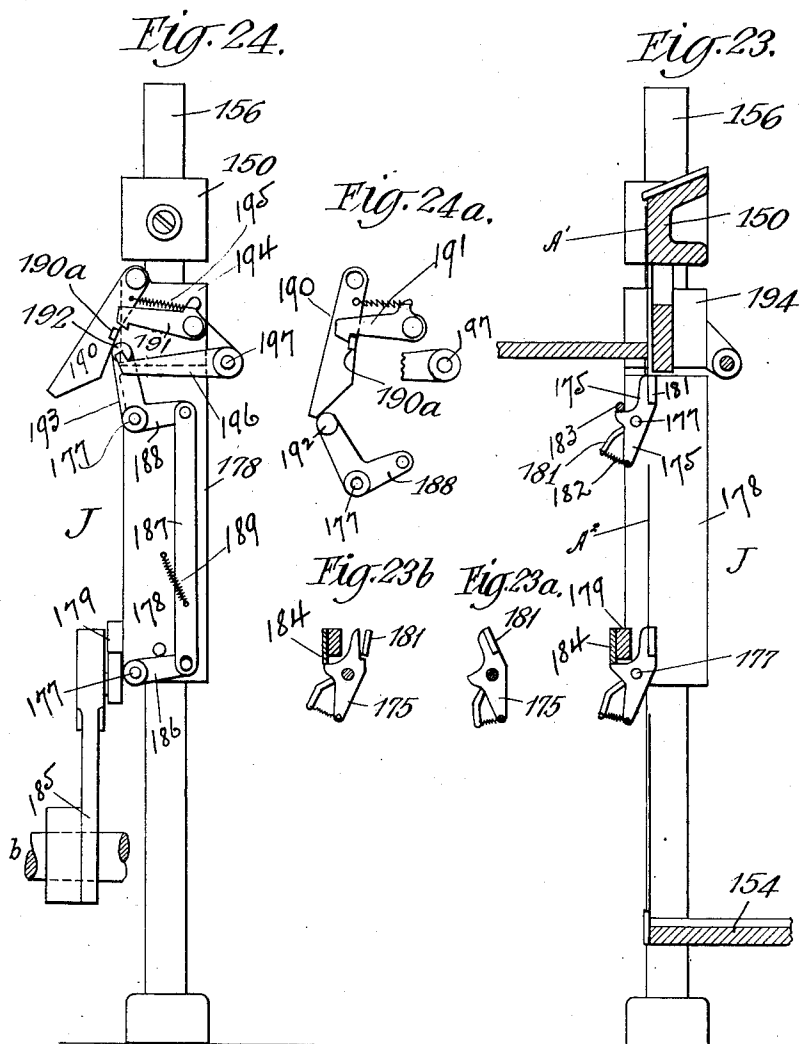
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Fig. 26a.

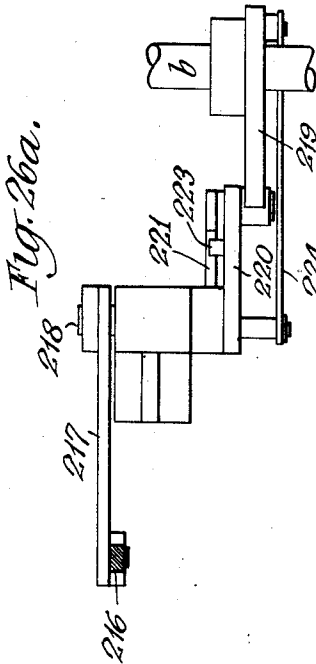


Fig. 26.

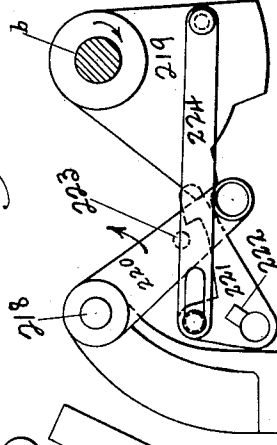
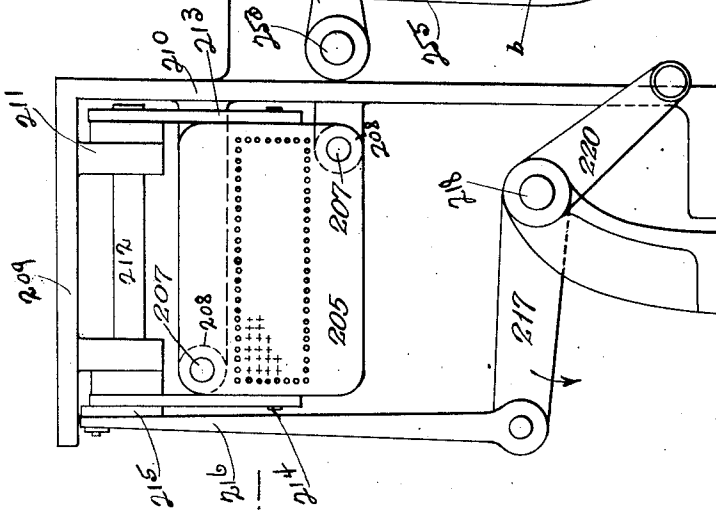


Fig. 25.



John Royden Peirce INVENTOR.
BY Anthony Hanna ATTORNEY

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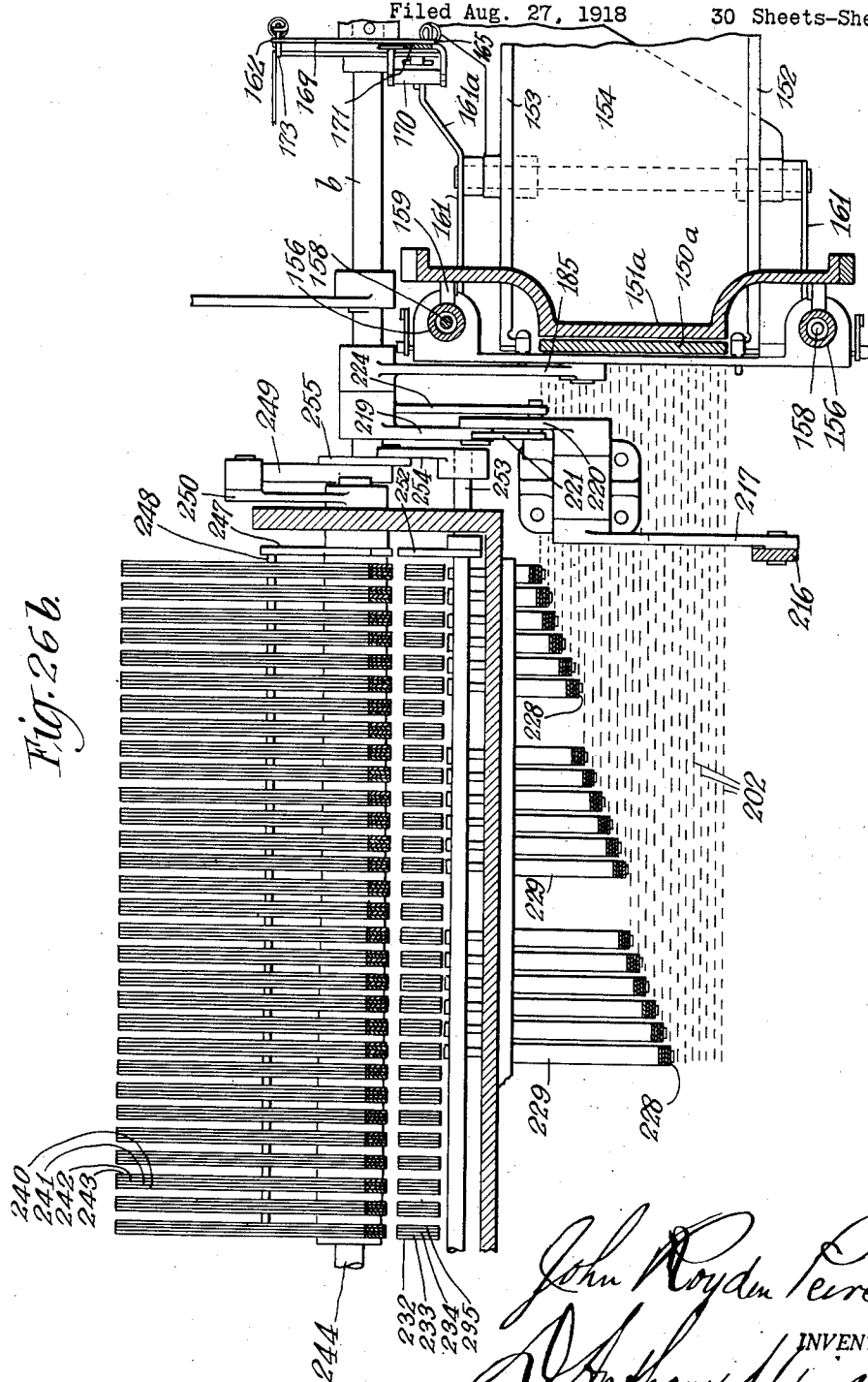
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Fig. 26b



John Royden Peirce,
INVENTOR.
BY Anthony Reina
ATTORNEY

ATTORNEY

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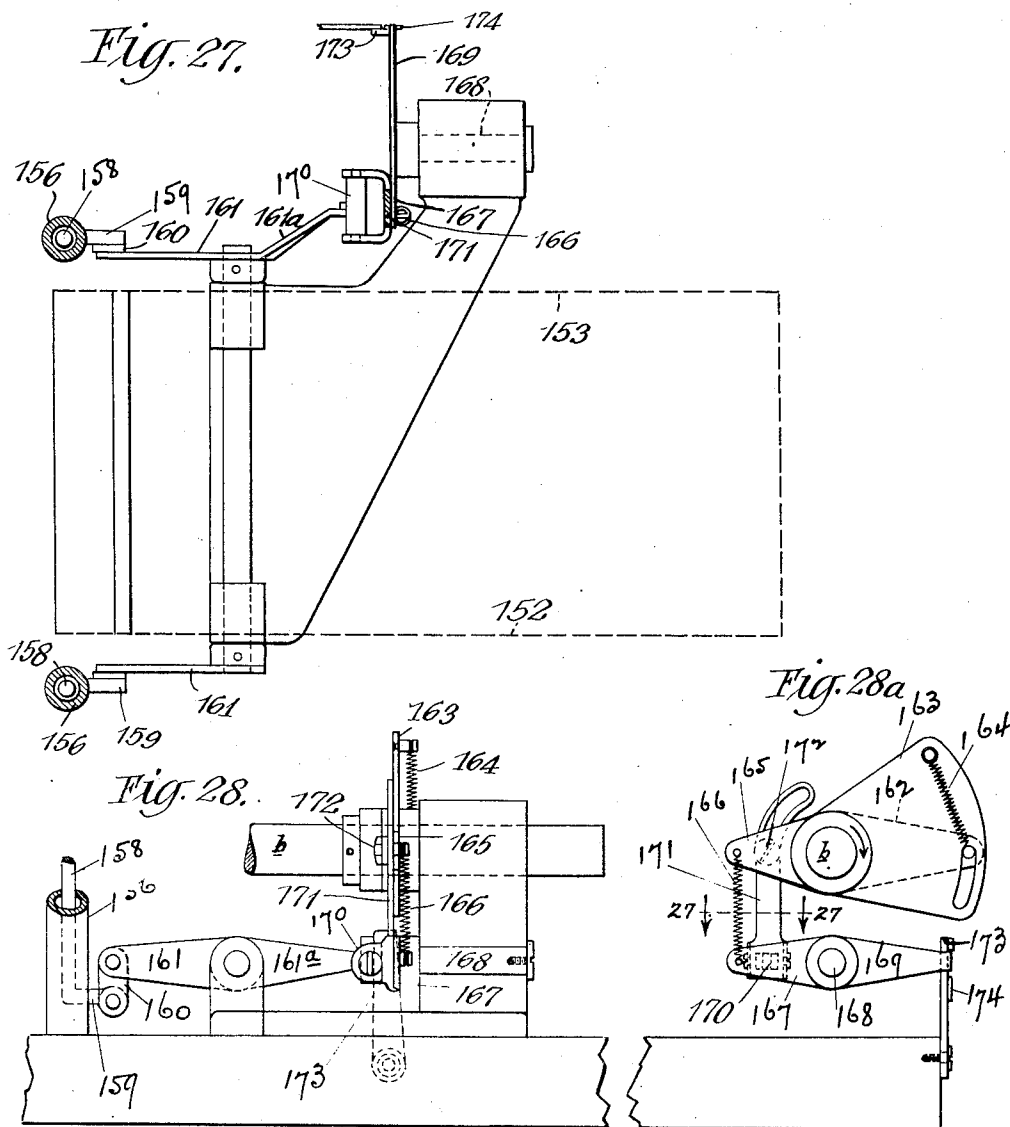
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John Royden Peirce, INVENTOR.

BY
Attorney

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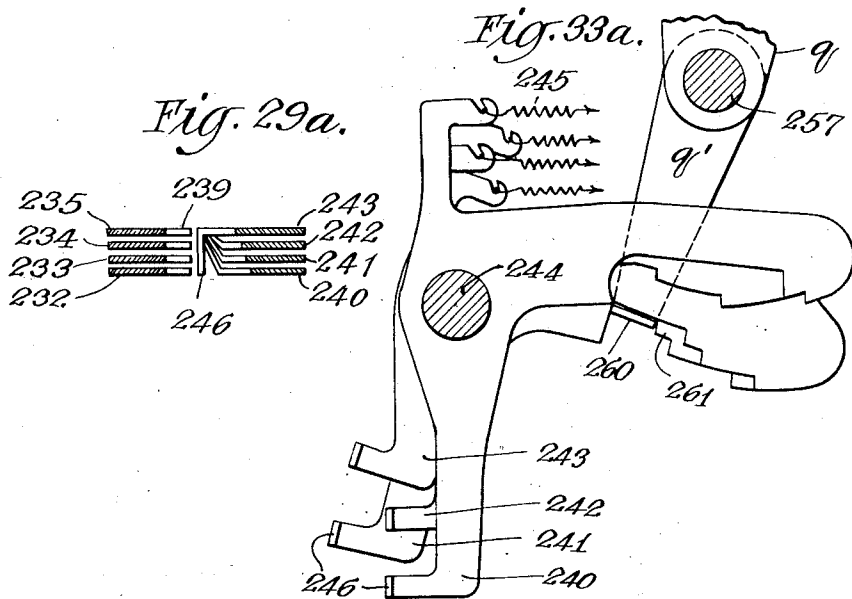
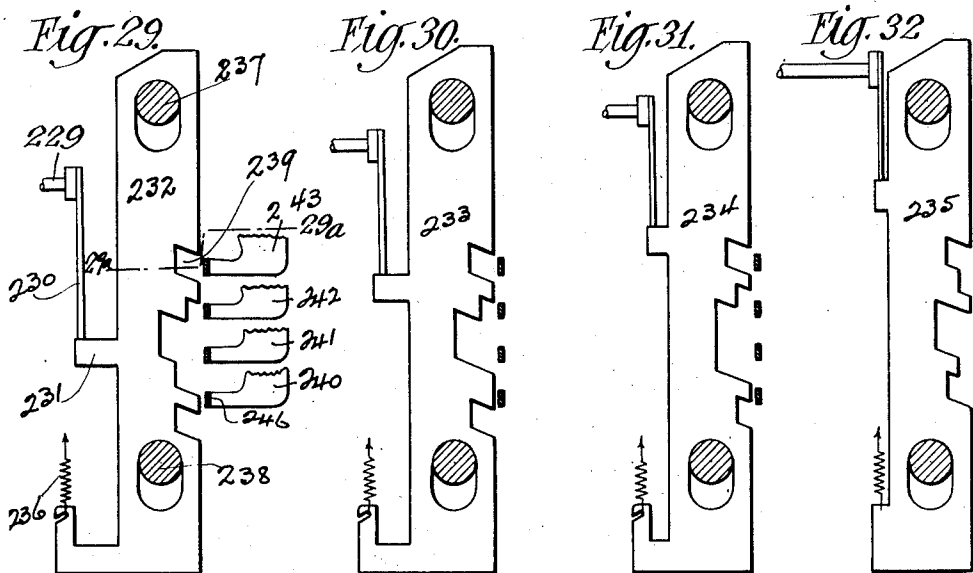
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John Royden Peirce, INVENTOR
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Anthony M. Ma, ATTORNEY

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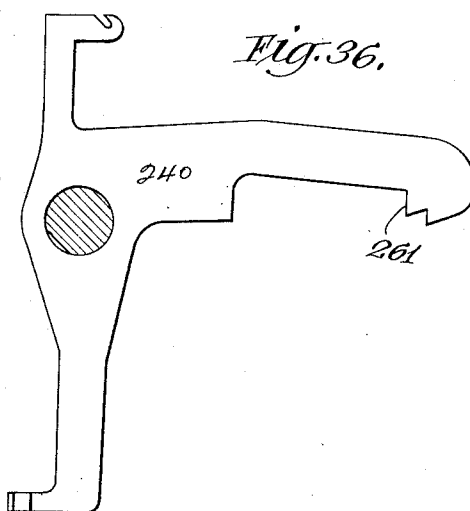
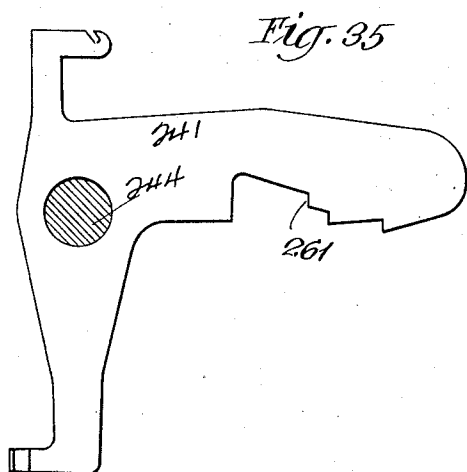
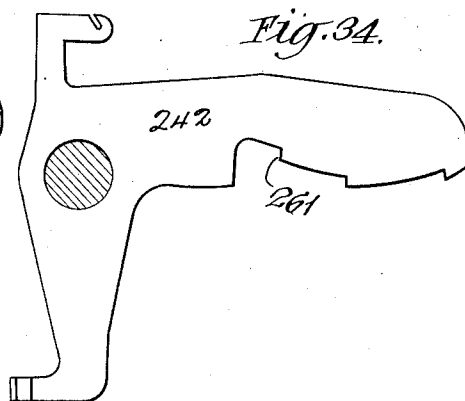
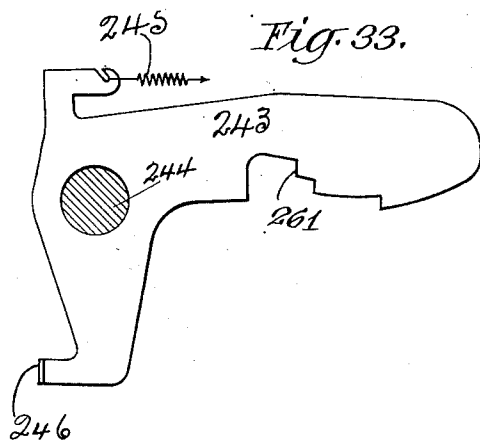
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John Royden Peirce, INVENTOR
Anthony Usma, BY ATTORNEY

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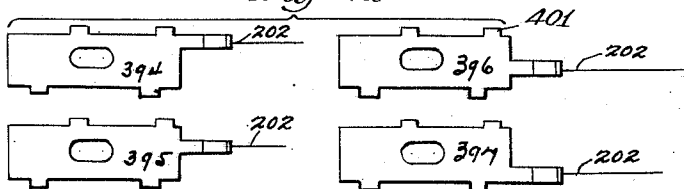
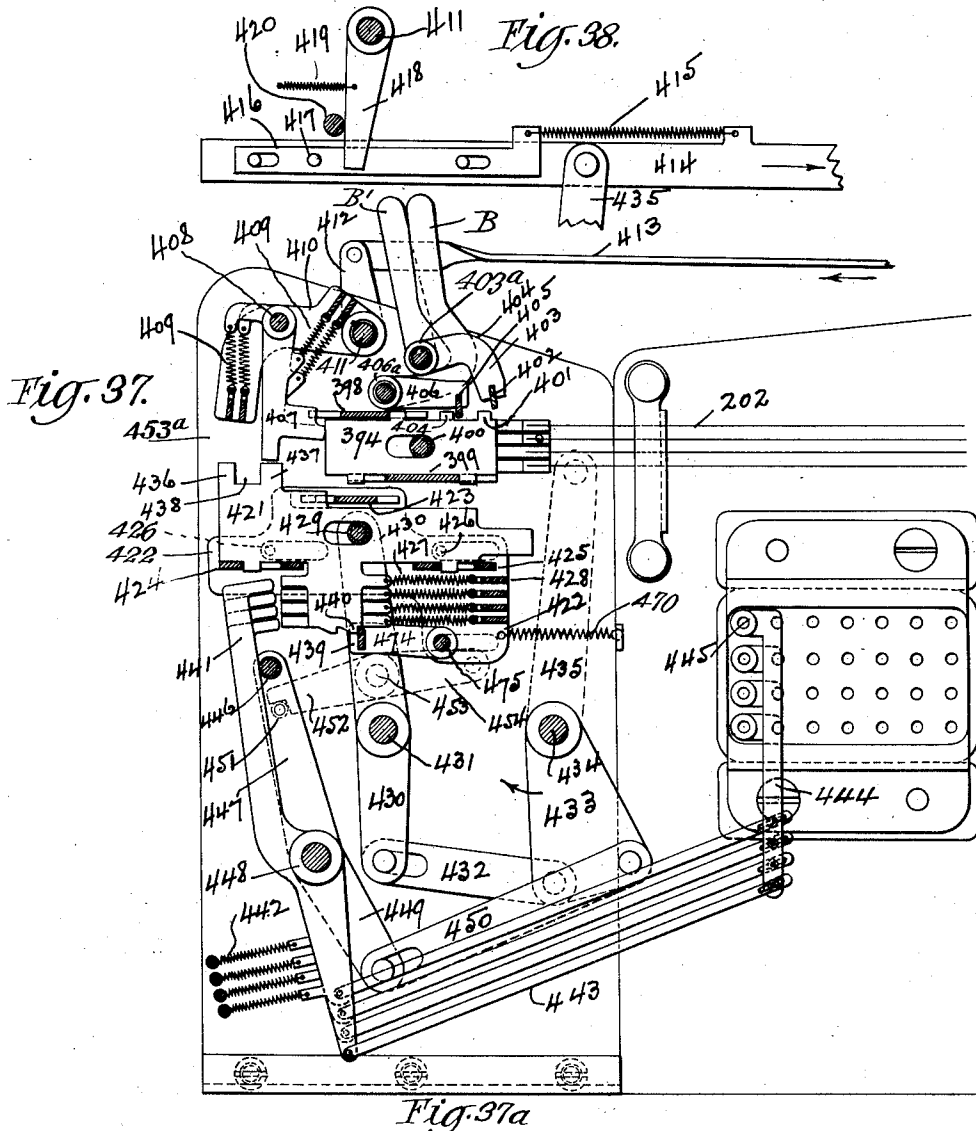
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INVENTOR.
John Royden Peirce
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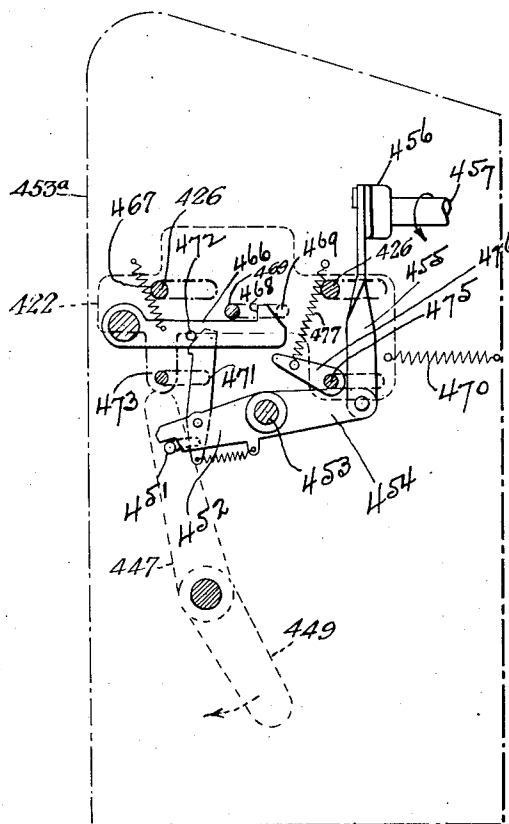
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Fig. 39.



John Royden Pearce
R. Anthony Hanna

INVENTOR

BY

ATTORNEY

UNITED STATES PATENT OFFICE

1,930,283

DISTRIBUTING MACHINE

John Royden Peirce, New York, N. Y., assignor,
by mesne assignments, to International Business
Machines Corporation, New York, N. Y., a
corporation of New York

Application August 27, 1918. Serial No. 251,597

59 Claims. (Cl. 235—58)

This invention aims to provide a machine for distributing items of information according to one or more different classifications, the machine being similar to that described in my previous application No. 519,925 and including certain modifications and improvements thereon.

The accompanying drawings illustrate an embodiment of the invention.

Fig. 1 is a perspective view of the complete machine;

Fig. 2 is a view of one of the perforated cards by which it is controlled; being a style of card showing the statistical items used by a life insurance company;

Fig. 3 is a table showing the system of perforations used for indicating figures from zero to nine;

Figs. 4 and 4^a are parts of lists printed by the machine under the control of cards of the class shown in Fig. 2;

Fig. 4^b is a diagram of the accumulators in the machine;

Fig. 5 is a right end elevation showing the driving mechanism and related parts, and omitting the mechanism immediately behind it for the sake of clearness;

Fig. 5^a is a similar view in a different adjustment and Fig. 5^b is a section on the line 5^b—5^b of Fig. 5^a;

Fig. 6 is a similar elevation of the controlling mechanism for the several selectors and totaling devices, located immediately behind the driving mechanism of Fig. 5, and omitting this driving mechanism for the sake of clearness;

Fig. 6^a is a detail of the same mechanism;

Fig. 7 is a right end elevation of parts of Fig. 6, being the total controlling mechanism separately in the position when the machine is ready for a totaling operation; Fig. 7^a is a detail thereof;

Fig. 8 is an elevation of the mechanism located at the left end of the machine for controlling the totaling operation. This mechanism works in conjunction with that of Fig. 7, the views being reversed, right and left, with respect to each other, since they are at opposite ends of the machine; Figs. 8^a, 8^b, 8^c, 8^d, 8^e, 8^f and 8^g are details of the same mechanism;

Figs. 9, 10, 11 and 12 are separate views of parts of the mechanism shown in Fig. 6; Figs. 9^a, 9^b, 9^c and 10^a and 12^a being details thereof;

Fig. 13 is a side elevation of one of the selecting sectors and related parts; Fig. 13^a being a similar view of a closure sector; Fig. 13^b, of a

wheel set resetter; Fig. 13^c, of a throw-off sector; and Fig. 13^d, of a trip resetter;

Fig. 14 is a similar view of one of the operating sectors, that is a sector which operates the adding wheels or accumulators, the figure showing also the relation of the sector to the "comb" mechanism at the left which is set by the controlling card and which determines the movement of the sector, and the figure showing also at the right the carriage for the paper on which the record is to be printed; Fig. 14^a being an enlarged detail of said sector, and Figs. 14^b and 14^c enlarged details of the carriage; Fig. 14^d is a detail view of mechanism partly shown in Fig. 14, for suppressing the hammer releasing mechanism at alternate time intervals;

Fig. 15 is a rear elevation of one end of the carriage and adjacent mechanism;

Fig. 16 is a perspective diagram showing a pair of racks or operating sectors, the adding wheels corresponding thereto, and the selecting sectors and controlling sectors and other devices therefor, various parts being separated from each other by an exaggerated distance in the lateral direction, for the sake of clearness; Fig. 16^a being a plan of the left end and Fig. 16^b a cross-section of the right end of Fig. 16;

Fig. 17 is a diagrammatic plan indicating the relative locations of the various groups of mechanism in the machine;

Fig. 18 is a time diagram illustrating the order in which the several main operations take place;

Fig. 19 is a time diagram of the machine in performing a totaling operation;

Fig. 20 is a front elevation (omitting the outer perforated block) of the pocket in which the cards are carried in their operative position; Fig. 20^a being a detail in plan, Fig. 20^b a section on the line of Fig. 20^b indicated, and Fig. 20^c a detail in vertical section;

Fig. 21 is a transverse section in the rear of the pocket, together with certain mechanism for transmitting the control of the cards to the sectors; Figs. 21^a and 21^b being details thereof;

Fig. 22 is a side elevation of the pocket and feeling pins, omitting the finder which would be located at the left hand end of this mechanism; Figs. 22^a and 22^b being details thereof;

Fig. 23 is a longitudinal vertical section through the pocket substantially on the line 23—23 of Fig. 20, showing the clips which feed the cards downward into and out of the pocket; Figs. 23^a and 23^b being separate views of these clips;

Fig. 24 is a side elevation of the mechanism

which controls the opening and closing of the clips, as indicated by the line 24—24 of Fig. 20; Fig. 24^a showing a detail in another position of the parts;

5 Figs. 25 and 26 are views in end elevation and Fig. 26^a is a plan (omitting various parts which might confuse) of devices located within the machine on the inside of the pocket for controlling the movement of the cones and stop pieces;

10 Fig. 26^b is a section on the line 26^b—26^b of Fig. 25; Fig. 27 is a plan of certain mechanism located at the foot of the pocket for operating the pusher which forces a card from the upper to the middle position;

15 Fig. 28 is a side elevation of the same and Fig. 28^a an end elevation of the same;

Figs. 29, 30, 31 and 32 are side elevations of the four combs of a group corresponding to one digit; Fig. 29^a being a horizontal section through such group on the line 29^a—29^a;

20 Figs. 33, 34, 35 and 36 are side elevations of stop pieces corresponding to the four combs; and Fig. 33^a is a side elevation of these four stop pieces grouped together;

25 Fig. 37 is a section approximately on the line 37—37 of Fig. 17, showing the principal parts of the finder mechanism in side elevation;

Fig. 37^a is a set of side elevations of the pin combs of the finder mechanism;

30 Fig. 37^b is a detail of Fig. 37 with the parts in a different position;

Fig. 37^c is a horizontal section of the same;

Fig. 38 is a side elevation of a part of the finder mechanism on the plane 38—38 of Fig. 40;

35 Fig. 39 is an elevation of certain mechanism mounted on the rear face of the back wall of the finder casing, the plane and direction of the view being indicated by the line 39—39 of Fig. 17; the supporting plate being merely indicated in outline so that the figure is chiefly diagrammatic;

40 Fig. 40 is a plan of the principal parts of the finder.

The machine is designed to take a number of cards A shown separately in Fig. 2 and shown in groups in the feeding and discharging positions in Fig. 1 and, as said cards pass in succession through the machine, to count all the cards showing a certain fact and to add certain amounts or other numbers represented by the perforations in such cards. Thus if the machine is set to distribute the information on the card according to ages it will count for each age the number of cards in the entire list, and will calculate the total amount of the premiums represented thereby and various other items as hereinafter explained more fully. It will register these upon mechanism from which the various data can be taken off and transferred to suitable lists or records, perforated, printed and otherwise; or the registering mechanism may carry one or more indicators upon which the several quantities are visible so as to permit of their being copied by hand upon a suitable list; the machine being preferably provided also with an attachment or an additional section or unit of mechanism by which after a group of cards has been run through the machine the resulting totals can be recorded or indicated.

The list or tabulation made by the machine may be of the character indicated for life insurance companies by way of example in Figs. 4 and 4^a. The listing sheet (Fig. 4) contains columns which will be for the purposes indicated on the headings; it being necessary to explain only that the letters Q, A and S follow-

ing the "payable premium" column indicate that the premiums noted are payable quarterly, annually and semi-annually. On this listing sheet the machine will print successive lines like the first three lines shown, each line representing one policy. These three lines (or there may be a greater or smaller number of such lines) represent policies which are all of the same kind (indicated by the arbitrary number 402 in Fig. 2) all of the same year, as 1916, and all for persons of the same age, as 30. When the last one of the group of cards corresponding to this classification has passed through the controlling position the machine will print the total line on the listing sheet. Instead of the policy number, of which, of course, the total is meaningless, it will print in the "policy number" column the figures representing the classification; in the payable premium column it will print nothing since there is no proper total for these premiums payable at different intervals; and in the other columns it will print the actual totals of the individual numbers. The form of report desired may be simply a listing sheet of this sort. In that case the machine after printing the total of the first group of cards will commence the listing of another group as shown by the last line in Fig. 4.

The machine may be set, however, to print a more complete and complicated style of report consisting of the listing sheet, Fig. 4, and also of the summary sheet, Fig. 4^a, and this double report is preferred for life insurance work. Supposing the double style of report is desired, then after printing the total line on the listing sheet this sheet will be withdrawn from printing position and the summary sheet will be brought to such position and on it will be printed such a line as is indicated in Fig. 4^a. This summary line repeats the total line on the listing sheet with the following differences. The classification numbers are repeated, but the sheet is preferably divided into three columns with the titles "kind" "year" and "age" at their heads so as to properly separate the figures which indicate these items. Three separate columns are provided for the separate totals of the annual, semi-annual and quarterly premiums of the group of cards which has been listed. The first totaling operation of the machine prints the total line on the listing sheet. For the second operation the summary sheet is shifted to recording position and a record is made of the total of annual premiums and all items to the left of this. The carriage is then shifted to the left and the third operation records the total of semi-annual premiums (the mechanism for printing the items on the left of this being suppressed). The carriage is again shifted to the left and the fourth operation prints the total of quarterly premiums only. After this the carriage is shifted back to its original position with the summary sheet withdrawn and the listing sheet in place and ready to receive the next line under control of the first card of a new classification.

Instead of a continuous list the machine may be adapted for making individual records preferably perforated upon individual cards which are to be subsequently run through a separate machine when a list is required, as described in my aforesaid distributing machine application for patent.

The machine may be similarly used for distributing the items according to years, kinds of insurance, sexes and races, and, by a suitable

modification of the card and machine, according to practically any desired kind of business or classification.

The card, of course, will be designed for the particular business involved, Fig. 2 showing a card for life insurance work. It is divided into separate portions corresponding to the different items which are to be recorded or control the machine in other ways. The headings and the full lines shown to divide the items are permanently printed on the card. It is then put into a machine which prints the proper figures in the several columns and punches in corresponding spaces below the figures groups of perforations corresponding to the figures printed. For convenience in reading the drawings the limits of the punching spaces corresponding to the several items are shown in dotted lines but these are not necessary, the delimitation of these spaces being taken care of by the machine which punches the cards. The letter M means "mode of cancellation", whether debit or credit; the letter S, sex; and the letter P "payable premium", whether annual, semi-annual or quarterly. For each of these items there are few possible indications and any arbitrary system of figures is used to distinguish one from the other. All the other items are naturally represented by figures and the corresponding perforations are arranged in groups according to the table indicated in Fig. 3. A very simple system of grouping the perforations is shown so as to limit the number required to present any digit from zero to nine to not more than three perforations in four spaces. Other systems may be used, of course, and the perforations may be arranged not only for controlling the recording machine herein described, but also for controlling a machine for sorting the cards according to any one or any group of the items, as according to the year, kind and age of the policy in question. The machine may also be built without any provision for recording items which are not desired on the sheets, or it may contain such mechanism and be adapted to suppress it when desired. I have assumed in the present case that the machine contains no mechanism for printing the state, distribution, mode of cancellation or sex. Except for these all the items on the card of Fig. 2 are recorded on the sheets of Figs. 4 and 4^a.

The cards may be made by hand and fed to the machine by hand, but preferably machinery is used for both these operations, suitable feeding mechanism being illustrated herein. With this mechanism all the cards containing the information to be distributed are placed in a tray or in a raceway and are fed therefrom in continuous succession to the pocket or the operative position of the card and thence to another raceway or tray; the machine taking off the desired items and registering the desired information, and indicating and listing if preferred. Thereafter if another kind of information is required the machine is set back to zero, the lever corresponding to the desired class of information is shifted, and the cards are again run through the machine. Thus for distributing information on the card of Fig. 2 according to ages and premiums, the most commonly required distributions, two runs of the machine are required (the first being indicated in Figs. 4 and 4^a). In each run all the cards, or all of a certain selected group of cards, are passed through the machine and the amounts on the cards added

on appropriate accumulators, in the machine, and the totals taken and listed.

The lot of cards may be put together indiscriminately and run through the machine without respect to any orderly arrangement. In that case the machine will record the numbers taken from each card upon the listing sheet, at the same time impressing this number upon the proper accumulator selected by the card, and it is only at the end of the operation with the entire lot of cards that the totals can be found. This will serve for some kinds of business. But for life insurance work, and indeed for most complicated records, it is preferable to sort the cards beforehand into groups according to the desired classification. For example, we would first take all the life insurance cards of kind 402 and the year 1916 and would then further segregate these into separate groups arranged one after the other according to ages. The machine will then take and list the cards in this order and perform successive additions on the accumulators until all cards for the first group, say age 1 year, have passed, after which the total accumulated for this age will be printed and the accumulators turned back to zero. The same operations will then be repeated for the cards corresponding to two years of age, etc.

The operator may separate the groups of cards corresponding to successive ages by division cards or otherwise and manually cause the totaling, starting and restarting operations of the machine. But I prefer to use a device which I call a "finder" for taking care of this phase of the operations. And with this finder I may operate in two ways, either to stop the machine when the finder indicates that one group of cards has passed and the next has arrived at operative position, or to cause the machine to go automatically through the proper sequence of operations, totaling for the first group and immediately afterward commencing the listing of the next group. The finder works under control of the selecting section or sections of the card. As long as the perforations in these sections of the successive cards are the same the finder causes the machine to perform the regular listing operations one after the other for the successive cards. As soon as a card with a different set of perforations in the selecting sections moves to operative position the finder learns this fact and causes a totaling operation for the records of all the cards of the group which has gone before, and causes the printing of the classification which caused their selection. Immediately after which the finder shifts its position so as to correspond with that of the new card and to cause a regular listing operation for this and for successive cards until their classification again changes as indicated by the perforations in their selecting sections.

In Fig. 1 there are shown two small levers B B' which I call "set up" levers and which control the finder and enable it to respond to various sections (or groups of sections) of the card. With the arrangement shown the finder is responsive to any change in one of the three sections of the card which indicate the kind, the year and the age. This finder mechanism is not only important in ensuring a proper sequence of operations of the machine, but also in finding cards which have accidentally been improperly punched or improperly grouped, since any such card will immediately act through the finder to cause a stoppage of the regular listing operation.

I have said above that the machine is adapted for taking the double record of Figs. 4 and 4*, or for making a single record as in Fig. 4 alone. The character of the report which shall be made in this respect is controlled by report levers C and C', Fig. 1. When the lever C' is pulled forward as shown the complete sequence of totaling operations above described for making both a listing and a summary sheet will take place automatically. When C' is back and C is pulled forward the machine will print only a listing sheet with a total line as shown at proper intervals under control of the finder. When both report levers C and C' are pushed back there will be no totaling but only a succession of listing operations.

The machine presents also a lever D which in the rearward position shown causes the machine to automatically stop at the end of a group of cards on which it is working; that is to say, when the cards have been sorted into separate groups and the machine arrives at the end of any group it will stop. Or if the lever D be pulled forward, the machine will automatically, as soon as it finds a card of another group, take the total of the completed group and record the same and continue its operation on the next group of cards.

A push button E is provided for starting the machine and a second push button F for stopping it. On pushing the latter button the machine will complete its cycle of operations for the card then in operative position and will stop with the parts in position to commence a new operation.

The general arrangement of the parts of the machine will be understood from Figs. 1 and 17. At the front the cards are put into a tray and pushed to the right where they are successively lowered into the operating pocket and subjected one after the other to the operation of certain feeling pins and are then moved downward and outward into the discharge tray at the right. The movements of the several feeling pins are transmitted to a certain control transmitting mechanism or comb mechanism hereinafter described and impressed thereon, after which the feeling pins are restored to their initial positions so as to be ready to take a reading from the next card independently of the progress of operations in the machine proper.

In the right hand end of the machine is a driven shaft and a set of cams, levers and similar devices (Figs. 5 and 17) which I call generally the driving mechanism and which are approximately in a common vertical plane.

To the left of this driving mechanism and also located in or close to a second vertical plane is a set of devices (Figs. 6 and 17) which I term timing mechanism. This mechanism is operated by the driving mechanism and determines the time of withdrawal and advance of the adding wheel sectors and the accumulators, of the racks which operate the accumulators to be operated and of the hammers for printing on the record.

At the right and left ends of the machine are mechanisms (Figs. 7, 8 and 17) which co-operate to control the totaling mechanism.

At the back and top of the machine is a double carriage for the paper on which the records are to be printed.

In the body of the machine, between the driving and timing and totaling mechanisms referred to, are the accumulators (in the top of the casing, Figs. 14* and 16), a number of sectors oscillating about a common axis for operating the accumulators other sectors for turning and

controlling them and for determining which of them are to be operated.

The machine is operated by a shaft within the right hand side of the casing and running from front to back and driven by a belt pulley G (Figs. 1, 5 and 17). The carriage at the back is indicated as a whole by the letter H (Figs. 1, 14 and 15) and will be described in more detail hereinafter. The card pocket J (Fig. 1) and the ends and cylindrical portion of the casing are provided with glass windows for convenient observation. In the views showing the movable parts of the mechanism the casing is omitted for the sake of clearness.

In Fig. 5 the driving pulley G is shown on the end of a worm shaft K which drives a worm gear L in the direction of the arrow. The latter is loose on a short shaft M but is clutched to the shaft when the starting button is pressed. For this purpose a style of clutch well known in adding machine mechanism is used. The worm gear L is provided with a number of recesses N. An arm O on the shaft M carries a pivoted lever P having on its rear face a pin adapted to enter a recess N of the gear and to be pressed in by a spring so that if it enters one of these recesses in the position shown in Fig. 5 it will be carried with the gear for a complete revolution. At the end of such revolution if the extended end of the lever P finds the cam-shaped arm Q in its path it will ride on the latter and be pressed outward and out of the holes N in the gear. The shaft will thus be unclutched from the gear L and the operation of the machine will stop. This is the position indicated. Any other style of one-revolution clutch will serve the same purpose.

If now we press the starting button E it will, through the crank lever R, link S and arm T, turn the pin U so as to swing the arm Q mounted thereon out of the path of the part P whereupon the latter will spring against the face of the gear L and will enter the first one of the recesses N which comes into register with it, and will thus cause the driving of the shaft M from which the various parts of the machine receive their movements. On the end of the crank lever R is a pin V which when the starting button is pressed catches in a notch in the end of the locking lever W so as to hold the parts in position for the continued operation of the machine. To stop the machine, the button F is pressed and swings the lever W so as to unlock the lever R, whereupon the spring X pulls the latter back and swings the cam arm Q into position to unclutch the shaft M at the end of a complete rotation of the shaft which corresponds to the complete cycle of movements as hereinafter described.

The relations of the lever D are illustrated in Figs. 5, 5* and 5^b. The inner end D' of the lever lies in the plane of the end of a link D² which is pulled up by a spring D³ and is connected at its rear end to a lever D⁴ which is oscillated at each operation through a link D⁵. The link D² has a projection D⁶ in the plane of a projection D⁷ on the stop rod F. The link D² has on its underside a wide slot D⁸ in which lies a pin D⁹ on the end of a bell crank lever D¹⁰, the lower end of which is connected to a link 278 which cooperates with the totaling mechanism by certain means hereinafter described in detail.

When a card is presented which is of the same class as the previous card the link 278 is pulled to the left for the purpose of preventing a total-

ing operation of the machine. But for a totaling operation the link 278 is not given this usual movement to the left, but remains in the position of Fig. 5.

5 The link D⁵ has on its left hand end a pin D¹¹ which bears against the edge of the sector e, the link being pulled to the right by means of a spring D¹².

10 When the machine is started by pushing the button E the lever R is caught by engagement of the pin V in the notch at the end of the stop lever W, and the clutch at the lower end of S is set to operative position. As long as the rod S remains in this position the machine will
15 continue to operate.

During an ordinary listing operation the link D² will be moved backward as soon as the sector e moves forward, and the reverse movement will take place at the end of a revolution of the
20 main shaft. But just before the link D² is moved to the right, near the end of a revolution, the link 278 will be pulled to the left and the pin D⁹ will pull the link D² down; so that when this link moves to the right the projection D⁶
25 will pass under the projection D⁷. But if the machine is to take a total then near the end of a revolution the link 278 will not be pulled to the left, the link D² will be allowed to stand in its upward position and the projection D⁶ will engage behind the projection D⁷; so that at the
30 end of the stroke, when the sector e strikes the pin D¹¹ and the link D² is moved to the right, it will also move the stop rod F to the right and will lift the latch W, leaving the lever R free
35 to yield to the pull of its spring X. If there were nothing to prevent such a movement of the lever R there would, therefore, be an unclutching and a stopping of the machine at the end of the first revolution when the machine starts to
40 total.

However, as explained at length hereinafter, the machine requires for totaling not merely a single revolution of the shaft but two revolutions or some multiple of two revolutions. Consequ-
45 ently, when the lever R is unlatched by the lifting of the latch W at the end of the first revolution of a totaling operation, the lever R must be held by other means until the end of the entire cycle of operations necessary for
50 totaling.

The means for holding the lever R is a latch D¹³ adapted to engage a projection D¹⁴ on the starting rod E when the latter is advanced. The latch D¹³, however, is held out of operativeness
55 during an ordinary listing operation by the engagement with the tail of the latch D¹³ of a pin D¹⁵ on a rod 303 referred to hereinafter.

The rod 303 is pulled down by a spring 305 and is engaged at its lower end (Figs. 6 and 7) with
60 an arm 302 on a shaft 301 which is the "restoring" shaft and which is turned in the direction of the arrow in Fig. 7 so as to push the rod 303 up at the end of the entire cycle involved in totaling.

65 At the commencement of a cycle of totaling operations, therefore, the rod 303 is let down and the latch D¹³ has been pulled down by its spring into engagement with the shoulder D¹⁴. The latch retains this position throughout the
70 entire cycle of operations; so that, although the latch W is lifted at the end of each revolution of the shaft, there is no movement of the lever R or unclutching rod S. But toward the end of the last rotation in the totaling cycle the rod
75 303 is pushed upward, withdrawing the latch D¹³,

so that when the stop rod F is pushed and the latch W is lifted the spring X will pull the lever R and will unclutch the main shaft and stop the machine. It cannot then be started except
80 by pushing the button E as before. If, however, the lever D be shifted to the opposite position indicated in Fig. 5*, then there will be no stopping of the main shaft M of the machine when a total is taken. The end D' of the control
85 lever will lie in such a position that, although the link D² is released from the total control mechanism yet it will be interfered with by the stop D' and cannot rise so as to bring its projection D⁶ into position to throw the stop rod.

Fig. 18 illustrates the cycle of movements. 90 When the main shaft M of the machine is clutched to the continuously rotating gear as above described the operations begin, and this point is indicated at the top of the diagram. The successive operations will be seen by follow-
95 ing the diagram around to the left from the uppermost point, all the operations being completed in one revolution. The outer circle indicates the operations within the machine proper, and the inner circle the operations on the cards
100 and feeling pins,—what we call the pocket cycle.

The first effect of the movement of the main shaft, indicated at (1) is to withdraw from engagement with their operating racks or sectors
105 any accumulators (adding wheel sets) which were found in such engagement at the end of the previous operation.

The sectors are then released and allowed to take readings from the card, or rather from the comb mechanism which has been set in accord-
110 ance with the feeling pins which have passed through the last card. This step is indicated at (2). The sectors do this by being released and advancing each independently to a position determined by its set of combs.
115

When the sectors are released the accumulators are also released. But they do not drop into active position until the selecting sectors have advanced to their determined positions. At the end of the sector advance the proper
120 accumulators are selected (3) and drop into their operating positions (4) where they are locked into engagement with their operating sectors in the advanced position of the latter.

The advance of the sectors at the point (2) 125 was accompanied by a corresponding movement of the type carriers; each type carrier was moved a distance corresponding to the distance which its sector moved (under limitation by its comb mechanism) so as to bring the proper figure
130 in the type carrier on the printing line. Behind the types in the operating line is a series of hammers of the style commonly used in adding machines. As soon as the accumulators have
135 locked, the hammers are released (5) and cause the type to print the items selected by the card. The selection and dropping in of the proper accumulators and the tripping of the hammers takes place during a supplementary stroke of the mechanism (that is, a period when the sectors
140 are stationary in their several advanced positions) and in the continuation of such supplementary stroke the selecting sectors are disengaged from the accumulators which they have selected (but leaving the accumulators in en-
145 gagement with their operating sectors) and the hammers are retracted (6) to leave the type carriers free.

In the next interval (7) all the sectors are restored to their starting point. In this back- 150

ward movement of the operating sectors each of them turns the adding wheels of its accumulator a distance corresponding to the distance which the sector was advanced, and therefore impresses on its accumulator an amount corresponding to that which was printed, and which was indicated on the controlling card. The restoration of the operating sectors restores also the type carriers to the zero position. The restoration of the selecting sectors has no effect, since they have been disengaged from the accumulators.

There follows another supplementary stroke in the first portion (8) of which there is no effect on the sectors or accumulators until we return to the starting position.

The pocket cycle of operations starts at a point somewhat in advance of the recording and adding mechanism, the card having been previously set in the operating pocket. The pins advance (9), those which find unperforated spaces being stopped by the card and the others passing through to operative position. The combs are then advanced (10) and take their readings from those pins which have passed through the card.

Overlapping the operation of the pins and the combs is the operation of the finder (11) which finds out if the operative card is of the same classification as those which preceded it and, if not, starts a totaling operation for the cards of the previous classification and shifts its own condition so as to respond to the classification of the new card.

As soon as the combs have been set, they remain so although the pins are withdrawn from the card (12). At the same time certain stop-pieces which transmit the positions of the combs to the sectors are let down into engagement with the combs and assume their intended positions to limit the advance of the sectors.

The pocket mechanism is then idle while the sectors are advancing (2) and taking their readings from the stop-pieces. After this has been done the stop-pieces are restored (13) and immediately thereafter the combs are restored (14), which brings the pocket mechanism again into the starting position.

The pocket mechanism although making the same number of revolutions in a given time as the recording mechanism may be advanced to any desired extent in comparison with the recording mechanism, since its operations in detail are quite independent of the operations of the recording mechanism, it being necessary only that the pocket mechanism have plenty of time to find its intended controlling position before the sectors of the operating mechanism come into play.

The operation and functions of the pocket mechanism will be more easily understood if we first describe the recording and accumulating mechanism.

We have seen that when the machine is started a rotary motion is contributed to the main shaft M, Fig. 5, shown also in dotted lines in Fig. 17. On the inner end of this shaft is a crank Y connected by a link Z to a crank a on a shaft b (Figs. 5, 25, 28, etc.) which controls the pocket mechanism as described in detail hereinafter. On the outer end of the shaft M is a crank c connected by a link d to one arm of a slotted cam e which is fixed on a shaft f whose principal use is in controlling the movements of the adding wheel sets or accumulators.

The oscillation of the cam e through the link d serves to swing an arm g which has at its free end a pin h lying in the slot of the cam and which is fixed on a central shaft j whose main function is the controlling of the sectors, that is the releasing of them and the resetting or restoring of them to their starting positions. The movement of all the main sectors is accomplished in the same way, the mechanism being indicated in Fig. 13 for one of the selecting sectors k and in Fig. 14 for one of the operating sectors l. The central shaft j is provided with depending arms m connected to each other by a resetting rod or bar n extending the full length of the group of sectors. The sectors are mounted loosely on the shaft j, and are pulled forward and downward by springs o and are provided with tails p which strike against the resetting bar n. In the position shown the shaft j has been turned to swing the resetter n forward and to set or reset all the sectors. As the machine operates the resetter n is swung back and the sectors are advanced by their springs. The extent of such advance is limited by stop-pieces q, one for each sector, adapted to oscillate independently and having ten notches in their edges any one of which may be brought into position to be engaged by a stop pin r of the sector. The notches in each stop-piece q are so positioned that the first notch will be engaged by the pin r when the sector is in the zero position, the next notch when the sector has advanced one step, and the successive notches corresponding to similar advances of the sector. The position of the stop-piece q of each sector is determined by the card as hereinafter described. Thus the card, or rather the location or the grouping of the perforations in the card determines the extent of advance of the several sectors.

Each of the operating sectors l, Fig. 14, has a rear arm s connected by an upward link t and by an oblique offset u to the lower end of a vertically movable type carrier v. As appears from Fig. 17, these operating sectors are separated a considerable distance from each other while the type carriers are grouped close together, whence the need for the oblique offsets. The recording sheet or sheets pass over the rollers or platens w w' of the carriage, and before the printing line is located a line of type hammers x. After all the type carriers are properly set, the hammers are tripped by mechanism similar to that used in the ordinary adding machine, and all significant types (excluding zeros at the left of any number) are struck. The figure printed in each column therefore corresponds to the extent of movement of the operating sector for this column.

Some of the operating sectors correspond to items on the card which are to be added, but some of them merely indicate certain classes so that they do not have to perform any adding operation nor anything but printing operations. The sectors in the latter class have plain arc shaped tops. Those which represent accumulative items are, as illustrated in Figs. 14 and 14', provided with operating racks y and above these are carried accumulators or adding wheel sets mounted on arms which pivot on the shafts z so that they may be dropped into engagement with the racks at the end of the forward movement of the latter, operated by the rearward movement of the racks and then lifted out of engagement, all as hereinafter described. The several accumulators carry a number of adding

wheels corresponding to the number of decimal places required for the several items, and for each accumulator there is a group comprising a corresponding number of adding sectors.

5 For example, to print the sheets of Figs. 4 and 4^a the accumulators would be grouped as in Fig. 4^b, one set for credit items and another for debit items and each set comprising three groups. At the left are two groups one for policy number used in regular listing and one for kind, year and age used in totaling. In the intermediate position are the regular listing accumulators which accumulate and control the totals on the listing sheet, and the summary accumulators which are operated during the listing operation and which control the recording operation on the summary sheet. And at the right are three smaller accumulators which are advanced as the regular listing operations go on and which are then used to control the printing of the totals on the summary sheet. In listing both the listing accumulators and the summary accumulators are advanced at each regular listing operation and they must show the same totals. For the annual, semi-annual and quarterly accumulators a selecting mechanism drops one or another into engagement with the operating sector at each listing operation, according as the card shows an annual, semi-annual or quarterly payable premium. Each of these, therefore, will usually carry a different total from the others.

Fig. 16 illustrates in perspective accumulators for two decimal places, having a unit pinion 2 and a tens pinion 3, with corresponding operating racks *y*, selecting sectors *k* and *k'* therefor, and the auxiliary sectors and mechanism for selecting and operating this accumulator. The advance movement of the sectors and racks is downward and to the right in this figure. After the sectors have moved in this direction the accumulator pinions are dropped into engagement with the racks *y*, and the pinions are operated on the backward movement of these racks. The accumulators are carried on arms loose on the shaft *z*. The dropping of the accumulators and the subsequent lifting of them under control of the selecting and throw-off sectors and related mechanism is described in detail hereinafter.

When one of the pinions passes from nine to zero, one must be carried or added to the pinion of the next higher decimal place. For example, when the unit pinion 2 passes to zero the tens pinion 3 must move an interval in addition to the movement impressed on it by the sector which carries its operating rack. There are various familiar carrying devices found in adding machines any one of which may be adopted for this purpose. In the example shown, the racks *y* for the tens and higher decimal places are mounted on their sectors *l* (Figs. 14 and 14^a) with pins and slots 7 which permit an additional movement of one step. The rack for the unit sector of any group is fixed on its sector. The racks of the tens and higher decimal places have each a carrying stop pin 8, see Figs. 16 and 16^b, which normally bears against the end of a loose pawl 9 carried on the shaft *z* and provided with a shoulder 10 which is normally held by a lug 11 on a releasing arm 12 pivoted on a fixed upper shaft 13 and pressed forward and downward by a spring 13^a. The end of the releasing arm 12 rests on a cam 14 which is loose on the shaft 15 and is fixed to the rotating unit pinion 2. Adjacent to the pawl

9 is an arm 16 fixed on the shaft *z* and forming an attachment for a spring 17 which tends to lift the pawl 9 when the releasing arm 12 is lifted. The arm 16 has a shoulder bearing on a pin 18 carried by the pawl. During the selecting operation and before the adding wheels are dropped the shaft *z* is turned to the position of Fig. 16^b, and the arm 16 moving with the shaft presses the pawl 9 backward and downward into the path of the carrying stop pin 8, in which position the stop 11 drops into engagement with the shoulder 10 of the carrying pawl, so as to hold the latter. Before the adding movement takes place, the shaft *z* is rocked back again into its former position, by mechanism hereinafter described, throwing the arm 16 forward and leaving the pawl 9 held back by the stop 11 but pulled forward by the spring 17 so that as soon as the stop 11 is lifted the pawl 9 will also be lifted out of the path of the stop pin 8. The cam 14 is shaped to lift the releasing arm 12 when the unit pinion 2 passes from nine to zero. This movement therefore will release the pawl 9, whereupon the spring 17 will lift this pawl and the stop pin 8 will be freed and the tens rack *y* will be permitted to move backward an additional step and to impress an additional number on its pinion.

On the backward or adding movement of the sectors they return to what may be called a zero position, and continue one step further to what we may call the carrying position. It is at the zero position that the stop pin 8 strikes the end of the pawl 9 when the latter is in line with it. The sectors then have an additional movement of one step during which the pins operate through the slots 7 of the racks, if the latter are held by the carrying pin. Such racks as are not so held will follow their sectors through the additional distance in order to add one to their pinions. Springs *y'* (Fig. 14^a) connect the racks to the sectors and yield to permit the sector to move backward beyond the zero position notwithstanding the stopping of the racks in this position. For convenience in manufacture each rack is made up of a number of sections.

These are provided with depending lugs having pins 19 which engage outward lugs 20 on an arc shaped bar 21 which is also mounted on the sector by pin and slot connections 22, and which furthermore is drawn backward by a spring 23 (Fig. 14). The bar 21 is used only in totaling, and then to prevent a carrying movement of the racks. Normally each rack is pulled back by one of the springs *y'*.

The selecting sectors operate first to drop the accumulators to bring their pinions into engagement with the racks. This takes place at the end of the forward movement of the selecting sectors. The accumulators are then left in gear with their racks during the rearward movement of the selecting sectors. And at the end of this rearward movement the accumulators are lifted out of engagement with their racks, the uppermost notches in the pinions engaging fixed teeth carried by the frame above them so as to prevent their accidentally turning. These teeth are shown at *y*² in Fig. 14^a.

In Fig. 16, two selecting sectors *k*, *k'*, are shown, the first for making the selections shown in Fig. 4^a and described in connection with this figure, and the second for selecting the entire debit or credit group and then closing the opposite group. These two sectors are shown sep-

arately, the main sector k in Fig. 13 and the supplementary or "closure" sector k' in Fig. 13*. Only when both act jointly on any particular accumulator or group of accumulators will it be permitted to drop into engagement with its operating racks. This is explained more in detail after the following description of the arrangement of the accumulators.

The arrangement of the accumulators in order to print the listing sheet and the summary sheet of Figs. 4 and 4* is indicated in the diagram Fig. 4^b, explained generally above. There are two groups of accumulators which for the sake of definition I have called "credit" and "debit", and which are used alternatively. In each of these alternative groups there are two complete sets of accumulators which are identical with each other, one supported beneath the uppermost longitudinal bar of the frame of the machine and the other supported on the next bar toward the front, and a third short accumulator supported on the next bar toward the front. In the first line there is one set of accumulators mounted on a common shaft so that they go into and out of gear with their operating sectors at the same time. They accumulate the items under the following headings, number of policies, disability, amount of insurance, amount of premium and deferred premium. In the first group there are five adding wheels so as to be capable of printing up to five decimal places, in the second six adding wheels, and in the next three eight each. Although these accumulators are mounted on a common shaft it will be understood that each operates separately from the others. Forward of this is a second line of accumulators identical with the first line and controlled simultaneously with the first. That is to say, these two sets of accumulators drop into gear and accumulate their items simultaneously and to the same amounts. These two identical sets of accumulators will show the same amounts at the end of any series of operations. Before taking out the listing sheet it is desirable to print on the same sheet the totals of the several amounts previously printed; and also to print the same totals on the summary sheet. The uppermost set of accumulators above described will be used for the listing sheet. The second set of identical accumulators is provided for printing on the summary sheet. After such printings the accumulators of both sets are restored to zero.

Located at the right of the two sets of accumulators referred to are three separate accumulators, each arranged for eight decimal places and indicated in Fig. 4^b at (Q), (S), (A),—meaning quarterly, semi-annually and annually. These accumulators are located under the first, second and third bars of the frame of the machine, counting from the back, the first two in line with the multiple sets of accumulators above described and adjacent to the ends thereof. The selecting sector which drops one or another of these three accumulators into gear with the operating sectors also operates a type carrier. When it selects the first accumulator, the movement of the selector is such as to bring into the printing line a type carrying the letter Q. When it selects the next accumulator it brings into line a type carrying the letter S, and when it selects the third accumulator it brings into line a type carrying the letter A. The movement of this selector is determined by the location of the perforation in the lower right

hand corner of the card, Fig. 2. In the corresponding printed space above in connection with the letter P (meaning payable premium) is the number 3, each of the three accumulators in question is given an identifying number, the number 3 in this case corresponding to the quarterly accumulator.

It will be understood therefore that when the machine is operated for a given card both the listing and the summary groups of accumulators at the left (considering only the credit group for the present) are dropped into gear and one or another of the three separate accumulators (A) (S) or (Q) at the right. In passing a number of cards through the machine, therefore, the listing and the summary groups of accumulators will carry the totals of all columns on the card except the column of payable premium. The items of this column will be distributed throughout the separate quarterly, semi-annual and annual accumulators. In printing the total line on the listing sheet (Fig. 4) the payable premiums are not printed, since their total would be meaningless. In printing the summary sheet the machine will print the same items as for the total line on the listing sheet and then will print in succession in the three separate columns at the right (Fig. 4*) the annual, semi-annual and quarterly premium totals. This effect is secured by printing one (the annual premium in the case illustrated) at the same time with the printing of the totals at the left, then shifting the carriage and paper and printing from the next accumulator in the next column, and similarly from the third accumulator in the third column of the sheet.

The first column of the listing sheet contains only the policy number, which is not an accumulative item. For this printing we depend upon the seven sectors in the group 26, Fig. 17. These are controlled by the perforated card in the same way as the accumulator-operating sectors but they have no teeth since they have no need to engage accumulator pinions. The next forty-three sectors shown at 27 in Fig. 17 are for the counters and adders above described.

The counters and adders are operated on the same general principle except that the accumulator used for the column entitled number of policies, is a counter which is advanced only one step at each operation and prints the figure 1 in each case except when totaling. The accumulators for the other columns take variable numbers.

Beyond the group of sectors 26 there are five sectors for effecting the selection and related operations. The two sectors indicated at k and k' are the selecting sectors similarly identified in Fig. 16. The sector 28 is the wheel set resetter or accumulator resetter. The sector 29 is the throw-off or resetting sector for the selectors and the sector 30 is the trip resetter.

These selecting sectors and related parts serve to control the group accumulators which I have described above and which relate to the various items on the sheet from the number of policies to deferred premium. The two sectors k , k' constitute the main sector and the auxiliary or closure sector of a single selecting device.

On the opposite end of the machine is a selecting mechanism for the three different accumulators which relate to the payable premium column. Here we use a closure sector k' which is fastened on the same shaft that carries the similar sector k' at the opposite end so as to

move with it, and we use a selecting sector k which is independent of but identical with k at the opposite end of the machine. These selecting sectors are accompanied by a wheel set re-
 5 setter 28, a throw-off or resetting sector 29 and a trip resetter 30 of the same style as at the other end.

I have described above and shown in the credit group of Fig. 4^b a single set of accumulators for
 10 taking care of the various listing and totaling operations required. The machine may be limited to such a set of accumulators or in fact to any number and arrangement of accumulators sufficient to take care of the desired operations.
 15 The machine illustrated, however, contains a duplicate group of these accumulators shown under the title "debit" in Fig. 4^b arranged under the three front bars of the machine and located transversely in line with the corresponding
 20 accumulators of the credit group. This duplication is for the purpose of enabling the machine to record debit and credit, or otherwise opposed, items, and this machine is further arranged to record one such class of items in red ink and the
 25 other in black.

This will explain the purpose of the use of closure sectors k' in connection with the selecting sectors. In one position of the closure sectors they permit the selecting sectors to work on the
 30 debit group of accumulators; and in the opposite position of the closure sector the selecting sectors work on the credit group of accumulators.

Returning now to the sectors in the group 26 which do not control or actuate any accumulators, these serve a double function. During the
 35 regular listing operations they print the number of each policy, as indicated in the first column Fig. 4. At the end, when the total line is to be printed on the listing sheet they print the classifications to which the totals apply. For example, in Fig. 4, they print the number 402, indicating the kind of insurance, the number 16 indicating the year and the number 30 indicating the age of the person (compare the card, Fig.
 40 2). And these items of the total line are repeated on the corresponding line of the summary sheet; the latter having columns in the proper position with the words "kind", "year" and "age" printed at the top.

45 The determination of the classification items which are to be printed is accomplished through a finder whose control we will explain here briefly and the details of which are explained later. The cards of a group to be first tabulated
 50 will be punched in the proper spaces to indicate the numbers 402, 16 and 30. When the first one of these cards is operated on it will set the finder to a corresponding position by reason of the passage of certain feeling pins through the perforations in these sections of the card, and the finder
 60 will be locked in this position until subsequently changed by a new card. When a card which does not correspond to the finder comes into operative position it will have either of two effects depending upon the position of the lever D (Figs. 1 and 5). If this lever is thrown to the position
 65 illustrated the entire machine will stop and not merely the card feed. Thereupon the operator by pressing the starting button E will again set the machine in operation. The first effect will
 70 be to print the total line on the listing sheet. Next the machine will print the corresponding line on the summary sheet. Then the feed will be renewed and the finder will take the position of the first of the new group of cards and

the operation will proceed as before, generally on a new listing sheet introduced for that purpose into the carriage. This is the usual mode of operation where there are a number of items
 80 of the same kind, sufficient to approximately fill an ordinary sheet. Where there are only a few cards in each successive group the records for several groups may be made on the same listing sheet.

In this case it is not necessary to stop the machine. In this case the lever D will be pulled forward to the automatic totaling position. The card feed having stopped, the machine will automatically proceed to print the total line on the
 85 listing sheet, then to print the corresponding line on the summary sheet and then to proceed on the next group of cards.

Each line on the summary sheet is a summary of all the lines in one group on the listing sheet. The listing sheet is fed upward automatically by the usual method after each operation of the machine to bring a new line into printing position. The summary sheet is fed upward automatically after each printing of a total line on the listing sheet. For this purpose the roller
 90 or platen which carries the summary sheet is brought up to the printing line (the roller for the listing sheet being at the same time moved up out of the way) and as the summary sheet roller comes into position it engages with the
 95 sheet feeding mechanism and the listing sheet roller is disengaged therefrom, and the feeding mechanism advances the summary sheet one line upward. The roller feed mechanism and the means for clutching and unclutching it from the
 100 rollers are described in detail hereinafter. Each roller is provided on its ends with knurled buttons 31 for adjusting it by hand and with pinions 32 (Figs. 14^c and 15) which are alternatively, for one roller and the other, brought into engagement with the automatic feeding device.

The two rollers w and w' are mounted in brackets 33 keyed on a shaft 34 which at one end has an arm 35 splined on it and (Fig. 14^b) pivotally connected to the end of a rod 36.
 105 The shaft 34 is mounted in brackets 37 fixed on a laterally shifting bar 38 which is mounted as indicated in detail in Fig. 14^b to slide with a ball bearing on the bar 39 which extends fixedly between the opposite end frames of the machine. The shaft 34 slides with the carriage and through the arm 35, the latter being held against lateral movement by end bearings 40 (Fig. 17), between which also operates the rod 36.
 110 115

The rod 36 is raised and lowered and locked in the desired position by means of a pair of cams 41, 42 of the shape shown and set at proper angles to each other, embracing the shaft between them and bearing on rollers 36^a on opposite sides of the rod; the cams being mounted on a cam shaft 43 which extends through to the left hand side of the machine (right hand side of Fig. 15) and is controlled in the manner hereinafter described.
 120 125 130 135

The shaft 43 is hollow. Through it runs a shaft 44 carrying a shifting cam 45 engaged by a pin 46 on the underside of the shifting bar 38. On the ends of the shafts 43 and 44 are ratchets 47 and 48 respectively shown in Figs. 15, 8 and 8^e. The movement of the ratchet wheel 47 throws the brackets carrying the rollers up, and this is followed by a printing operation (including annual premium), then by a movement of the cam 45 through the ratchet
 140 145 150

48 to shift the carriage for printing in the second of the three payable premium columns, (followed by a printing operation), after which a second movement of the ratchet wheel 48 shifts the carriage to bring the last column into the printing position (and a printing operation follows). A final two steps (blank, without printing) of the ratchet wheel 48 returns the cam 45 and the carriage to its original position laterally and the next turn of the shaft 43 and its cam returns the rollers to the original listing position. Thus one quarter turn of ratchet 47, four successive quarter turns of ratchet 48 and then a second quarter turn of ratchet 47 constitute a complete cycle for making a record on the summary sheet and returning the carriage and controlling devices to their starting positions.

For clearness sake I have omitted any illustration of the means for holding the sheets on the rollers, these devices being the same as for ordinary typewriters and adding machines. The ribbon is indicated at 49, Fig. 17, carried on spools 50 and these may be provided with the usual or suitable mechanism for raising and lowering them when it is desired to print with a two colored ribbon.

The hammer mechanism is of a type familiar in adding and similar machines. The hammers are loosely mounted on a fixed shaft 51 (Fig. 14) and thrown forward by means of separate springs 52 attached to tails 53 which are normally restrained by hooks 54 pivotally mounted on a fixed shaft 55 and provided at their lower ends with offsets 56, the hooks being pressed into engagement with the tails of the hammers by means of springs 57. Releasing hooks 58 are pivotally mounted on a shaft 59 carried between arms 60 fixed on a shaft 61 which is turned in the anti-clockwise direction (Fig. 14) when a printing operation is to be performed. The rearward end of each releasing lever 58 bears under the corresponding type carrier *v*. While the carrier is down any rearward movement of the shaft 59 will swing the releasing lever 58 to the rear without effect, its forward hooked end passing above the offset 56 of the corresponding hook 54. But as soon as the type carrier *v* has advanced upward one step or more the hook on the member 58 will drop into engagement with the offset 56, and when the shaft 59 is thrown to the rear the hook 54 will be withdrawn and the hammer will strike. The purpose of this is to suppress all zeros at the left of the highest significant figure. To ensure, however, that zeros to the right of this highest significant figure shall be printed each of the hook members 54 has a lateral projection 62 which overlaps the forward face of the hook of the number of the next higher decimal order; so that when the hook 54 of any decimal order is withdrawn it will carry with it the hook of the next lower decimal order and this movement will be transmitted in succession to all the hooks at the right of the significant figure.

Preferably, though not necessarily, a centering device to hold the type carriers exactly in the positions to which they are lifted is provided. Such a device is illustrated in Fig. 14 consisting of a bar 63 carried on arms 64 which are pivoted at their lower ends and which are pivotally connected to a link 65 which is connected to an arm 66 on the shaft 61. The lower part of each type carrier is provided on its rear

edge with notches 67 which come into register with the centering bar 63. The type being lifted, the turning of the shaft 61 will draw the centering bar 63 into proper notches of the several type carriers an instant before the hammers are released, thus holding the type carriers with the types firmly on the printing line.

The shaft 51 on which the hammers are pivoted is provided with arms 68 at opposite ends, carrying a bail 69 which overlies the tails 53 of the several hammers. By turning the shaft so as to swing the bail downward all the hammers are retracted and caught by their several hooks 54. Just before a printing operation the shaft is swung to lift the bail and free the hammers for operation as above described.

The selecting control may be through a single sector having a notched edge, which notches cause the dropping in of the accumulators, and which notches are arranged at such intervals that a movement of one distance will bring a notch into register with one accumulator, a movement of another distance with another accumulator, and so on. For the machine shown it is preferable to have an auxiliary selecting sector, such as I have shown in the present case and which I have called a "closure sector" because it closes or cuts off from operation one or the other (credit or debit) group of accumulators, alternatively. The selecting sector proper is shown at *k*, Fig. 13 and has a variable movement controlled by the stop piece *q* as previously explained. A closure sector *k'* is shown in Figs. 13^a and 16. This has a movement of one, two or three steps. For recording a number of cards in succession all of the same kind, as credit for instance, the closure sector will move one step, the stop *q* being unmoved, and its notches 70 will come into register with the three accumulators (A, S and Q) of the credit group. When it is desired to record items of the opposite class, as debit items, the stop *q* will advance to its second position, the sector *k'* will move two steps forward and the notches 72 will come into register with the pins 71 of the debit accumulators while the notches 70 move out of register with and close out the credit accumulators. When the stop-piece *q* moves to its third position the sector will advance three steps and close out all the accumulators, as is sometimes desirable, and the items on a card will be recorded without adding them.

The movement of the stop-piece *q* is controlled by the "mode of cancellation" perforation in the column on the card designated M which, in the example, Fig. 2, contains a zero so that the stop-piece will be unmoved and a credit operation will be recorded and accumulated. Fig. 13^a illustrates the closure sector applied to the three payable premium accumulators at the right of the machine. The same description applies to the closure sector at the left except that it controls only two accumulators in the credit group and two in the debit group, and of course the sector will need only two notches 70 and two notches 72.

Assuming that the closure sectors have closed out the debit group and opened the credit group, we have to select alternatively one or another of the three accumulators of the credit group and this is done by the main selecting sector *k*, Fig. 13. Here the notches 24 in the upper group are arranged so that one step forward will bring the first notch 24 into register with the first accumulator, two steps will bring the next notch

into register with the second accumulator, and three steps will bring the third notch into register with the third accumulator; the letters A, S and Q being applied to indicate the different "payable premium" accumulators which are to be selected; and a second similar group of notches is arranged for the forward or debit set of accumulators. The card, by its punching in the lower right hand, "payable premium", section, determines the advance of the stop-piece *q* which in turn determines the selection of the accumulator corresponding to the card and the printing of the letters A, S and Q on the listing sheet. The selecting sector *k* at the left of the machine will be notched so that for the regular one step advance it will render operative both the listing and the summary accumulators and until advanced will hold such accumulators up.

For reasons which will be clear later, the accumulator is held up by a latch until the selecting sector comes into position, whereupon the latch is withdrawn; the accumulator however is still held up by a resetting device and will not drop until the latter releases it. The shaft 15 (Fig. 16) which carries the pinions is supported in the ends of the arms 4 which are loose on the shaft *z* and is further supported by links 72 pivoted at their upper ends to arms 73 which are keyed on the rock shaft 13. On the end of this shaft 13 is loosely mounted a hub 74 carrying arms 75, 76 and 77 Fig. 16^a. Between the outer ends of the arms 75 and 76 is carried the pin 71 which is dropped into the notches of the closure sector *k'* and the selecting sector *k*. Mounted between arms 76 and 77 is a roller 78 with a projecting central pin 79 (projecting through and beyond the arm 77) which is engaged by a latch 80 pivoted loosely on a pin 81 which is mounted in the end of an arm 82 which is keyed on the rock shaft 13, the latch 80 being drawn upward and backward by means of a spring 83, but being held against such movement by a lever 84 which is carried loosely on the shaft 13 and pulled upward by a spring 85 and which has an offset 86 which underlies the arm 77 which carries the roller. The lever 84 has also a shoulder 87 which lies back of the end of the latch 80 and prevents rearward movement of the latter. In this position the latch prevents the downward movement of the arm 82 and of the rock shaft 13 and the accumulators, the roller 78 being held up by a cam 88 carried on the throw-off sector.

The selecting sectors being first positioned, the throw-off sector 29 is given a short backward movement. The cam 88 permits the roller 78 to drop and the pin 71 to enter the notches of the selecting and closure sectors if these have been positioned to select this accumulator. The arm 77 is carried down with the roller 78 and by its bearing on the projection 86, moves the arm or lever 84 downward and releases the latch 80 which swings backward to the unlatched position.

The latch 80 and the arm 82 which carries it will not move down immediately however, the shaft 13 being prevented from rocking by the action of the wheel set resetter 28. This carries, for each of the accumulators controlled by it, a cam 89 which underlies a roller 90 on the end of the shaft 15 of the accumulator pinions. Although the accumulators cannot drop, yet the lowering of the roller 78 permits the pin 71 to drop into the notches of the selecting sec-

tors, the arms 75, 76 and 77 which support this pin being loose on the shaft 13.

Connected to the arm 75 is a link 91 the lower end of which is connected to the pin 6 previously referred to. Therefore, when the arm 75 is dropped by the entrance of the pin 71 into the notches of the selecting sectors, the arm 5 and the lower shaft *z* will be rocked so as to swing backward the arms 16 keyed on this shaft and to bring the pawls 9 which control the carrying operations to their normal positions, in which positions they will be locked by the offsets 11 on the releasing arms 12 as previously described.

The next step is a forward movement of the wheel-set resetter 28, with its cams 89, which releases the accumulators and allows them to drop into operative position.

The operating sectors and the selecting sectors must both move backward now, the accumulators being stationary in their lowered position. This movement of the selecting sectors cannot take place as long as the pin 71 is engaged therewith. The throw-off sector 29 is therefore immediately given a forward movement to disengage the pin 71. This it does by the action of the cam riding under the roller 78 and lifting the latter and the entire frame which carries it, the lever 84 following upward under the force of its spring. The latch 80 having been swung backward out of the way of the pin 79 will now not be affected by the upward movement of this pin and the rock shaft 13 will remain in advanced position, although the pin 71 will have been withdrawn to permit the backward movement of the selecting sectors. The throw-off sector 29 therefore has to have only a limited backward movement after the selecting and operating sectors have been advanced, followed by a brief rest to permit the accumulators to drop in, after which it has an equal forward movement before the selecting and operating sectors are moved backward. The resetter 28 has a limited forward movement after the movement of the throw-off sector, remains in its forward position during the entire backward movement of the operating sectors, and at the end of such movement is restored to its original position and lifts the accumulators out of gear.

There remains only the necessity of restoring the latch 80 to its starting position. For this purpose I use the trip resetter 30 provided with a cam 91 which bears under a roller on an arm 92 pulled down by a spring 93 and pivoted on a fixed stud 94, the arm 92 being connected by a link 95 with an arm 96 pivotally mounted on a fixed stud 97 and carrying a lateral arm 98 which bears on the upper edge of the rearwardly extending tail of the latch 80. When the latch 80 is released and swung upward to the rear, it will be stopped by striking the arm 98 and its backward movement thus limited. At any time during the backward stroke of the machine, a suitable interval after the forward movement of the throw-off sector 29, the trip resetter 30 moves forward and backward. The forward movement drops the arm 92 and the arm 98 and causes the latch 80 to swing forward and be latched over the shoulder 87 of the arm 84; and the backward movement of the trip resetter again lifts the arms 92 and 98 to their starting positions.

The means for giving the various sectors their movements will now be described. The operat-

ing sectors *l* are moved forward by the springs *o* (Fig. 14) and backward by the resetting bail *n* carried on the shaft *j* as previously described. They always move forward until they strike their notched members *q* in whatever positions of adjustment the latter members have taken, and backward to their starting point.

The selecting sectors *k* and *k'*, Figs. 13 and 13^a are moved forward and backward by springs *o* and the bail *n* in the same way during the making of a record from a card; but differently when the machine is recording totals, as hereinafter described.

The wheel set resetter 28, the throw-off sector 29 and the trip resetter 30 are operated by means of shafts 105, 106, 107 (Figs. 13^b, 13^c and 13^d) connected by arms and links to the several sectors. The relative locations of the several shafts for controlling the selecting and related sectors is indicated in Fig. 14. The sectors 28, 29 and 30 have the same operation whether making an original record or totaling. They differ from each other as to their time of operation, as previously explained.

The first of these three to operate is the throw-off sector 29 which, after the operating and selecting sectors have taken their position, is given a short backward movement followed after a brief interval by a returning forward. The movement is obtained from the shaft *f*, Figs. 5, 6 and 11 which is continuously oscillated as above described. The shaft *f* carries a slotted cam 108, the slot of which engages a roller 109 on a slide 110 which is guided by a forked engagement with the shaft *f* at one end and which at its opposite end is attached to an arm 111 on the shaft 106 which is connected within the machine as shown in Fig. 13^c to the sector. On the forward movement of the machine the cam 108 moves in the direction of the arrow and the rear end of its slot serves to swing the shaft 106 in a direction to give the throw-off sector 29 the desired short backward movement; and when the cam 108 returns, to give the sector a corresponding return movement at the beginning of the cam's movement.

The following mechanism operates the wheel set resetter 28 through its shaft 105. See Figs. 6, 10 and 10^a. The shaft 105 has at its end a transverse head 112 with pins 113 and 114 extending outward from its ends and connected by a strap 115. In the space between the head 112 and the strap 115 is located the lower end of a member 116 which is T-shaped and pulled to the backward position by a spring 117 and which has notches adapted to engage the pin 113 in one position or the pin 114 in the other. In the ordinary recording operation the T-piece will stand always in the position of Fig. 10. This T-piece is pivoted at its upper end to a lever 118 pivoted on a stud 119 and having a lower projecting end 120. On the other end of the lever 118 is a pivoted flipper 121 pulled by a spring 122 to position against a stop 123. On the shaft *f* is a cam 124 having at its end a pin 125 which is adapted in the first part of the stroke to engage the flipper 121 and in the last part of the same stroke to engage the projection 120. On the first part of the forward stroke, therefore, the upper end of the lever 118 will be thrown back and the T-piece 116 will move downward and, through its engagement with the pin 113 will give to the shaft 105 a rocking movement in a direction to withdraw any accumulators which may be in engagement with their op-

erating racks; this withdrawal being accomplished through the cams 89 (Fig. 13^b) as previously explained. The position of the cam 89 before the forward stroke begins is shown in Fig. 16. At the beginning of the forward stroke it is moved back under the roller 90 to hold up the latter until the selection has been made and the selecting sectors released for their return movement as before described. At the end of its forward stroke the cam 124, striking the projection 120, will throw the lever 118 back, lifting the T-piece 116 and returning the shaft 105 and the wheel set resetter 28 to its starting position, Figs. 13^b and 16, dropping the accumulators which have been released by the selecting and throw-off sectors into engagement with their operating racks.

On the totaling operation, as hereinafter described more fully, the main shaft of the machine is given two revolutions for each printing operation, the first being necessary in order to determine which of the accumulators is to have its total taken. Each totaling operation may involve only one printing, or it may involve several successive printings, as described in connection with the different kinds of records desired. At the end of such a recording operation, involving two, or some multiple of two, revolutions of the main shaft there are two supplementary revolutions of the main shaft referred to in detail hereinafter for the purpose of restoring the machine to the regular listing position. The forward movement of the first totaling stroke serves this purpose. But at the end of this forward stroke the accumulators do not drop into gear as in an ordinary operation. Instead, they are held up until the operating sectors return to their starting position. At the beginning of the second stroke of the totaling operation the accumulators drop into gear with the operating sectors. The operating sectors are then released and advanced by their springs a distance controlled, not by the card as formerly, but by the accumulator with which they are in gear. So that at the end of this forward stroke the operating sectors have advanced to positions which represent the total on the accumulators, and the type-carriers are lifted to the same positions. The hammers are then struck and the accumulators withdrawn after which the sectors are all retracted to their starting point. In the forward movement the operating sectors in gear with the accumulators take the reading therefrom, the accumulators being thereby turned backward to zero, their stopping at zero determining the stoppage of the forward movement of the operating sectors. Therefore after such a totaling operation the accumulators which were in gear are all in the zero position and they will commence the accumulation of the next items from this point.

On the totaling operation, therefore, we cannot operate the wheel set resetter 28 in the same way as in a normal operation. Its movements are the following. On the forward half of the first stroke the first effect is the usual one of lifting at the very beginning any accumulators which may be in gear. At the end of this advance, however, it does not as usual permit the accumulators to drop into gear, but continues to hold them out. The operating sectors then take a backward stroke and it is at the end of this backward stroke of the operating sectors that the resetter comes into play and drops the accumulators into gear. The accu-

mulators are left in throughout the entire second advance. After the printing operation has taken place, and immediately before the final retraction of the sectors the resetter again comes into play to lift the accumulators out of gear. For securing this variation in the operation of the resetter the T-piece 116 is utilized.

The T-piece when moved to an intermediate position, Fig. 12, will be raised and lowered by the lever 118 without effect on the resetter. Means are provided, described hereinafter in connection with the totaling mechanism, for shifting the T-piece either to the middle position shown in Fig. 12 (to break its engagement with the head 112 on the resetter shaft 105) or to the extreme left hand position shown in Fig. 12^a (to reverse the operative connection to the shaft 105.)

On the first forward stroke of a totaling operation the parts will be as in Fig. 10 and the action of the cam 124 on the flipper 121 will rock the shaft 105 in the clockwise direction (anti-clockwise in Fig. 16) and withdraw the accumulators as in an ordinary recording operation. The T-piece 116 will be withdrawn to the intermediate position, Fig. 12, before the cam strikes the tail 120 of the lever, so that when this happens the T-piece 116 will be raised from the position shown in Fig. 12 without effect on the shaft 105 and the resetter, carrying the T-piece to a position where its left hand notch is in line with the left hand pin 114. On the retraction of the cam 124, representing the backward part of the first stroke, the pin 125 will pass the flipper 121 without effect. Thereafter the totaling mechanism will shift the T-piece 116 over to the reverse position of Fig. 12^a where it will engage the pin 114. Then as soon as the next advance begins the cam 124 acting through the flipper 121 and the lever 118 will throw the T-piece 116 downward and will give to the resetter controlling shaft 105 an anti-clockwise direction which will drop the accumulators into gear, after which the sectors immediately move forward and take the reading as described. At the end of this second forward stroke the cam 124 will strike the tail 120 of the lever 118, and T-piece 116 being still in engagement with the pin 114 will turn the shaft 105 again in the clockwise direction to lift out the accumulators.

This leaves the resetters not in their normal rest position but in position to hold the accumulators withdrawn. The backward return of the cam 124 is without effect. On its next regular operation the cam 124 will cause a downward movement of the T-piece, but in the meantime this will have assumed its intermediate position and will simply move down to come into line with the pin 113; and at the end of its downward movement it will spring into engagement with the pin 113 and be ready for the regular operation of dropping the accumulators when the cam 124 strikes the tail 120 at the end of its advance.

In order to prevent the operating sectors from jumping back to their starting point as soon as the accumulators are lifted therefrom by the resetter at the end of this forward stroke, and to hold these sectors long enough for the printing operation to take place, the sectors are held in whatever advanced positions they may take by means of a rack and pawl device for each sector shown in Fig. 14.

The part *t* is projected downward and formed

into a rack 126 with teeth for engagement by a pawl 127 pivoted on a pin 128 and having an arm 129 which is connected to a rod 130, the forward end of which lies alongside of the arm *m* on the main shaft and has a slot engaging a pin 131 on said arm. At the end of its rearward stroke the pin 131 will throw the arm 129 backward causing the pawl to engage the rack and hold it and its sector positively against movement. Thus the forward movement of the sector is permitted easily and at the end of this forward movement the pawl is thrown in to catch and hold the sector. As soon as the arm *m* starts to return forward it releases the pawl. And as soon as any one of the sectors commences a return movement the beveled teeth of the corresponding rack 126 will force the pawl out sufficiently to permit the rack to move down. At the end of the return movement of the arm *m* the pawl is positively thrown out and held out.

This pawl mechanism is particularly useful in the totaling operation and offers no obstacle to the simple recording operation.

Returning now to the totaling operation of the resetter 28 through the T-piece 116, Figs. 12 and 12^a, we have explained that at the beginning of the second forward stroke the T-piece 116 will be thrown downward from the position shown in Fig. 12^a, which will carry the head 112 to the reverse position with the pin 114 down and the pin 113 up. The totaling devices referred to will then allow the T-piece to swing to its intermediate neutral position and the cam 124 will strike the tail 120 of the lever and lift the T-piece into line with the raised pin 113. It will then be completely released by the totaling mechanism and will swing into engagement with 113, thus restoring the parts to the position of Fig. 10, so that when the shaft *j* is given its second backward movement it will assume the position there shown ready for the next operation.

The mechanism for operating the shaft 107 which oscillates the trip resetter 30 is shown in the left end elevation, Fig. 8. The shaft *j* at this left hand end carries an arm 133 with a cam slot 134 in its end engaging a pin 135 on a sliding bar 136 which is guided at its upper end by a pin 137 on the end of the shaft *j* projecting through a slot in the end of the slide 136. The slide at its lower end is pivotally connected to an arm 138 on the left end of the shaft 107 which rocks the trip resetter, the arm 138 being pulled upward and forward by a spring 139. The forward movement of the shaft, looking at this end of it, is clockwise. The bar 136 moves upward (when permitted) according to the shape of the slot 134, and then downward, turning the shaft 107 in a clockwise direction in Fig. 8, or an anti-clockwise direction in Fig. 13^d, which through the cam 91 lowers the arm 92 and with it the trip resetting arm 98, Fig. 16, and then raises this arm just before the end of the stroke. Thus during the middle portion of an advancing stroke the resetting arm 98 has pressed down the tail of the latch 80 and restored the parts to the position of Fig. 16; so that when they come to the end of this forward stroke they will perform the selecting operation as previously described. The trip resetter should be held out of play during the backward movement of the mechanism so as not to interfere with the latter in any way. To serve this purpose I use the pawl 140, Fig. 8, which is held by a spring 141 on its stud in what-

ever position it is moved to. The bar 136 has a stop 142 which in the lower position of the bar may be engaged by the pawl 140. The arm 133 carries a pair of pins 143 and 144 which strike the tail of the pawl 140 just before the opposite ends of the stroke of the arm and shift the pawl to the operative or to the inoperative position. In the starting position the pin 143 has thrown the pawl out. At the end of an advance movement (the bar being down) the pin 144 will strike the tail of the pawl and throw it in the operative position so that it will engage the tooth 142 and hold the bar 136 down. Then on the backward stroke of the main shaft and the arm 133 the bar will remain down, the pin 135 traveling in the lower straight portion of the slot 134, until the parts arrive again at the position of Fig. 8.

Before proceeding to describe the mode of control of the sectors by the cards I will describe the movements of the cards and the feeling pins which find the perforations therein.

The cards A, Fig. 22, stand in the magazine as shown, the latter having its front wall 145 lower than its rear wall 146 for convenience of access. They are pushed forward by a follower 147 connected to a coiled spring 148. The foremost card A is carried forward until it bears against a fixed stop 149 and a movable stop 150, the latter being in fact the pusher which starts the card downward and being provided with a lip 151 projecting inward just sufficiently to engage the foremost card without striking the second one. This pusher has a comparatively short movement, pushing a card down to about the point indicated in dotted lines at A'. The card is then grasped between certain clips and pulled down to a position between the inner plate 150^a and the outer block 151^a both of these being perforated with a hole for each of the pins or for each of the hole spaces on a card. This is the operative position. After an operation the clips pull the card down into the lower magazine 154, similar to the upper one with front and rear walls 152 and 153. A card is also indicated in dotted lines in the operative position at A², and in the discharge magazine at A'. The card A' is held firmly by stops 155 (Figs. 20, 22 and 22^b) on which its lower edge rests, which stops are retracted before each discharge operation.

The pusher 150 is a bar which extends across a pair of hollow posts 156 (Figs. 20 and 20^c) and is connected by pins 157 which pass through slots in the outer sides of the hollow posts to rods 158 which pass down to the lower ends of the posts. The latter are slotted at the lower ends and the rods 158 have offsets 159 (Figs. 20, 27 and 28) passing through the slots and connected by links 160 to levers 161 by which the rods 158 and the pusher are given a short up and down movement. In Fig. 27 I have shown in dotted outline the lower magazine. The pocket operating shaft b carries fixedly an arm 162 (Fig. 28^a) and carries loosely a lever having an arm 163 connected by a spring 164 to the fixed arm 162, the loose lever 163 having also an arm 165 which is connected by a spring 166 to the arm 167 of a lever which is pivotally mounted on a stud 168 and has a rear arm 169. The arm 167 is connected to the lever 161 through an arm 161^a and a universal joint connection 170. The arm 167 also carries an extension 171 with a curved slot at its upper end in which travels a pin 172 on the arm 165. On the forward stroke the shaft b moves in the direction of the arrow tensioning the spring 164

and swinging the lever 163, which tensions the spring 166 and pulls up the arm 167 and the arm 161^a, pulling down on the pusher rods 158 and giving the cards the initial feeding movement desired. On the backward stroke of the shaft b the pins shown in Fig. 28^a engage the ends of their slots and the result is a forcible downward movement of the arm 167 which causes a lifting of the pusher.

The springs shown in Fig. 28^a are for the purpose of permitting the feed-control shaft b to rock without effecting a feed during a totaling operation. A lever 172 connected to the total lever is provided with a shoulder 174 which when a total operation is to be performed is thrust under the arm 169 so as to prevent a downward movement of the latter. The shaft b will still rock, but the only effect will be to tension the springs 164 and 166, without moving the solid parts.

There are four clips indicated at 175 in Figs. 20 and 23, two for the card A' and two for the card A². They travel up and down along the edges of the plate 150^a and the block 151^a and grip the margins of the cards at approximately the lower corners thereof. The block 151^a is omitted from Fig. 20 because with its supports it will obscure the view. It will be understood that the block is located immediately in front of the perforations 176 indicated on the plate 150^a. It will be understood also that the perforations are arranged in lines and columns continuously across the space although for clearness sake only those perforations on the periphery of the space are indicated fully.

The clips are carried in a guide frame comprising tubular members 178 sliding on the posts 156 and connected to each other near their lower ends by a cross-bar 179. Guides 180 grooved as shown in Fig. 20 to receive the edges of the cards are supported fixedly from the lower cross-bar 179 of the guide frame. Each clip comprises a member indicated at 175 and a second member indicated at 181, the tails as well as the lips of which members are drawn together by springs 182. The "flipper" member 181 is fixed on the shaft 177 and the other member 175 is loose on the shaft. The shaft is arranged to rock in order to open the flipper, the members 175 being held in position by means of stops 183 and 184 carried on the clip frame, but these stops are so located as to allow a slight play, and in fact the clips are practically free to adapt themselves to any irregularities in the cards caused by warping or other conditions. The upper clips engage a card A' in the position to which it has been pushed down by the pusher. The lower clips engage a card A² in the operating position. The two sets of clips move down together to shift the cards to the succeeding positions. They move further below the cards and are then turned by their shafts 177 to the position of Fig. 23^a, being so shaped that in this position they will clear the card during their return movement, and are raised back to their starting positions. Just before reaching their starting positions the shafts 177 are turned forward to bring the clips into proper line and are turned slightly more until they bring the tails of the members 175 against the stops 183 and 184, and still further to open the flippers 181, the loose members 175 being stopped by the part 183 or 184. This open position is shown in Fig. 23^b. This takes place just before the clips reach the lower edges of the cards. The movement of

the clip frame upward continues and the jaws of the clips pass up along the opposite faces of the card after which the shafts 177 are released so that the springs 182 close the jaws on the cards and the clips are left free to rock as above described without letting go of the cards or being under any substantial strain.

The grip of the clips is frictional and comparatively light so that when the upper card strikes the stops 155 and when the lower card strikes the bottom of the lower magazine the clips will simply slide off the cards, having a travel slightly greater than that of the cards. The shape of the clips is also such that the lowermost clips striking the rear card in the lower magazine will push it forward and make room for the card carried by the clips.

The clip-carrying frame is raised and lowered by means of an arm 185 on the feed-control shaft *b*, which arm has at its end a slot engaging a pin on the cross-bar 179 of the clip-carrying slide. The mechanism for turning the shafts 177 of the clips is illustrated in Fig. 24 and is actuated by the sliding movement of the clip-carrying frame. The lower shaft 177 is provided with an arm 186 connected by a link 187 with a similar arm 188 on the upper shaft 177. To secure the independence of movement of the clips desired the connection between 186 and 187 is made with a slight slot and the link 187 is held up by a light spring 189. There is a cam 190 with a lug which is engaged (Fig. 24^a) by a hook 191 and which has a cam face engaged by a pin 192 on an upright arm 193 of the upper shaft 177. The cam 190 is mounted on a fixed part 194 of the frame of the machine (see Fig. 20) so that as the clip-carrier rises it will force the pin 192 inward and will turn the shafts 177 first to bring the free members of the clips to a bearing on the stops 183 and 184 and then to slightly open the members 181. Thereupon the pin 192 will strike the latch 191 and lift it, and the cam 190 will swing outward (Fig. 24) and allow the clips to close on the cards by means of their springs 182. When the clip-carrier slides downward the cam 190 will be drawn inward by its spring 195 and automatically caught by the latch 191.

A second latch 196 is arranged, out of the path of the pin 192 but adapted to engage the offset on the cam 190 to hold it. It is operated by a shaft 197 which, as hereinafter described is turned to latch the cam when a totaling operation is to be performed, so as to hold the clips open in their upper positions and thus prevent their feeding the cards; in the ordinary operation of recording single items the latch 196 will remain in the position of Fig. 24 without effect on the clips.

The stops 155 which limit the downward movement of the card and hold it in the operative position have to be moved out of the way as soon as the card is to be discharged. The mechanism for moving this stop is shown in Figs. 22^a and 22^b. It comprises a projection 198 mounted on the cross-bar 179 of the clip-carrier or frame and adapted near the ends of its stroke to strike top and bottom projections 199 and 200 on a slide 201. The stop 155 comprises a pair of pins (Fig. 22^b) passing through holes in the plate 150^a and pivoted on the back of the plate, with tails 155^a spring-pressed toward the plate against the upper end of the slide 201 which terminates in a cam 201^a so that as the slide is raised the stops are drawn back

and as the slide is lowered the stops are thrust outward into operative position. At the end of the upward movement of the clip-carrier therefore the stops 155 are withdrawn so that the card may be carried down freely by the clips. Just before the end of the downward stroke of the clip carriage the slide 201 is struck and throws the stops out to stop the next card in correct operating position.

Feeling pins.—The feeling pins 202 are located in line with the holes 176 (Fig. 22). There may be one pin for each of the holes in the entire block, where it is desired to tabulate items from each of the hole spaces in the card. But where the cards are perforated (as for sorting purposes) for items which are not to be tabulated the pins for these hole spaces may be omitted and similarly the hole 176 in corresponding positions might be omitted. Each pin is provided with a collar 203 against which bears a coiled spring 204 pressing it forward. Bearing on the outer face of each of the collars 203 is a common retracting plate 205, at the two opposite corners of which are guide lugs 206 sliding on pins 207 fixed in bosses 208 which are fixed to the frame of the pocket (Fig. 25). The bosses 208 are fixed to the casting which supports the cards and pins and related mechanism, the upper part of the casting being shown at 209 and the vertical inner side wall of which is shown at 210. Supported also from the part 209 of the casting are lugs 211 which carry a rock shaft 212 with arms 213 (Figs. 22 and 25) having a slotted engagement with pins 214 carried on backward projections from the retracting plate 205. The shaft 212 is operated by an arm 215 connected by a link 216 with an arm 217 on a shaft 218 which is controlled by the pocket-control shaft *b* in the manner shown in Figs. 25, 26 and 26^a. On the shaft *b* is a cam 219, the face of which engages a roller on the end of an arm 220 on the shaft 218. In the stationary position shown the cam holds the arm 220 against the pressure of the feeling pin springs which tend to throw it upward. As the cam is advanced the arm 220 is released and the springs, pressing the pins forward, advance those which find holes in the card. The pins remain in the advanced position only long enough for the reading to be taken therefrom and locked into the mechanism hereinafter described, the pins being then withdrawn to permit the feeding forward of the cards without the necessity for awaiting the operation of the machine (as is the case in those machines which have to hold the pins advanced until the machine takes a reading therefrom and operates under control thereof). The interval represented in the cam 219 is just long enough to permit the intermediate mechanism to take the reading. Thereupon the cam again presses the arm 220 backward, which throws the retracting plate 205 backward and retracts all the pins which have been advanced, leaving the card free for a next feeding movement.

In order to prevent the release of the pins on the backward movement of the cam 219 a locking pawl 221 is provided held by a friction spring 222 in either an operative position engaging the pin 223 on the arm 220 or in an inoperative position out of the path of said pin. The cam 219 carries a link 224 having a slotted engagement with a pin on the latch 221 so that at the end of an advanced movement of the cam 219 the latch 221 will be thrown up to engage

the pin 223, in which position it will remain until the cam has completed its backward movement, at the end of which the slot will strike the pin on the latch and draw the latter out to the position illustrated.

The springs 204 are supported at their rear ends, Fig. 22, by a plate 225 carried at its opposite sides by bars 226 which are supported from the cast frame of this part of the apparatus. The pins which move transmit their movements to the intermediate mechanism by means of collars 227 mounted on the pins and engaging the ends of the levers 228, Figs. 21, 22 and 26^b, which are mounted on shafts 229 passing through the back plate 210 of the cast frame. Some of the pins act directly on the intermediate mechanism above described into which their readings are locked, and all such pins have corresponding levers 228. There are the pins, for example, which determine all the characters on the listed items, the first three lines of Fig. 4. There are others of the pins which act through the intermediation of a finder hereinafter described, and not through levers 228. The levers 228 are held back against the collars 227 on the pins by means of springs one of which is indicated in Fig. 22 at 228^a. There is a similar spring for each of the levers, the others being omitted for the sake of clearness. These springs, therefore, cause the retraction of the levers 228 to their starting positions after each advance and withdrawal of the pins.

The combs and stop pieces are shown separately in Figs. 29 to 36 and in proper juxtaposition in Figs. 21 and 26^b. The reading taken by the various ones of the four feeling pins, either singly or in combination, is translated and used to effect the setting of the type and accumulator actuators in one of ten positions representing the numerals 0 to 9. The mechanism for effecting the translating includes combination combs, the setting of which is controlled by the feeling pins, and stop pieces which are set under control of the combs. On the inner ends of the shafts 229 are arms 230, the position of one of them being indicated in dotted lines in Fig. 22. In the normal vertical position these arms 230 stand in the upward paths of lugs 231 on the forward faces of the several combs 232, 233, 234 and 235 of the corresponding group, the arms 230 being arranged as in Fig. 21 so that each co-operates with only one of the combs. Each of the combs is pulled upward by a spring 236. When a pin of any group of four finds a hole in the card and advances, this pin swings the corresponding shaft 229 and swings the arm 230 out of the path of the stop 231 on its comb, and the latter rises under the pull of its spring a distance permitted by the slots in the ends of the combs engaging the fixed guide pins 237, 238, this distance being one step and being the same for all the combs. The combs are provided with notches 239 in their rear edges, the notches being of different widths and depths. Co-operating with each group of four combs is a group of four stop pieces 240, 241, 242 and 243 pivoted on a fixed pin 244 (see Fig. 33^a and the horizontal section Fig. 29^a) and pulled forward by separate springs 245 and having at their lower ends tails with lateral offsets 246, each of which extends clear across the four combs as shown in Fig. 29^a. Whenever the position of the four combs is such that a notch is left open continuously across their rear edges the offset 246 of the corresponding stop piece will enter this multiple

notch. And according to the depth of the complete transverse notch the stop pieces will swing inward a greater or less distance. It will be observed that the notches are of three different depths. One or more, generally a plurality, of the stop pieces will swing into notches of the combs. In the zero position illustrated in Figs. 29 to 32 the fourth stop piece 243 is free to swing two spaces inward. The third stop piece 242 is held from moving by the comb 235. The second stop piece 241 will swing three spaces inward. The first stop piece 240 is held by comb 233. The elevation, Fig. 33^a, shows the parts in this position. The notches in the combs are so located and designed that they will give a different combination of movements of the stop pieces for each digit, or each combination of pins advanced.

The shaft 244 on which the stop pieces 240, 241 etc. are pivoted, carries at its ends arms 247 (Fig. 21) between which is a bail 248 underlying the horizontal portions of the stop pieces. This bail holds the stop pieces out of engagement with the combs for a period sufficient to permit the latter to find their places under control of the pins. Thereupon the bail is released and the stop pieces are pulled down by their springs into engagement with the combs as above described. After the combs have served their function of determining the movement of the notched stop *q* as hereinafter described the bail 248 is swung upward to restore those stop pieces which were moved. The necessary rocking movement and timing of the shaft 244 is obtained from a cam 249, Fig. 25, which is fixed on the shaft *b*. The shaft 244 has an arm 250 at the end of which is a roller bearing on this cam. The latter, starting from the position shown will hold up the arm 250 and the stop pieces for an interval sufficient to allow the combs to take their places and will then release the arm 250 to permit the described operation. This operation will be reversed on the backward stroke of the main pocket shaft *b*. The pocket mechanism, as stated above, is timed to act somewhat in advance of the sector operating mechanism. It is only necessary that the stop pieces 240, 241, etc. be dropped in time to permit the setting of the notched stop piece *q* before the sectors complete their advance. And, the sector *l* (Fig. 21) having advanced and its pin *r* having caught in one of the notches of the stop *q*, the latter will be held and the stop pieces 240, 241, etc. may be withdrawn without disturbing the notched stop *q*, which will remain in position until the sector *l* rises.

The stop pieces 240, 241, etc. not only transmit the control by the pins to the main mechanism of the machine, but they also lock the combs in the positions to which they have been set by reason of the pins which are advanced. The pins being immediately withdrawn as above described, the combs 232 to 235 and stop pieces 240 to 243 will nevertheless remain in the position to which they have been set until the machine takes the reading from the stop pieces. The combs are reset by means of a bail 251 carried between arms 252 on a shaft 253 shown in Figs. 21 and 25 and 26^b. Referring to the latter figures the shaft 253 has an arm 254 connected to a link 255 which is guided by a slot embracing the shaft *b* and which has a roller bearing on the lower portion of the cam 249. The shape of this cam is such that it will, as the shaft is advanced, first hold the combs

down for a short interval until the arms 230 controlled by the pins are removed from the projections 231 on the front edges of the combs. Thereupon the cam 249 will release the link 255 and allow the upward movement (by their springs) of the combs which have been released by the pins. After this happens the cam 249 will release the arm 250 and the stop pieces 240, 241, etc. so as to let the latter swing into engagement with the combs. On the rearward movement of the shaft *b* the cam 249 first lifts the arm 250 to withdraw the stop pieces 240, etc. and then throws down the link 255 to restore the combs to their lower position.

The notched stops *q* are pulled forward by individual springs 256 and are mounted loosely on a shaft 257, Figs. 14 and 21, which has arms 258 between which it has a bail 259 bearing against the forward edges of the stops. Each stop *q* is made fairly thick or heavy to receive the stroke of the sector and is provided with a thin tail piece *q'* which passes between two groups of four stop pieces 240, etc. freely and has a lateral projection 260 (Fig. 21^a). The stop pieces 240 have notches and projections or shoulders 261 on their lower edges which, when the machine is operated, drop, one or another, into the path of the projection 260 and limit its rearward movement, and thus limit the forward movement of the stop *q*. In Fig. 21 the stop pieces are shown in their starting or zero position to which they have been turned by the bail 248. If zero is to be recorded, the combs remain in the position of Fig. 33^a and the stop pieces 240 swing down as shown in this figure, and the third of these stop pieces presents a shoulder 261 in position to prevent any advance whatever of the notched stop *q*. This is the zero position and the record will be made accordingly.

After the record is made, the restoration will be accomplished by means of the bail 259 on the arms 258. As shown in Fig. 21^b the shaft 257 carries at one end an arm 262 having a pin and slot engagement with a link 263 which is connected as shown in Fig. 14 to an arm 264 on the central shaft *j*. When the shaft *j* rotates anti-clockwise to permit the sectors to advance, the link 263 is carried rearwardly and the springs 256 carry the notched stops *q* forward, pressing the bail 259 in the same direction until each of these stops has assumed its position, the link 263 traveling so far as to bring the forward end of its slot about the pin on the arm 262. On the backward movement of the machine the link 263 moves forward with the main resetter *n*. But the latter engages the tails of the sectors and retracts them through a considerable distance before the link 263 travels the length of its slot and commences to operate the bail 259 to restore the stops *q*; so that these stops *q* are returned only after they have been completely released from the sectors.

The levers *C* and *C'* (Fig. 1) act on the stops *q* through a system of levers and shafts shown in Figs. 8, 17 and 21. These levers are pivoted on a shaft 265, the levers carrying links 266 connected to arms 267 on shafts 268 which are provided with arms 269 extending rearwardly in position to engage pins 270 on certain of the stops *q*. These devices are for the purpose of "locking out" any group of sectors. For example, if the payable premium column in Fig. 4, stating how the premiums are payable, is not desired to be recorded the arm 269 correspond-

ing to the stop *q* of this division will be thrown down by pulling the corresponding lever *C* forward. There are eight stops *q* for this group of sectors. There will, therefore, be eight arms 269 fixed on the shaft and adapted to engage the corresponding eight stops *q*. The holding of these stops prevents any record being made, at the same time that it leaves the pins and combs free to move. The corresponding sectors will move to the zero position (from the minus one starting position) but since the machine will not print zeros at the left of any significant figure, therefore, it will not print when all the type carriers come up to the zero position. In the deferred premium column there are eight decimal places. The second of the shafts 268 is shown provided with arms 269 for cutting out this item. The shafts and arms are shown in plan in Fig. 17. It will be understood that one or more of these groups of stop devices may be used and they may be used to control any desired part of the record.

Totaling.—For totaling, as described above, we require two complete strokes of the machine for each printing operation, the first to restore the parts to their starting positions and the second to operate the racks to turn the accumulators back to zero and thus take their readings from the accumulators (after which there are two supplementary strokes for clearing or restoring the cards to regular listing position). The diagram, Fig. 19, illustrates the succession of operations. The first operation (1) locks the pocket and the card feed and lifts or withdraws any accumulators which were in gear with their operating sectors at the end of the last stroke. During the second interval (2) the sectors advance idly. Then in the interval (3) any desired selection of accumulators is made. If, for example, we are printing the total line on the listing sheet, Fig. 4, there is no literal selection but there is an equivalent operation consisting of the blanking or preventing of the selection of any accumulator in the payable premium column. Or if we are working on the summary sheet, Fig. 4^a, there is during the interval (3) a selection of the annual premium accumulator or the semi-annual or the quarterly, as the case may be. For the usual operation of printing a total line on the listing sheet and then a corresponding line on the summary sheet, we have first the two complete strokes of the machine necessary for the total line on the listing sheet, then two complete strokes for the total line on the summary sheet including only the annual premium, followed by two strokes recording only the semi-annual premium and two strokes only for the quarterly premium. In printing a line on the summary sheet in three successive operations in this way, it will be remembered that after the first operation the accumulators in the group at the left of the payable premium group were turned back to zero. Therefore, in the next totaling operation when we are going to print the total under semi-annual premium, the accumulators at the left of this column will all stand at zero so that the sectors in engagement therewith will have no movement and will cause no printing on the summary sheet.

This selecting movement is accomplished by the advance of the selecting sector *k* and the advance and retraction of the throw-off sector 29 so that the accumulators are unlatched or released from the control of these two sectors, but the wheel set resetter 28 has not been op-

erated and it still holds up the accumulators. Now, the desired accumulators having been selected and unlatched but not dropped, these selecting sectors are given a retracted movement in the interval (4), this being an idle movement. The resetter sector 28 remains idle to the end of the stroke by reason of the disconnection of the T-piece as previously explained. This brings us to the end of the first stroke. The T-piece is then reconnected to the resetter shaft, but in the reverse position; and in the first interval (5) of the second advance the T-piece causes an operation of the resetter and a dropping of the accumulators into gear with the sectors so that when the latter advance they will take their readings from the accumulators. During the next effective interval (6) the sectors advance and are locked by their pawls. Then, at the end of the advance, the resetters which are still reversely connected lift the accumulators out of gear during the interval (7) and in the same interval there is a tripping of the hammers. This done, the sectors are restored (8) by a backward movement, which brings all the parts to their original starting position except that the accumulators are withdrawn beforehand and do not need to be withdrawn at the beginning of the next stroke as usual.

For securing this sequence of operations we require an alternating mechanism which will shift the T-piece 116, Fig. 12, so as to cause the resetting sector to operate at the end of a backward instead of at the end of a forward stroke, and means for selecting in regular order the different accumulators under the payable premium column.

The alternating mechanism which controls the resetter is shown in Figs. 6, 7, 9, 10 and 12. For this purpose a cam 270 is used which throws the T-piece to the left or allows it to swing to the right under the pull of its spring. The cam serves to disconnect the T-piece 166 from the shaft 105 which causes the rocking of the resetting sector. The cam comes into the position of Figs. 7 and 12 at the beginning of the totaling operation and remains so throughout such operation, permitting the T-piece 116 to be thrown over to the left for a reverse operation of the shaft 105, or to stand in the intermediate disconnected position, and preventing the restoration of the T-piece 116 to its regular position until the end of the strokes utilized for totaling. The cam 270 bears on a roller 271 on the T-piece, rocks about a shaft 272, and is operated through a link 273 connected to one arm of a lever 274 which rocks about a supplementary shaft 275 (which I call the totaling shaft because its operation controls most of the movements which are peculiar to totaling). The lever 274 is connected to a hook 276 which is normally (when the shoulder 277 moves down) to the left of the position of Fig. 7 so as to be clear of a shoulder 277 on the lever 118 and to be without effect on the cam 270, leaving this in the position of Fig. 6 and leaving the T-piece 116 always in engagement with the pin 113. This hook 276 is thrown into engagement with the shoulder 277 by means of a link 278 under control of the finder (hereinafter described) when a total is to be taken. That is to say, during an ordinary operation the finder pulls the link 278 to withdraw the hook 276 from the path of the stop 277 before each downward movement of the stop; but at the beginning of a totaling operation the finder leaves the hook 276 under

the shoulder 277. The hook 276 being in engaging position, the cam 124 in the first part of its forward stroke will swing the lever 118 and pull down the hook 276 and pull up the link 273 so as to shift the cam 270 to the position of Fig. 7.

A spring flipper 279 is mounted on the cam 270 in position to engage the pin 113 as the cam is rotated anti-clockwise and as the T-piece is withdrawn, to throw the pin down and to rock the shaft 105 in the direction to withdraw any accumulators. When this movement has taken place, the lever 274 is locked by the engagement of the shoulder 280 on its upper arm engaging a locking pawl 281, this pawl being released only at the end of the totaling operation and the supplementary or restoring operations as hereinafter described.

The parts being in the position of Fig. 7, the continued advance of the cam 124, at the end of which the lever 118 is rocked backward, will be without effect on the shaft 105, merely lifting the T-piece 116 to a position where its left hand notch is in line with the left hand pin 114. At the end of the backward stroke however the T-piece 116 will be thrown to the left to engage the pin 114, by the following mechanism. The T-piece has a pin 282 (Figs. 6 and 9) located in a slot in the end of a link 283 which is connected to an arm 284 having a pin and slot connection with a link 285 pivotally connected to the lower end of a plate 286 (Fig. 9a) mounted to rock on a pivot 287 and designed to produce an alternating movement of the arm 284. The plate 286 is provided with flippers 288 and 289 at its opposite sides connected together by a spring 290 and adapted to cooperate with pins 291 and 292 (Figs. 9b) on a plate 293 oscillating about a pivot 294 and pivotally connected to a hook 295. The hook is used to swing the plate to the left and a spring 296 pulls it to the right.

The hook 295 is normally held up as in Fig. 6 by means of a link 297, and pulled down by its weight, the link 297 being pivotally connected at its upper end to the lever 274. After the first movement of the cam 124 has swung the lever 118 to pull down the hook 276 and thus to shift the T-piece 116 to its middle, inoperative, position, the hook 295 drops to the limit allowed by its pin and slot connection with the link 297, and a pin 298 on the cam 124 slides under the end of the hook without effect. Near the end of the backward stroke (dotted line position, Fig. 9) of the cam 124, the pin 298 catches the hook 295 and pulls it to the left. At the moment when the pin 298 engages the hook the parts are in the position of Figs. 6 and 9. The action of the pin 292 on the flipper 289 will rock the plate 286 in the direction of the arrow, pulling the arm 284 and the link 283 to the left and shifting the T-piece (which has been raised to the level of the pin 114 as previously described) into engagement with the pin 114. The lever 284 will be caught by the spring pawl 299 and held in this position. Thus at the end of the first backward stroke the T-piece is restored to its engagement and ready on its next downward movement to swing the shaft 105 in a direction opposite to that produced in the ordinary operation of the machine.

Now at the beginning of the second forward stroke of the machine, the cam 124 acting through the flipper 121 will swing the lever 118 and throw down the T-piece 116 and rock the left hand end of the head 112 downward and

swing the shaft 105 in an anti-clockwise direction; which will move the resetters in a direction to release those accumulators which have been selected and allow them to drop into gear.

5 And at the end of this second forward stroke when the lever 118 is turned in the opposite direction by the cam 124 the reverse movement of the shaft 105 will take place and the selected accumulators will be withdrawn. And the return of the cam 124 will be without effect on the lever 118 and the T-piece 116.

I have shown that on the backward stroke of the cam 124, that is at the end of the first backward stroke, the hook 295 was operated to throw the T-piece into its left hand position, the arm 284 being then locked. Now as the cam 124 starts on its second forward stroke, the hook 295 is released for movement toward the right and is moved in this direction, maintaining its engagement with the pin 298, by means of the spring 296 pulling on the plate 293. In this movement of the plate 293 the pin 292 will simply swing the flipper 289 back to the position of Figs. 6 and 9; and the pin 291 will strike the flipper 288, swing it to the right and engage the notch in its end. This is a common mechanism in this type of apparatus. The movement of the plate 293 to the right does not move the plate 286 but merely brings the flipper 288 to operative position so that the pin 291 cannot move backward without pressing the flipper 288 upward with a toggle motion. Since the plate 286 does not move, the link 285 and the arm 284 are also stationary. Now at the end of the second backward stroke of the cam 124 the hook 295 is pulled again to the left, the pin 291 forces up the flipper 288 and rocks the plate 286 back to its starting position. This pushes the link 285 until the slot therein engages a pin 300 on an arm of the pawl 299 and withdraws the pawl from engagement with the arm 284, so that the T-piece 116 can be pulled to the right by its spring 117, restoring the parts to the position of Fig. 7.

45 Thus it will be seen that at the end of the first backward stroke the alternating oscillating plate 286 is oscillated in the clockwise direction, and at the end of the second backward movement of the cam 124 the same plate 286 is oscillated in the reverse direction. Therefore, at the end of the first backward stroke the T-piece is thrown into its position of engagement with the left hand pin 114 of the head 112 for totaling and at the end of the second backward stroke it is released therefrom and restored to its neutral position in Fig. 7.

We have now to restore the T-piece completely to its normal position of engagement with the pin 113 by withdrawing the cam 270. This is done through a total releasing shaft 301, Figs. 6 and 7 (the opposite end of which is shown in Fig. 8). By an automatic mechanism hereinafter described, this shaft 301, is given a movement counter-clockwise in Fig. 7 after all the totaling operations have been performed and during the supplementary or clearing operations.

The shaft has an arm 302 connected to a link 303 which in turn is connected to an arm 304 of the pawl 281 by a pin and slot connection, the link 303 being pulled down by a spring 305; therefore, when the shaft 301 is turned in the direction of the arrow, the pawl 281 will be withdrawn from engagement with the shoulder on the lever 274, and the latter will be restored to its starting position by the pull of its spring

306. The restoration of the total lever 274 to its starting position, however, does not take place until during the second clearing operation, after the finder has been reset to the position corresponding to the new card; so that in the first following operation the finder will be in the "agreeing" position and will cause an ordinary listing operation of the machine.

The mechanism which during a totaling operation selects and performs various other functions is shown chiefly in Fig. 8. The control is effected by certain discs mounted loosely on a pair of shafts 307, 308, the discs having certain notches and stops by which they produce the desired movements. The carriage controlling discs are of the shape shown at 309^a and 309^b and the accumulator selecting discs of the shape shown at 310^a and 310^b, these being referred to generically by the numerals 309 and 310. For convenience I have shown only one disc of each sort in Fig. 8. As a matter of fact, and as will appear from the plain views in Figs. 8^c and 17, the shaft 308 carries a pair of accumulator selecting discs 310, and also a pair of carriage controlling discs 309 (one for lifting and one for laterally shifting) and the shaft 307 carries a pair of accumulator selecting discs 310. The discs of the set on the shaft 308 all rotate together. And the discs of the set on the shaft 307 all rotate together. Those on one shaft are held locked while those on the other shaft rotate. According to the kind of record we wish to make, we may use one shaft or the other. Each set of discs determines a complete succession of totaling operations on the machine. The discs on the shaft 308 are designed to give the necessary succession of movements for first printing a total line on the listing sheet as in Fig. 4 and then in three successive operations printing a line on the summary sheet as in Fig. 4^a. The discs on the shaft 307 are designed merely to print a total line on the listing sheet as in Fig. 4, restoring the machine to normal after one totaling cycle as in the time diagram in Fig. 19.

For a complete set of total operations, such as the four printings involved in making the listing and summary sheets in Figs. 4 and 4^a, the discs 309 and 310 are arranged to make a half revolution. They may be shaped and operated so as to effect a complete cycle of printing operations in one revolution of the discs, or in any even fraction of a revolution. Their movement is produced by certain racks and pinions driven from a shaft 311, the driving mechanism for this shaft (at its opposite end) being indicated in Fig. 6. This shaft has an upward arm on the end of which is a pin 312 bearing on a cam 313 carried on the shaft *f*, and pulled forward by a spring 314. The shaft 311 has also a lower arm 315 which during the normal operation of the machine is prevented from moving backward by striking a spring-urged pawl 316 pivoted on the stud 317 and having a tail 318 which is in the path of a shoulder 319 on a bar 320 which is pivotally connected at its upper end to the lever 274. When this lever is swung during the first part of a totaling operation the bar 320 presses down the tail 318 of the spring stop and releases the tail 315 of the shaft 311, this condition continuing as long as the totaling operations are going on. The shape of the cam 313 causes a rocking of the shaft 311, the arrow in Fig. 8 indicating the direction in which the shaft turns during the advance of the sectors. On the shaft 311 is an arm 321 connected to a

link 322 which (Fig. 8^a) is pivoted to an arm 323 which rocks on the shaft 307 and carries a spring pawl 324 adapted to engage a ratchet 325 fixed on the sleeve on which the group of discs 310 is mounted; so that at each oscillation of the shaft 311 the discs are advanced a distance of one tooth. There are eighteen teeth on the ratchet 325. The four printing operations provided for, each of which involves two strokes of the machine and two oscillations of the shaft 311 and a supplementary clearing stroke hereinafter referred to of which only the first half is operative, the pawl 324 being lifted after the end of such half stroke, will mean nine oscillations of this shaft and nine forward steps of the discs; after which this mechanism is thrown out of operation until the next total is to be recorded, during which the next nine teeth are used, the discs being symmetrical about a diameter so as to repeat the same operations for each half revolution. The arm 323 which carries the pawl is connected by a link 326 with a similar arm on the other disc shaft 308, the latter carrying the same ratchet mechanism.

For throwing this selecting mechanism into or out of operative condition I use the hand levers C and C' referred to in the beginning of this specification. The hand lever C is pivoted on the shaft 265 and has an arm 327, the end of which is connected to a link 328 which (Fig. 8) is connected at its lower end to an arm 329 of a cam 330 (see also Fig. 8^a) which is pivotally mounted on the shaft 307 and which bears against a pin 331 on the side of the pawl 324. With the lever C in the position shown the cam holds up the pawl which reciprocates idly thereon. When the lever C is pulled forward (in the direction of the arrow) the cam 330 is retracted and the pawl drops into engagement with the ratchet and operates the discs. Alongside the lever C is the lever C' also pivoted on the shaft 265 and having an arm 332 connected by a link 333 to a similar cam for controlling the pawl on the shaft 308. When a series of totals according to the discs on the shaft 307 is desired the lever C is drawn forward. When a series of totals according to the shaft 308 is desired the lever C is pushed back and the lever C' drawn forward. When both levers are in the backward position shown there is no selection by this mechanism. It merely leaves the selecting and closure sectors free to move as determined by their card controlled notched stops q.

The discs 310 which select the desired accumulators whose totals are to be recorded, are provided with notches at regular intervals and of different radial depths. The selection is caused by the swinging into these notches of lateral projections 335 and 336 on arms 337 and 338 which are mounted on shafts 102 and 99 respectively; these being the shafts which we have shown in Figs. 13, 13^a and 14 and which are rigidly connected to the selecting sectors, the shaft 99 to the selector k at the right of the machine for selecting one of the three payable premium accumulators and the shaft 102 to the sector k at the left of the machine for selecting either of the two main accumulators, said notches permitting said shafts to oscillate and so permitting the sectors to be pulled down by their springs o through distances determined by the extent of movement of the shafts, which distances are determined by the depths of the notches in the discs 310. The shafts turn anti-

clockwise in Figs. 13 and 13^a on the advance of the sectors, or clockwise in Fig. 8.

As has been explained the closure sectors k' at opposite sides of the machine operate together to close out all the debit group of accumulators or all the credit group as may be determined by the "mode of cancellation" perforation in the card. The main selecting sectors k, however, at opposite sides of the machine, operate independently of each other. The one at the right, according as it moves forward one, two or three steps, selects the annual, semi-annual or quarterly accumulator of the group (credit or debit) which has been left open by the closure sector. The sector k at the left differs from that at the right only in that it has two notches instead of three (for each of the debit or credit group) so located that on taking one step forward it selects the list accumulators and on taking two steps forward it selects the summary group (credit or debit) which has been left open by the closure sector at this end. (The closure sector at this end uses also two notches for each group instead of the three notches which are provided on the right hand closure sector.) The policy number and the kind, year and age numbers are not provided with accumulators, the former being controlled by the policy number section of the card and the latter by the finder; consequently these figures in the first column of the record are not controlled by the totaling discs.

The disc 310^a controls the movement of the shaft 102 which is connected to the selecting sector at the left of the machine, which selects the listing accumulator or the summary accumulator. These two accumulators are selected as comparison with Figs. 4 and 4^a will indicate, as follows. For the first printing on the listing sheet, the listing accumulators are selected; for the second printing on the summary sheet, the summary accumulators are selected; for the third and fourth printings both the listing and summary accumulators are closed, that is, they are not used. Each printing involves two operations, each comprising a forward and a backward stroke. Fig. 8^a shows the disc 310^a in the starting position, with a notch 335^a in line with the projection 335, so as to allow of the usual listing selection under control of the card to an extent which is not limited by the disc. The first operation of the machine advances the disc 310^a one step bringing into position under the projection 335 a notch 335^b of depth to allow the selector to advance one step and to select the listing accumulators. On the second operation of the machine the disc 310 advances another step, bringing a full portion under the projection 335 and the only operation is a printing one. On the third operation the disc 310^a advances to bring under the projection 335 a notch 335^c which is deep enough to allow the selector to advance two steps so as to select the summary accumulators. On the fourth, fifth, sixth, seventh and eighth operations of the machine the movement of the disc 310^a merely returns a full portion under the projection 335 and there is no further selection of either the listing or the summary accumulators. On the ninth operation the disc 310^a is carried around a complete semi-circle, bringing it again to normal position, and the tenth stroke has no effect on this disc.

The disc 310^b on the other hand will be

notched as in Fig. 8^d. It limits the movement of the arm on the shaft 99 carrying the sector (K, Fig. 13) at the right of the machine which controls the three accumulators of the payable

premium column (annual, semi-annual and quarterly). There are nine ratchet teeth in each half of the ratchet 325. The first step of the ratchet takes place immediately after the machine starts because the lever 118 (Fig. 6) is rocked and pulls down the hook 276, lever 274 and link 320 which raises the stop 316, and the shaft 311 is rocked forward at once. The projection 336 of the arm 338 lies in radial line with a deep notch 339 in the normal position when the totaling mechanism is inoperative and stationary (so as to permit the projection to swing down without obstruction as the shaft 99 is rocked during normal selecting operations), and is above this notch when the discs commence to turn as in Fig. 8^d. The disc then takes one step forward before there is a selecting operation. This brings the portion 340 of the circumference of the disc under the projection 336, which prevents the latter from moving, which holds the selecting sector stationary so that there shall be no total printed from any of the accumulators in the payable premium section of the machine. The disc then advances two further ratchet teeth on the second and third operations and brings the comparatively shallow notch 341 under the projection 336 so that when the selector sector is released it will advance only one step and will select the first of these three accumulators, say the annual. The disc then advances two more ratchet teeth on the fourth and fifth operations bringing the notch 342 of double depth under the projection 336 and the second accumulator is selected, say the semi-annual. Again the disc advances two steps on the sixth and seventh operations, bringing the notch 343 of triple depth under the projection 336 and causing the selection of the third accumulator, the quarterly. The eighth operation brings a full portion of the disc again under the projection 336.

Besides the four regular pairs of strokes above referred to, there is a pair of supplementary strokes at the end of the total recording operations. During the first supplementary stroke the disc 310 (Fig. 8) advances the distance of one more ratchet tooth and brings one of the projections 367 on the side of the disc against the side of the arm 369 and by the connections previously described gives an initial turning-movement to the shaft 301; so that the shaft is turned in the direction of the arrow, Fig. 7, sufficiently to lift the rod 462 a distance slightly greater than the length of the slot and to cause it to lift the stop arm 461, as in Fig. 7^a and to allow the turning of the shaft 457 which causes a carriage in the finder to take an extra long stroke which is the beginning of its resetting movement for the new card as hereinafter described.

Following the first supplementary movement of the disc 310, Fig. 8, as above described, there is a second supplementary stroke causing an advance of the disc a distance equal to one more ratchet tooth, at the end of which the pawl is lifted so that the disc is not moved by subsequent operations of the shaft of the machine. It is in this second supplementary stroke that the remaining parts of the total mechanism are thrown out of their total taking positions, leav-

ing the machine in readiness for an ordinary listing operation.

The continued advance of the disk 310, on this second supplementary stroke, carries the projection 367 clear over the end of the arm 369 and in doing so turns the restoring shaft 301 further. Fig. 7 represents the position before there was any movement of the shaft 301. In the first supplementary stroke the movement was sufficient to release the shaft 457 leading to the finder. But the upward movement of the link 303 was only sufficient to take up the length of the slot in its upper end. This upward movement is continued during the second supplementary stroke sufficiently to lift the arm 304, withdraw the pawl 281 and permit the total lever 274 to be pulled to the right by its spring 306; bringing the total lever and connected parts to the position of Fig. 6.

On the shaft 308 there are similar discs 310^a and 310^b, notched in the same way as the discs on the shaft 307. The shaft 102 has an arm 345 with a lateral projection 346, and the shaft 99 has an arm 347 with a lateral projection 348. These lateral projections are in position to enter notches in the discs 310^a and 310^b on the shaft 308. As stated before the discs on one shaft 307 are held stationary in the zero position when those on the other shaft 308 are being used, and vice versa. These discs on the shaft 308, therefore, serve to control the action of the accumulators in the same way as those described on the shaft 307. When a report controlled by the shaft 307 is to be made there will be no summary sheet used, nor any lateral movement of the carriage, but only the usual line by line upward movement of the listing sheet. The total disc on this shaft 307 may also be varied so as to secure various other styles of report, such for example as sub-total reports, the summary accumulators and the operations in control of the discs on the shaft 308 being used only for securing a grand total when desired. The use of two accumulators, one for listing and one for summary printing has this advantage of adaptability to taking sub-totals and grand totals and has also, even where such a distinction is not desirable, of providing a better mechanical arrangement for working first on the listing sheet and then on the summary sheet. In this use also they serve as a very good check on each other.

In addition the group of discs which are moved together on the shaft 308 comprise carriage controlling discs indicated in Fig. 8^c at 309^a and 309^b. The disc 309^a serves to produce an upward movement of the carriage which throws out the listing sheet and substitutes the recording sheet. The disc 309^b accomplishes the lateral shift of the carriage. In angular arrangement the two discs are located as indicated in Figs. 8 and 8^c. We have explained in connection with Figs. 14 and 15 that the lifting and lowering cams are mounted on a sleeve 43 driven by a ratchet and the laterally shifting cam 45 is on a shaft 44 which is turned by a ratchet 48. These ratchets 48 and 47 are indicated in Figs. 8 and 8^c in connection with the mechanism for turning them, which mechanism receives its movement from the discs 309. The operating means of the two ratchets is identical, the difference in result being dependent on the shapes of the controlling discs.

The ratchet wheel 48 is driven by a pair of spring pawls which alternately engage the ratch-

et wheel so as to advance the latter on both a forward and a backward stroke. The lower spring pawl 349 is shown in its advanced position. It is carried on an arm 350 which oscillates on the shaft 44 and which is connected by a link 351 to an arm 352 on the oscillating main shaft *j*. A cam 353 is provided in the path of a lateral pin on the toothed end of the pawl 349 for throwing the pawl out of engagement when the pawl is retracted and thus preventing its springing into the next tooth of the ratchet, this cam being also mounted to turn on the shaft 44 for adjustment to operative or inoperative position and connected by a link 354 with a lever 355 pivoted on a bracket 356 fastened to the left hand side of the frame of the machine and carrying a roller 357 which rides on the periphery of the disc 309^b; so that the roller may be lifted by projections on said disc and the link 354 pulled down to throw the cam out of its normal position in which it renders the pawl inoperative; a spring 358 serving to retract the link and cam when the disc permits.

The second pawl 359 for actuating the ratchet wheel 48 is mounted on an arm 360 rocking on the shaft 44 and connected by a link 361 to the arm 352. It is shown in its rear position and held up by its cam 362 out of engagement with the ratchet. These two pawls 349 and 359 serve to advance the eight-toothed ratchet one step for each oscillation of the main shaft *j* and arm 352, each pawl advancing the ratchet half the length of one tooth, the pawl 359 operating on the right hand half of the stroke and the pawl 349 on the left hand half of the stroke. The cam 362 is mounted on the same member with the cam 353 so that these two cams operate simultaneously to render both pawls inoperative or to release both pawls.

The second disc 47 is controlled by two pawls and links exactly identical with those which operate the ratchet 48. Fig. 8 shows the link 363 for operating the cams which release the pawls of the second ratchet 47, the link 363 being pulled upward by a spring 364 and having its lower end connected to a lever 365 pivotally mounted on the bracket 356 and having at its inner end a roller 366 which bears on the second disc 309^a. The contour of this disc is shown separately in Fig. 8^f.

The cams 353 and 362 for both ratchets normally hold the pawls up so that there is no movement of the carriage. This position is maintained until the total line on the listing sheet is printed. At the end of this time a projection 366^a on the disc 309^a will register with the roller 366 and will cause a throwing of the cams out of operative position, allowing the pawls to function, and a turning of the ratchet 47 sufficiently to elevate the carriage, after which the cams will be again shifted to prevent further movement of the ratchet until the three printing operations have been performed on the summary sheet, after which the projection 366^b will again withdraw the cams and the pawls will be dropped into engagement with the ratchet 47 to cause a lowering of the carriage. Each quarter revolution of the ratchet 47 will shift the carriage from the lower to the upper position or vice versa, so that only two steps of the eight-toothed ratchet 47 (accomplished by two complete oscillations of the shaft *j*) are necessary to make a shift.

After the carriage has been raised the ratchet

wheel 48 will be held stationary long enough to permit the first printing on the summary sheet, including the amount under annual premium. Thereafter disc 309^b will bring its first projection to bear under and to lift the roller 357, withdrawing the cams 353 and 362 from their pawls long enough to ensure a quarter turn of the ratchet 48, and will produce a shift of the carriage to the left and a holding of it there long enough for the printing of the amount in the semi-annual premium column. Again the disc 309^b will advance and its second projection will engage the roller 357 and cause a further quarter turn of the ratchet 48 and a shift of the carriage to bring it to position for the printing of the amount in the quarterly premium column. The machine will then have executed the eight strokes required for the four printings. On the supplementary clearing stroke the ratchet 48 will be turned again through a quarter revolution, shifting the carriage one step to the right. And the second supplementary clearing stroke will shift it entirely to the right, that is to its regular printing position.

When the discs on the shaft 307 or those on the shaft 308, whichever set is being used, come to the end of a half revolution they stop the totaling operation. For this purpose there are tappets 367 and 368 on discs on the respective shafts in position to strike arms 369 and 370 which are connected to levers 371 and 372 pivoted on studs 373 and 374, which levers are connected to each other by a link 375. The lever 372 is further connected by a link 376 with an arm 377 on the shaft 301 which is shown in Figs. 6 and 7 to be connected through the link 303 with the arm 304 of the pawl 281 which locked the lever 274 in the totaling position. At the end of a half revolution of the discs therefore the shaft 301 will be turned in the direction of the arrow in Fig. 7, and in the opposite direction in Fig. 8, to lift the link 303 and release the lever 274. The latter will be drawn back to the position of Fig. 6, lifting the cam 270 out of the way of the T-piece 116 and lifting the link 320. But before the lifting of the link 320 it is shifted to the right as soon as the discs have completed their movement, by the turning of the shaft 301 as before described and through the arm 378 and link 379 which is connected to the lower end of the bar 320. This will free the tail 318 of the locking device 316 and allow the latter to shift to its operative position to prevent further movement of the shaft 311 which actuated the discs.

In totaling (that is, in recording totals) there are no carrying operations from a lower to a higher decimal place. In the normal operation we have explained that the operating racks *y* (Fig. 14) are permitted to have an additional backward movement beyond the zero position to what we have called the minus one position. The racks are connected by pins and slots to the sector and are provided with pins 19 (Fig. 14^a) on their inner edges engaging ears 20 on the curved bar 21 which is also slotted as at 22 and travels on pins carried by the sector and is pulled backward by a spring 23. When a rack strikes a carrying stop and is thus stopped in the zero position on its backward movement, the bar 21 will be carried back with the sector by the action of the spring 23. But, the racks being held in the zero position, the springs *y'* will be stretched, and if the racks do not strike the carrying stop the spring *y'* will cause them to

take the additional backward step with the sector so as to carry one to the next higher decimal place. In totaling, however, there is no carrying from one decimal place to another and the racks must be prevented from following the backward movement of the sector from its zero to its minus one position. To prevent this the bar 21 is stopped on its backward stroke at the zero position, and the lugs 20 engage the pins 19 and also stop the racks at the zero position.

For thus stopping the bar 21 during a totaling operation a movable stop 380 is mounted on an arm 381 on a shaft 382, the operating mechanism of which is shown in Figs. 6 and 7. The shaft 382 has at its right hand end an arm 383 which is connected by a link 384 to an arm 385 turning on a shaft 386 and connected with an arm 387 carrying a link 388 connected by a pin and slot to the lever 274 and also by a spring 389. When the total lever 274 is swung around to the position of Fig. 7 the link 388 is pulled forward by its spring 389 and the shaft is pressed in a clockwise direction so as to press up the stop 380 (Fig. 14). Then as soon as the sectors advance the stop 380 is thrown up and when the sectors return a lug 390 on each bar 21 strikes the stop and holds the bar in the zero position which in turn holds the racks in the same position. Now at the end of the totaling operations the lever 274 is swung around to the right as in Fig. 6 and throws the link 388 and the shaft 382 in the opposite direction to remove the stop 380 and permit the free movement of the bar 21 and the racks γ .

The accumulators may have to carry amounts of more decimal places than are on any one section of the card. If, for example, a section of the card will carry at most four decimal places there may be six decimal places on the corresponding accumulator. These two extra adding wheels on the accumulator will not be operated from the card. But for the purpose of taking a total from such accumulator there must be rack-carrying sectors corresponding to the extra decimal places, similar in all respects to the operating sectors and racks heretofore described except that they are not subjected to any control from the cards. During a normal operation these supplementary sectors are permitted to have a movement from the minus one to the zero position and are limited to such a movement by means of hooks 391, Fig. 14, which swing under pins 392 on the supplementary sectors with just sufficient clearance to permit a movement of one step forward. But these sectors during a totaling operation have to swing through a distance corresponding to the position of the adding wheels with which they engage. To permit this the hooks 391 are withdrawn during a total operation. This hook is fixed on a shaft 393 which has a forked arm 394 pulled up by a spring for the totaling operation but depressed by the bar 380 during a normal operation.

In the ordinary operation of the machine the hammers act to print on each revolution. In totaling however there is a printing operation only once for two revolutions. The hammer releasing mechanism, must be suppressed for alternate revolutions during totaling. The means for suppressing the hammer mechanism on alternate revolutions during totaling is illustrated in Figs. 6, 14 and 14^a. The arm 284 previously described is oscillated alternately and this arm therefore provides a convenient means for sup-

pressing the hammer releasing mechanism during alternate revolutions. The lever 284 is loosely mounted on a shaft 284^a to which are keyed or otherwise secured two levers 284^b and 284^c. The lever 284^b has a laterally bent ear 284^d arranged to be engaged by the lever 284 as it is oscillated, and the lever 284^c carries the pin 284^e which projects into a slot 284^f in the enlarged end of the slide 284^g. A second slot 284^h of the shape shown in Fig. 14^a is formed in the slide. The slide is moved back and forth by an arm 106^a secured to the shaft 106 which shaft has an alternating movement imparted to it. A link 61^a secured firmly to the shaft 61 is provided at its lower end with a pin 61^b which projects into the slot 284^h.

In operation, as the lever 284 is rocked in the direction of the arrow, it will contact with the lug 284^d on the lever 284^b thus swinging it and turning the shaft 284^a in a clock-wise direction which will cause pin 284^e to raise the slotted slide 284^g. This will bring the slot 284^h into such a position that the shoulder formed therein will be in position to engage pin 61^b of the lever 61^a. The shaft 106 will now be rocked and through the levers 106^a and 61^a will cause the shaft 61 to be rotated in a counter-clock-wise direction which will cause hooks 58 (Fig. 14) to engage the lugs 56 thereby tripping the hooks 54 which engage the tails 53 of the hammers α ; thus causing the hammers to operate as previously described.

When the pin 61^b is at the top of the slot as indicated in Fig. 14^a it is clear that the hammer mechanism will not be effected by the oscillation of the lever 106^a and as the lever 284 is actuated alternately it is clear that if during one stroke the pin 284^e holds the slotted member in the position shown, and during its subsequent stroke it raises this member, into position to engage the pin 61^b, the hammer releasing mechanism will be suppressed for alternate revolutions during the totaling operations.

Finder.—The finder, as we have said above, finds out that the card presented in operating position differs from those which have gone before in respect to one or perhaps a plurality of classifications. And when such a change in classification is found the finder automatically sets the machine for totaling the group of cards which have passed. The finder may be set in an entirely inoperative position so that whatever cards pass through the machine will be recorded in succession on the listing sheet. Or the finder may be set by levers B, B', Fig. 1, to be operative for certain classes and inoperative for others. For example, taking the card of Fig. 2, the classification items which I have used are those entitled "kind" "state" "year" and "age". There may be one lever B, B', for each of these classes. Or one lever may be used for a group of classes. As I have used the machine, and as indicated in Fig. 4 the classes "kind" "year" and "age" are controlled by a single lever B and the class "State" is controlled by the lever B' (which stands in the neutral position where it, and the machine, are unaffected by the "state" indicated on the card). When the lever B is advanced, therefore, any change in either of the three classes "kind" "year" or "age" will be found automatically and the machine will be caused to go through a cycle of totaling operations. In the example shown, I have supposed the cards sorted according to "kind" "year" and "age"

and have put into the machine all those of say kind "402", year "16", meaning the year 1916, and all ages in succession; those of the lowest age first, followed in succession by those of successively higher ages. With the finder as described, when all the cards of one age (age 30, as shown in Fig. 4) have passed they will be totaled and the listing of those of the next age will follow. The purpose of setting the finder for the kind and the year also is to automatically detect any error in the sorting of the cards under these classifications and by the same means the machine will find any card representing an age which is different from those among which it ought to be placed. The same mechanism enables the finder also to locate and call attention to any card which has been improperly punched under any of these three classification headings.

The operation of the finder will be understood from Figs. 37 to 37c, which show one element of it controlled by a group of four of the pins 202. All pins of the classifications which control the finder are connected to elements similar to that shown and located in the adjacent vertical planes. For each group of four pins 202 in a column there are four pin combs 394, 395, 396 and 397. Fig. 37a, located alongside one another as in Fig. 37c and each connected to the rear end of one of the pins. The several combs are mounted between transverse plates 398 and 399 extending across the casing and having longitudinal slots engaged by ears on the upper and lower edges of the combs to guide the latter. And a rod 400 extends similarly across the frame and through slots in the combs to guide them. When any one of the pins 202 finds a hole in a card and advances to the right, it carries with it the comb to which it is attached. The combs are provided on their upper edges with offsets 401 and 404. Stops 402 are adapted to engage the offsets 401 and stops 405 to engage the offsets 404, see Figs. 37 and 40. The stops 402 are mounted on arms 403 fixed on a sleeve 403a mounted to turn on a transverse shaft and provided with an operating arm or lever B' by which the stops 402 can be raised or lowered. Similarly the stops 405 are mounted on arms 406 on a sleeve 406a having a bent operating arm B. The stops 402 are shown in Fig. 40 co-operating with the pins for "kind" "age" and "year" and with the stops 405 with a "state" group of pins and the method of cancellation pins. When the two levers B and B' are in their forward positions all the finder combs are locked, the pins connected to them cannot advance through the holes in the card, and there is not only no selection under the control of these pins, but no recording of the numbers represented by perforations in the corresponding sections of the card. In the case shown the lever B' is pushed back to the left (the lever B standing in its forward position) and the finder combs which correspond to the "kind" "year" and "age" sections of the card only are free to move; so that the finder will respond only to these sections of the card. When any set of finder combs which has been in use is to be locked out of use, all the pins will be retracted by the operator's pushing up the link 216, Fig. 22, by hand, after which the pushing forward of the levers B and B' will lock the corresponding parts of the finder. Those combs 394 to 397 which are freed as de-

scribed and whose pins can find holes in the card advance at each operation of the machine and are followed in their advance by feelers 407 which are pivoted at their upper ends on a shaft 408 and pulled forward by springs 409. The shaft 408 extends transversely across the mechanism, being supported at its ends in arms 410 which are fixed on a shaft 411 which at its inner end carries an arm 412 connected to a link 413 which (Figs. 5, 6, 6a and 7) is connected to a horizontal lever 414, the opposite end of which is bent up vertically and pivoted to the link 278 which, as we have previously shown, serves to push and hold the hook 276 into engagement with a shoulder on the lever 118 so as to cause the pulling down of the hook and the turning of the lever 274 when the totaling operation is to be started. The connection of this hook to the shaft 408 of the finder causes the link 278 to be pulled to the left as in Fig. 6a and the hook to be withdrawn, so as to prevent a totaling operation, whenever a card is of the same classification as the previous one; and causes the hook to remain in totaling position otherwise; as described below. Returning to Fig. 37, the feelers 407 carried on the shaft 408 follow any of the combs 394 which have advanced, and thereafter a spring pressure is exerted on the shaft 411 in an effort to rock it so as to push the feelers 407 down. The rocking movement of the shaft 411 (when such rocking movement is not prevented by the positions of the feelers 407) is produced by the mechanism in Figs. 22 and 38. Referring to Fig. 22 it will be seen that the arm 213 has a slotted engagement with the pin 214 carried by the pin retracting plate 205. On the first part of the movement of the arm 213 the springs are allowed to push the pins and plate 205 forward to the limit. Thereafter there is a continued movement of the arm 213 through the distance permitted by the slot. The arm 213 at the far side in Fig. 22 is pivotally connected to a rearwardly extending link 414, the rear end of which is shown in Fig. 38 having a spring 415 connecting it to a slide 416 guided by slots engaging pins on the link 414 and having a pin 417 which at the end of the first part of the advance of the link 414 will strike an arm 418 on the shaft 411, a spring 419 being used to retract this arm against a stop pin 420. The first operation of the advance of the link 414 will bring the pin 417 into engagement with the arm 418, the pins in the meantime passing through the holes in the card. The continued motion of the link 414 will, through the spring 415, tend to pull the slide 416 and the pin 417 and arm 418 and to turn the shaft 411 in a direction to throw down the feelers 407 and thus to prevent a totaling operation. If these feelers are free to move downward, as they are when the card is of the same classification as the preceding one, the shaft 411 will turn and throw the link 413, which will pull the link 278, Fig. 7, and pull the hook 276 out of operative position and will thus prevent a totaling operation and cause a regular operation. But, if the new card is of a different classification the feelers 407 cannot move down and the shaft 411 cannot turn, and the link 413 will remain in the position shown in Fig. 6a and the hook 276 will be in the path of the stop 277 so as to be pulled down at the beginning of the stroke of the machine and to cause the starting of the sequence of totaling operations above described.

As soon as the hook 276 pulls the totaling lever 274 down the latter is caught by the pawl 281 and held with its various connected parts which determine the totaling operations until the pawl 281 is withdrawn as previously described by the mechanism in Fig. 8 which causes the necessary sequence of total takings and of two clearing strokes, during the second of which the pawl 281 is withdrawn. Therefore, until the sequence of operations involved in totaling and restoring is completed the failure of the feelers 407 to move down and the failure to withdraw the hook 276 will have no effect. The totaling sequence once started will continue to the end. At each revolution of the main shaft the feeling pins will move into and out of the new card and the rod 414 will be advanced and withdrawn, the spring 415 yielding to permit such advance without the turning of the shaft 411; and the grippers which accomplish the feed of the cards will be held open as long as the machine is in totaling position.

In order to permit the feelers 407 to move down during a regular operation and to prevent them from moving down during a totaling operation, and to insure that this totaling operation shall show the classification of the last previous card rather than that of the card which has caused the finder to operate, I use what I call "locked combs" 421. These are all substantially identical. They are mounted in a carriage having opposite side walls 422 connected together by horizontal partitions 423, 424 and 425 with longitudinal slots in which are guided lugs or ears on the several combs; the carriage being provided with pins 426 which travel in longitudinal slots in the side frames of the finder casing. The locked combs are pulled forward by individual springs 427 fastened to cross pieces 428 in the carriage. The carriage is also provided with a transverse rod 429 serving as a guide for the combs therein and the far end of which is connected to an arm 430 mounted on a transverse shaft 431 the lower end of which arm is connected by a pin and slot to a link 432 pivotally connected to an arm 433 on a shaft 434 which carries at its far end an arm 435 connected, as shown in Fig. 38 to the link 414. The first part of the forward movement of the link 414 will release the locked comb carriage by reason of the slot in the link 432. As soon as the carriage is free to do so it will be pulled to the right by its spring 470 and the carriage and the locked combs therein will be moved forward one step to the position shown in Fig. 37^b. This movement is limited to one step by the shoulder 468, Fig. 39, which is normally in the path of a pin 469 carried on one side of the carriage, which shoulder is withdrawn for a resetting operation as described hereinafter. The tops of the locked combs 421 are provided with upward projections 436 and 437 between which is a notch 438. When the parts are in the starting position of Fig. 37, the projection 437 lies under the feeler 407 and prevents a downward movement thereof. When the carriage is advanced to the position of 37^b, assuming that the locked combs are in the same relative position as before and in the same relative positions as the pin combs, the notches 438 will all come under the corresponding feelers 407 and the latter will be permitted to move downward and the shaft 411 to rock and prevent the starting of a totaling operation. If on the other hand, for the

position of the carriage shown in Fig. 37^b, any one of the upper set of combs is advanced and the corresponding one of the combs 421 is not advanced, then the projection 437 of such comb will come under its feeler 407, the latter will not be permitted to move down, and the shaft 408 will be held up so that the shaft 411 will not turn and a totaling operation will be commenced. Similarly when a pin comb 394 to 397 does not advance and its locked comb is in an advanced position the projection 438 will prevent the feeler 407 from moving down and will cause the commencement of a totaling operation.

Assuming that the locked combs 421 have taken their position from the first of a lot of cards, all of the same classification, they will be held relatively immovable in the carriage 422 as long as cards of the same classification are passing, and the movement of the carriage and combs will be limited to that from Fig. 37 to Fig. 37^b. Consequently after the feeding pins 202 enter a first card and determine the positions of the finder combs 394 to 397 and corresponding positions of the followers 407 each succeeding forward movement of the carriage 422 will bring the locked combs to points where the notch 438 of each will be, as before, immediately under the tail of the corresponding follower 407. When a card of another classification is presented one or more of the feelers 407 will take a new position where its tail will not register with the notch 438 of the corresponding locked comb, the rocking of the shaft 411 will be prevented and a totaling operation will commence.

At the end of the entire cycle of totaling operations, that is during the supplementary, clearing operations, the locked comb carriage will again take not only its ordinary one step movement, but an additional forward movement necessary to find the new combination. But this card of new classification which has arrived must not control the printing of the classification, because the total is to be of the previous classification. The classification sectors of the machine are, therefore, controlled by feelers which take their positions from the locked combs which contain the combination of the last previous card before these locked combs are shifted to positions corresponding to the new card. For this purpose sector controlling feelers 441, one for each of the locked combs, are adapted, when a total is to be printed, to swing forward and feel for the positions of the locked combs, these feelers being swung forward by springs 442 acting on their lower ends and being connected by links 443 with arms 444 on shafts 445 passing transversely through the inside wall of the pocket and controlling combs and sectors identically the same as the other combs and sectors illustrated in Fig. 21.

The feelers 441 are held out of operation (and reset after an operation) by means of a resetting rod 446 carried on arms 447 fixed on the shaft 448 on which the feelers are pivotally mounted, this shaft having an arm 449 connected by a pin and slot with a link 450 which is connected to the arm 433 which moves backward as previously described immediately after the pins move forward through a card; thus releasing the feelers 441 from the resetting rod.

But actual movement of the feelers 441 takes place only when a card of different classification comes into operative position and a total is to be struck. For holding the feelers out of

operation during the running of cards of the same classification through the machine, one of the arms 447 is provided with a pin 451 which bears on the end of a stop arm 452 mounted on a stud 453 in the inner side wall of the frame. The inner side wall 453^a is indicated in dotted outline in Fig. 39, the parts illustrated in full lines being located beyond the side wall and being either supported on the wall or connected with the carriage and other movable parts and projecting through slots in the wall; the outlines of such slots, as well as the outlines of the carriage and other parts within the wall, being dotted. The stop arm 452 is connected with an arm 454 which is pivoted to a link 455 which is connected at its upper end to an arm 456 on a shaft 457 which is turned in the direction of the arrow at the beginning of a cycle of totaling operations and backward to its starting point at the end thereof. The mechanism for actuating the shaft 457 is shown in Figs. 6 and 7. The shaft has an arm 458 which is pulled backward by a spring 459 and at the end of which is a pin 460 which is held in engagement with a shoulder on the end of a rod 461, which is connected at its upper end to the upper part of the main totaling lever 274. When the totaling operation commences by the turning of said lever as previously described, the rod 461 pushes the arm 458 to the left from the position in Fig. 6 to that of Fig. 7, lifting the stop arm 452 (Fig. 39) and holding it up during the entire sequence of totaling operations so that the feelers 441, Fig. 37, when released from the backward pressure of the rod 446 will move forward and take the reading from the locked combs. The described movement of the shaft 457 at the beginning of the totaling operation also pushes up a hook 471 hereinafter referred to and causes it to spring over a pin 472 on a stop arm 466.

At the end of a totaling operation, and during the first supplementary stroke the rod 461 is lifted from engagement with the pin 460, allowing the spring 459 to swing the arm backward and to restore the total stop arm 452 in the finder. For this purpose a link 462 is connected by a pin and slot connection to the rod 461 and is connected through a lever 463 and link 464 to an arm 465 on the shaft 301 which, as before stated, is rocked in the clockwise direction from the position of Fig. 6 when the totaling operation starts, so as to bring it to the position of Fig. 7, and is rocked in the opposite direction from the position of Fig. 7 to release various total mechanisms. The weight of the rod 461 holds its end down on the pin 460 in the starting position, Fig. 6, the link 462 being moved downward to permit such weight to hold the bar in engagement with the pin 460 and ensure the operation described. When the shaft 301 is rocked in the opposite direction it causes a lifting of the rod 461 to the position shown in Fig. 7^a, permitting the pin 460 to swing back to its starting position indicated in full lines, being stopped in this position by the limited movement of the stop 452 in the finder. On the second supplementary stroke the main totaling lever 274 swings back into the position of Fig. 6, drawing the bar 461 with it to the position of Fig. 6, the bar riding on the pin 460 and dropping into engagement back of it as in Fig. 6.

When the feelers 441 of the finder take their reading from the locked combs and transmit it to the sectors for printing the classification num-

bers, the carriage containing the locked combs is in its backward position so that the combs represent the last previous card. After this has taken place, it is necessary to reset the locked combs for the new card. The carriage, as previously stated, takes a short step forward for each operation of the machine and an additional long step when it is to take a new reading. The mechanism for producing these movements is illustrated chiefly in Fig. 39. On the inner side frame of the finder is mounted a rocking arm 466 normally held up by a spring 467 and having on its upper edge a shoulder 468 adapted to be struck by a pin 469 mounted on the adjacent side frame of the carriage 422. The carriage is released at each operation of the pins by the backward movement of the slotted resetting link 432, Fig. 37. The backward movement is through the full length of the slot in the link 432 so as to permit not only the regular short advance of the carriage, but also an extra advance when necessary to take a new reading. But in the ordinary operation the springs 470 which pull the carriage forward can pull it only until the pin 469, Fig. 39, strikes the stop or shoulder 468. For the full forward movement of the carriage, the arm 466 is swung downward to bring the stop 468 below the level of the pin 469, and in that case the carriage will move forward to the limit of the movement of its slotted guides on the pins 426.

The downward movement of the rocking arm 466 is effected by a spring pawl 471, pivotally mounted on the arm 452 and adapted at its upper end to hook over a pin 472 on the arm 466. Starting with the parts in the position of Fig. 39, the arm 452 will be raised at the beginning of the cycle of totaling operations and the pawl 471 will catch the pin 472. This is because of the turning of the shaft 457 by the total lever 274 as described in connection with Fig. 7 and the maintenance of the total lever and shaft 457 in this position throughout the total-recording operations. When such operations have been completed and the shaft 457 is released, during the first supplementary stroke, and springs back, it lifts the arm 454 and pulls down the arm 452. Therefore, the pawl 471 will pull down the rocking arm 466 and permit a full movement of the carriage to cause the locked combs to take their positions from the new card. On such a full forward movement of the carriage, a pin 473 carried on a bracket depending from a lower edge of the carriage, will strike the pawl 471 and release it from the arm 466 so that the latter will spring up against the pin 469 and out of engagement with the pawl 471. The pin 469 at that time will bear on the arm 466 at a point beyond the projection 468 and will ride backward over the latter when the carriage is returned to its rearward position, thus restoring all the parts to the position of Fig. 39.

The further movement taken by the locked comb carriage as just described causes the projection 437 of each locked comb to engage the rear edge of the corresponding pin comb and to be stopped thereby if its pin comb is not advanced or to follow it if it is advanced. The four locked combs will therefore take positions determined by their pin combs, some advanced and some stopped as in Fig. 37c where the pin comb 395 of this group has advanced and the others have not and the second only of the locked combs has taken a similarly advanced position. As soon as the combs 421 take this

position they will be locked by a bail 439, Fig. 37, which will engage one or the other of the two teeth 440 on the bottom of each comb. Thereafter they will retain their relative positions, moving all together backward and forward as their carriage is moved in regular operation and on each forward movement bringing their several notches 438 into register with the tails of their several followers 407 when the latter swing against their several pin combs.

The bail is supported on the carriage so as to move back and forth with it. When a new reading is to be imposed upon the locked combs, the bail 439 is withdrawn until the combs take their positions and is then sprung back to engage and hold them in their new relations. This bail is mounted on arms 474 on a shaft 475 which extends through the casing of the machine and has on the outside an arm 476 (Fig. 39) pulled up by a spring 477 to cause the bail to engage the teeth on the combs. The end of the arm 476 lies under the rocking arm 466 which limits the regular movement of the carriage, which is depressed when a new reading is to be taken and which thus rocks the shaft 475 and withdraws the bail allowing all the combs to be pulled forward by their individual springs. At the end of the forward stroke of the carriage, the arm 466 is released and swings upward as previously explained, allowing the bail to swing upward so that it will catch on the left hand tooth of the combs which have not been pressed backward beyond their normal positions, and on the right hand tooth of those which have been pressed backward by a corresponding position of their pin comb.

It will be observed in Fig. 39 that there is a slight play between the arm 466 and the arm 476. When the arm 466 is pulled downward by the hook 471 the movement is of considerable extent and the corresponding movement of the arm 476 is sufficient to clear the bail. But after the carriage has advanced to the dotted line position of the pin 469, at which time the pins have advanced into the card and the locked combs followed the pin combs to the allowed limits, and the bail has swung up into locking position, the return movement of the pin 469 will depress the arm 466 to such a slight extent as not to withdraw the bail.

The functions of the separate parts of the mechanism having been described in detail, it remains only to describe the operation of the machine as a whole. Assume that the listing sheets and summary sheet of Figs. 4 and 4^a are to be printed and that these sheets are properly set in the carriage and the cards placed in the magazine. If the operator wishes to use a separate listing sheet for each class of items, he will set the lever D, Fig. 1, to the rearward position shown, so that after printing the total line on the listing sheet and the corresponding line on the summary sheet, the machine will stop and a new listing sheet may be introduced. Or, if, as is usually the case, he wishes to fill the listing sheet, whether this requires one or several classifications, he will swing the lever D forward, in which case after recording the total for one class of cards the machine will continue the printing for the next class as indicated by the last line on Fig. 4. The lever B or B' which controls the finder will be thrown to the left so as to unlock the finder for the particular classification desired. For the classification illustrated in Figs. 4 and 4^a, according to "kind"

"year" and "age", the lever B' will be thrown to the left and the lever B will remain in the right hand position. Then in accordance with the kind of report desired (whether a listing sheet only or both a listing and a summary sheet) the lever C or the lever C' will be pulled forward; the lever C' being used in the case indicated in order to secure a report which includes a total line on the listing sheet without the payable premium items and a total line on the summary sheet which prints these items in three separate columns.

The current being turned on the operator will then press the starting button E. The first card will be fed from the upper magazine downward to the position of operation, its reading being taken by the pins and transferred to the comb mechanism, after which the pins will be withdrawn and the card shifted to the lower magazine. Following after a suitable interval, the sectors will advance, taking their positions under control of the combs, shifting the type carriage to a printing position and releasing the hammers to print the line, and at the end of this forward stroke of the sectors the selected accumulators will drop into gear with their operating sectors. This will be followed by a return of the sectors to their starting positions, which will cause a corresponding advance of the several wheels of the accumulators by reason of their engagement with the operating sectors so as to add on each accumulator the amount represented by its sectors. By the time this operation has been completed the second card will have passed through the operating position and the combs will have taken their reading from it and the next advance of the sectors will take place with the same effects.

Now when a card which arrives at operating position differs in any point of the determined classification from those which have preceded it, the finder, which has heretofore kept the totaling mechanism inoperative, will start the totaling and will cause a readjustment of the relations of the various parts so that the accumulators will drop into gear with their operating sectors when the latter are in their rearward positions and the regular comb control of these sectors will be withdrawn so that they will be controlled only by the accumulators and will advance only sufficiently far to turn the wheels of the accumulators back to zero and to cause the printing of figures corresponding with those on the accumulators. The sectors which print the numbers of the individual cards in the first column, however, although released from the control of the locked comb mechanism the same as the other sectors, are not thrown under control of accumulators since they do not represent cumulative items. Instead, the combs which limit their advance are controlled from the finder representing the classification of the last previous card; so that they will print such classification on the total line for such cards. The carriage will be shifted and the total lines printed in a number of successive operations, at the end of which time the finder will secure its new position from the classification of the new card. The regular combs in the machine will have already been set in position by this new card. Therefore, the next regular operations of the machine will make a record of the first card of this new classification and the operations will continue as before. It is only at the end of the full cycle of totaling operations desired including supplementary op-

erations that the mechanism is shifted from the totaling to the regular position, this being accomplished by the stops on the discs at the left hand end of the machine which determine the kind of total report which is to be made. The time relation of the finder mechanism during the recording of a total and the restoring of the parts is as follows. Once a totaling cycle is commenced, the recording mechanisms are no longer controlled by the finder. There are two revolutions of the main shaft or strokes of the notched discs of Fig. 8, for each recording operation. The amount recorded in each case is the total taken from one (or more) of the accumulators. The feeding of the cards is stopped. But at each stroke the pins advance and are retracted and the link 414 extending back to the finder moves forward and backward.

When the last total recording operation has been completed the parts are in the positions shown in Figs. 37, 38 and 39 except that in Fig. 39 the stop arm 452 is lifted and the hook 471 is in engagement with the pin 472, the parts having been in this position since the beginning of the totaling operation.

The first supplementary stroke, finding the parts in the positions stated, causes the turning of the shaft 301 (Figs. 6, 7 and 8) sufficiently to release the shaft 457 so that it turns to the position of Fig. 7^a and (Fig. 39) pulls the stop arm 466 down. This also withdraws the bail 439 from the locked combs and allows them to spring to the extreme right hand position. The carriage containing them, however, is still in the retracted position of Fig. 37.

Near the end of the first supplementary stroke the pins advance and the link 414 (Fig. 38) moves to the right releasing the locked comb carriage so that the latter moves to its extreme right hand position, indicated by the dotted line position of the pin 469 in Fig. 39. The locked combs (unlocked at the moment) advance against the rear ends of their pin combs and take relative positions corresponding to those of the pin combs. During the advance of the carriage and just before it reaches its right hand position the hook 471 is knocked off by the pin 473, which permits the arm 476 and the bail to spring up and lock the combs in their several positions. On the backward movement of the link 414, the locked comb carriage is restored to the position of Fig. 37, but with its combs in the new positions. This resetting of the combs is an operation which occurs during the latter part of the first supplementary stroke and the beginning of the second supplementary stroke.

Now when, on the second supplementary stroke, the totaling mechanism is unlocked, the recording mechanism within the machine will be restored to its regular control through the hook 276 of Fig. 7 and the link 413 and feelers 407 of Fig. 37. That is to say, if the feelers are in a disagreeing position with respect to the locked combs, the machine will commence totaling; otherwise the machine will list as usual. The determination whether the feelers 407 shall agree with or shall disagree with the locked combs does not take place until the next advance of the pins and of the link 414; which takes place toward the end of the second supplementary stroke, so as to set the record controlling combs at the very beginning of the next stroke of the machine. Of course, on the first card after a totaling operation, the locked combs of the

finder having been set to correspond with the pin combs for the card which is still in the operative position, the feelers 407 will take an agreeing position with the locked combs and will prevent a totaling operation.

It has been explained that during the second supplementary stroke the totaling mechanism is unlocked by a proper upward movement of the rod 303, Fig. 7. The hook 276, however, is held down (and holds down the total lever) by its engagement with the shoulder 277 and by the bearing of the pin 125 against the upper part of the lever 118, as in Fig. 7. Toward the end of the advance of the arm 124 it strikes the end 120 of the lever 118 and swings the latter up, allowing the total lever 274 to be pulled over by its spring, and allowing the hook 276 to be withdrawn by the finder mechanism at the proper time.

Though I have described with great particularity in detail a complete machine for carrying out a great variety of operations, yet it must not be understood therefrom that the invention is restricted to the particular machine illustrated and described. Various modifications thereof may be made in detail, various intermediate mechanisms between the cards on the one hand and the printing and accumulating devices on the other hand may be modified or eliminated, certain sections of the machine may be increased or diminished in number and size according to the needs of the business in which they are used, and various parts of the apparatus may be used alone or in other combinations than those illustrated without departing from the invention as defined in the following claims.

What I claim is:—

1. In a machine of the class described the combination of means for recording in succession a list of entries on a listing sheet and means for recording in succession a summary of said entries on the listing sheet and also in different form on a separate summary sheet.

2. In a machine of the class described the combination of record controlled means for recording in succession a list of entries on a listing sheet including in at least one column items of different classifications and means including an accumulator also controlled by records for recording a summary of said entries with the items of said different classifications in separate columns.

3. In a machine of the class described the combination of record controlled means for recording in succession items of different classifications in one column and means including an accumulator also controlled by a record for totaling the items of each such classification and recording the totals separately.

4. In a machine of the class described the combination of record controlled means for recording in succession a list of entries on a listing sheet, means including an accumulator also controlled by records for recording a summary of said entries involving a succession of separate recording operations, and means for shifting the sheet laterally between such separate recording operations.

5. In a machine of the class described the combination of means for recording in succession a list of entries on a listing sheet, means for recording a summary of said entries involving a succession of separate recording operations on a separate summary sheet and means for shifting the listing sheet out of recording position and the summary sheet into recording position and also

shifting the summary sheet laterally between said separate recording operations.

6. In a machine of the class described the combination of means for recording in succession a list of entries on a listing sheet, means for recording a summary of said entries involving a succession of separate recording operations, and means for shifting the sheet laterally between such separate recording operations, and mechanism for automatically controlling the order of succession of the recording operations and the movements of the sheet.

7. In a machine of the class described the combination of means for recording in succession a list of entries on a listing sheet, means for recording a summary of said entries involving a succession of separate recording operations on a separate summary sheet and means for shifting the listing sheet out of recording position and the summary sheet into recording position and also shifting the summary sheet laterally between said separate recording operations, and mechanism for automatically controlling the order of succession of the recording operations and the movements of the listing and summary sheets.

8. In a machine of the class described the combination of a recording section which comprises cumulative mechanism controlled by perforations in certain sections of a card and another recording section which comprises non-cumulative mechanism controlled also by perforations in a certain section of the card and alternative means for controlling said non-cumulative mechanism to make a record which is determined by perforations in another section of the card.

9. In a machine of the class described the combination of a recording section which is controlled by and records alternatively an identifying number of a card and a classification number common to several cards, in combination with such cards having perforations in one section corresponding to their several identifying numbers and in another section corresponding to their common classification number.

10. In a machine of the class described the combination of listing accumulators and summary accumulators adapted to be operated together during accumulating operations to be used separately to control total-recording operations and special accumulators adapted to be operated selectively during accumulating operations.

11. In a machine of the class described the combination of a group of accumulators which are operated together during accumulating operations and a special group which are operated selectively during accumulating operations and means for similarly using said groups to control total-recording operations.

12. In a machine of the class described the combination of perforated-card-controlled mechanisms for recording in one column items of different classes indicated at different points on the card.

13. In a machine of the class described the combination of perforated-card-controlled mechanism for recording in one column items of different classes indicated at different points on the card and means controlled also by the card for recording an identifying symbol with each of such items.

14. In a machine of the class described the combination of perforated-card-controlled mechanisms for recording in one column items of different classes and separate accumulators con-

trolled by the card and adapted to be operated selectively for said classes.

15. In a machine of the class described the combination of mechanisms for recording a non-cumulative individual identifying number, cumulative items in classes which are common to all entries and cumulative items which are in sub-classes selectively determined for each entry and identifying symbols in connection with each of the last named items.

16. In a machine of the class described the combination of mechanism for recording successive entries each comprising a plurality of items, means for accumulating at least some of said items and means for recording the accumulated items on a plurality of record-forms.

17. In a machine of the class described the combination of accumulators, means for recording in succession totals accumulated thereon, mechanical controlling devices for selecting such accumulators and determining the order of such recording operations and perforated-card-controlled means for setting said mechanical controlling devices in operation.

18. In a machine of the class described the combination of means for listing a succession of entries and means for performing a succession of total-recording operations and mechanical controlling devices for determining the order of such total-recording operations and classification-recording mechanism which is caused to make a record and also to determine the next classification by said mechanical devices.

19. In a machine of the class described the combination of means for listing a succession of entries and means for performing a succession of total-recording operations, mechanical controlling devices for determining the order of such total-recording operations and the resetting of the machine thereafter for listing operations and perforated-card-controlled means for setting said mechanical controlling devices in operation.

20. In a machine of the class described the combination of means for listing a succession of entries and means for performing a succession of total-recording operations, mechanical controlling devices for determining the order of such total-recording operations and for suspending the card-feed during such total-recording and perforated-card-controlled means for setting said mechanical controlling devices in operation.

21. In a machine of the class described the combination of means for feeding perforated cards in succession and accumulating the totals of items represented by said cards, means for recording the totals accumulated for a succession of cards representing any particular class of entries and controlling means for causing at will either a resumption of such accumulating operations or a stoppage of the machine after a total-recording operation.

22. In a machine of the class described the combination of means for feeding perforated cards in succession and recording entries represented by said cards and a finder which is ineffective as long as the successive cards represent entries in the same class and which is automatically effective to cause a total-recording operation for said cards in the same class when a new card representing an entry in another class arrives.

23. In a machine of the class described the combination of means for feeding perforated cards in succession and recording entries repre-

sented by said cards and accumulating totals thereof and a finder which is ineffective as long as the successive cards represent entries in the same class and which is automatically effective to cause a discontinuance of the accumulating operation and the commencing of a new total when a new card representing an entry in another class arrives.

24. In a machine of the class described the combination of perforated-card-controlled mechanism and a finder having two parts, the first of which determines its position for each card in succession and the second of which takes its position from the first and is locked in such position until the first part takes a new position, total mechanism set in operation by said first part and class recording mechanism set in operation by the second before taking a change in position from the first.

25. In a machine of the class described the combination of perforated-card-controlled mechanism and a finder comprising a group of members which take advanced or retracted positions according as corresponding spaces on the card are perforated or imperforate, and means controlled by a change in the combination of positions taken by said members for automatically rendering said mechanism operative only with cards corresponding to such changed combination of positions of the finder members.

26. In a machine of the class described the combination of perforated-card-controlled mechanism and a finder comprising a group of members which take advanced or retracted positions according as corresponding spaces on the card are perforated or imperforate, and feelers whose movement in one direction is controlled by the positions of said members and means for permitting the movement of said feelers in a transverse direction whenever the positions of said members is the same as in the next previous operation and for preventing such transverse movement when said positions are changed.

27. In a machine of the class described the combination of perforated-card-controlled mechanism and a finder comprising a group of members which take advanced or retracted positions according as corresponding spaces on the card are perforated or imperforate, and feelers whose movement in one direction is controlled by the positions of said members and means for permitting the movement of said feelers in a transverse direction whenever the positions of said members is the same as in the next previous operation and for preventing such transverse movement when said positions are changed and means for permitting the uninterrupted regular operation of the machine when said feelers move in said transverse operation and for interrupting the regular operation of the machine otherwise.

28. In a machine of the class described the combination of perforated-card-controlled mechanism and a finder comprising a first group of members which take advanced or retracted positions according as corresponding spaces on the card are perforated or imperforate, a second group of members which take their positions from the first and feelers whose operativeness is determined by the correspondence or lack of correspondence between the positions of the members of the first group and those of the second group, total-recording means controlled by said feelers and class-recording means controlled by said second group of members.

29. In a machine of the class described the combination of perforated-card-controlled mechanism, a finder controlled by perforations in a determined section of the card and adapted to permit an uninterrupted regular operation of the machine as long as the perforations in said section are the same and to interrupt the operation otherwise and means for setting the finder for control by any desired one of a plurality of sections of the card.

30. In a machine of the class described the combination of perforated-card-controlled mechanism, a finder having different groups of members controlled respectively by perforations in different sections of a card so as to find such cards as are restricted to a certain group of items and means for neutralizing one or more of said groups.

31. In a machine of the class described the combination of perforated-card-controlled mechanism, a finder having different groups of members controlled respectively by perforations in different sections of a card so as to find such cards as are restricted to a certain plurality of items.

32. In a machine of the class described the combination of perforated-card-controlled mechanism, means for feeding cards in succession to operative position and a finder adapted to cause a recording operation including the recording of the classification of a group of cards when a card of new classification arrives.

33. A machine of the class described including in combination feeling pins adapted to advance through holes in a card and manually operating latching means for stopping one group of said pins while permitting another group to advance.

34. In a machine of the class described in combination, pins adapted to enter holes in controlling cards and combs adjustably connected to the pins and permitting the operation of the machine only when a certain combination of pins is advanced.

35. In a machine of the class described, the combination of recording mechanism, means for feeding perforated cards to and from operative position, a common driving means and timing means adapted to cause the card feed to operate synchronously with and a certain interval in advance of the start of said recording mechanism.

36. In a machine of the class described, the combination of recording mechanism, means for feeding perforated cards to and from operative position, a common driving means and timing means adapted to cause the card feed to operate synchronously with and a certain interval in advance of the start of said recording mechanism, and stop devices for limiting the movement of the recording mechanism set by a card when in operative position and remaining set until their use in a recording operation.

37. In a machine of the class described, the combination of recording mechanism, means for feeding perforated cards to and from operative position, a common driving means and timing means adapted to cause the card feed to operate synchronously with and a certain interval in advance of the start of said recording mechanism, totaling mechanism and means for determining during said interval whether the machine shall perform a totaling or an ordinary recording operation.

38. In a machine of the class described the combination of printing means at the rear of

the machine, means at the front of the machine for carrying cards in planes extending transversely from front to back of the machine, and for feeding said cards in succession to and from
 5 operative position, feeling pins extending longitudinally and adapted to pass through perforations in said cards while in said operative position, means lying between said printing devices and the front of the machine and movable in
 10 a plane from front to back for determining the amounts to be printed, and devices controlled by said pins limiting the movements of said amount-determining-means, said amount-determining-means being in the form of sectors, and
 15 accumulators arranged to be brought into engagement with and operated by said sectors in their amount-determining movements, and selecting mechanism including similar sectors adapted to selectively cause said accumulators to enter into engagement with said determining
 20 sectors, and means arranged beyond one end of said group of sectors for timing their movements to cause first a recording and then an accumulating operation, and means located beyond
 25 the other end of sectors for timing the operation of the parts to cause a total recording.

39. In a machine of the class described the combination of printing means at the rear of the machine, means at the front of the machine
 30 for carrying cards in planes extending transversely from front to back of the machine, and for feeding said cards in succession to and from operative position, feeling pins extending longitudinally and adapted to pass through perforations in said cards while in said operative position, means lying between said printing devices
 35 and the front of the machine and movable in a plane from front to back for determining the amounts to be printed, and devices controlled by said pins limiting the movements of said amount determining-means, a finder located at
 40 one end of the group of pins adapted to be controlled thereby, and totaling mechanism located at the corresponding end of the group of amount-determining devices, said total mechanism adapted to be set in operation by said
 45 finder.

40. A machine of the class described having a part adapted to assume positions corresponding to the numbers from 0 to 9, four feeling
 50 pins adapted to enter various combinations of holes in corresponding spaces on a card, the position to which said part moves being controlled by the combination of holes entered by said pins.

41. A machine of the class described having a part adapted to assume a number of different positions and having feeling pins adapted to enter various combinations of holes in a number
 60 of spaces on a card, said number of spaces being less than said number of positions, the position to which said part moves being controlled by the combination of holes entered by said pins.

42. A machine of the class described having a part adapted to assume positions corresponding to the numbers from 0 to 9, a number of
 65 feeling pins less than nine adapted to enter various combinations of holes in corresponding spaces in a card, the position to which said part moves being controlled by the combination of
 70 holes entered by said pins.

43. A machine of the class described having a movable record-controlling member, feeling pins adapted to enter various combinations of
 75 holes in corresponding spaces in a card, and

means controlled by the combination of holes entered to determine the extent of movement of said member.

44. A machine of the class described having a movable record-controlling member, feeling
 80 pins adapted to enter various combinations of holes in corresponding spaces in a card, and movable stops under control of said pins and adapted to be moved into the path of said member at different points to determine the
 85 extent of its movements in accordance with the combinations of holes entered by said pins.

45. A machine of the class described having a movable record-controlling member, feeling
 90 pins adapted to enter various combinations of holes in corresponding spaces in a card, movable combs under control of said pins adapted to be moved relatively to each other and to bring their notches into line at various points corresponding to the combinations of holes entered
 95 by said pins, said means determining the extent of the movements of said member by the points at which said notches are brought into line.

46. A machine of the class described having a movable record-controlling member, feeling
 100 pins adapted to enter various combinations of holes in corresponding spaces in a card, movable combs under control of said pins adapted to be moved relatively to each other and to bring their notches into line at various points corresponding to the combinations of holes entered by said pins, and stops movable into the path of said member at different points to determine the extent of its movements, each of said
 110 stops having a part extending across said combs to hold the stop out of operative position until notches of the several combs are brought into line with said part.

47. A machine of the class described having operating elements and means for controlling
 115 said elements singly by combinations of perforations in a card.

48. In a machine of the class described, the combination of recording mechanism, means for
 120 feeding perforated cards to and from operative position, a common driving means and timing means adapted to cause the card feed to operate synchronously with and a certain interval in advance of the start of said recording
 125 mechanism, totaling mechanism and means controlled by a card when in operative position for determining whether the machine shall perform a totaling or an ordinary recording operation.

49. In a machine of the class described the combination of recording mechanism for recording a noncumulative individual identifying
 130 number, recording mechanism for recording cumulative items in classes which are common to all entries, recording mechanism for recording cumulative items which are in sub-classes selectively determined for each entry and means for effecting such selective determination.

50. In a machine of the class described, recording devices having two separate and independently operating controls, one of said controls comprising mechanism whose successive
 140 positions are determined through a succession of perforated cards, and the other comprising a mechanical device which automatically determines a succession of totaling operations for printing a plurality of totals.

51. A machine of the class described including in combination a selector and two controlling
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mechanisms therefor adapted to be alternatively rendered operative, one of said mechanisms comprising perforated-card controlled devices for determining the position of the selector and the other comprising devices for automatically determining a series of successively different positions of the selector.

52. In combination, a movable member adapted by the distance of its movement to control a record, and a number of separate devices adapted to take different positions relatively to each other according to the arrangement of perforations in a corresponding number of delimited spaces in a card, said movable member being adapted to move through a different distance for each of the relative positions of said separate devices.

53. In a machine of the class described in combination, pins adapted to enter holes in controlling cards, combs adjustably connected to the pins and permitting the operation of the machine only when a certain combination of pins is advanced, and means for automatically altering the connection of the combs to the pins when a different combination of pins is advanced.

54. In a record controlled accounting machine, the combination of an accumulating apparatus; a total-taking mechanism adapted when set to adapt said apparatus to take a total; a movable means operatively connected to said total-taking mechanism for setting the latter; and a latch for retaining said movable means in set position.

55. In combination with a drive for an adding or sorting machine, a stop-action cooperating with perforated cards comprising means for cooperating with perforations in a card, a drive control member adapted to be controlled by said means when said means cooperate with a certain perforation, said controlling member being adapted to be differently controlled when said means cooperate with a different perforation, and connecting means for operatively con-

necting said member with said drive, said change in control of said controlling member disconnecting said drive with the result that the machine stops whenever a new group or series of cards commences or when the supply of cards is exhausted.

56. In combination with a drive for an adding or sorting machine, a stop-action cooperating with perforated cards comprising pins for cooperating with the perforations in a card, a drive controlling member adapted to be controlled by any one of said pins when one of said pins cooperates with a certain perforation, said controlling member being differently controlled when another of said pins cooperates with another perforation and connecting means for operatively connecting said member with said drive; said difference in control disconnecting said drive with the result that the machine stops whenever a group or series of cards commences.

57. In combination with the drive of an adding or sorting machine, a stop action adapted to cooperate with perforated cards comprising analyzing pins adapted to cooperate with perforations in a card, a drive controlling member to be differently controlled by said pins when said pins successively cooperate with different perforations, said difference in control being adapted to disconnect said drive.

58. A record controlled accounting machine having means for successively feeding and analyzing control records, and means controlled by the analyzing means for accumulating data taken from the records, said analyzing means being adapted to analyze one record while the accumulating means is receiving data taken from a previously analyzed card.

59. A record-controlled machine comprising record sensing elements having a cycle of operation and devices operated under control of said elements having a cycle of operation partially overlapping said first mentioned cycle.

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