Aug. 5, 1952 W. T. GOLLWITZER 2,605,699

PRINTING MACHINE

Filed May 27, 1946 10 Sheets-Sheet 1

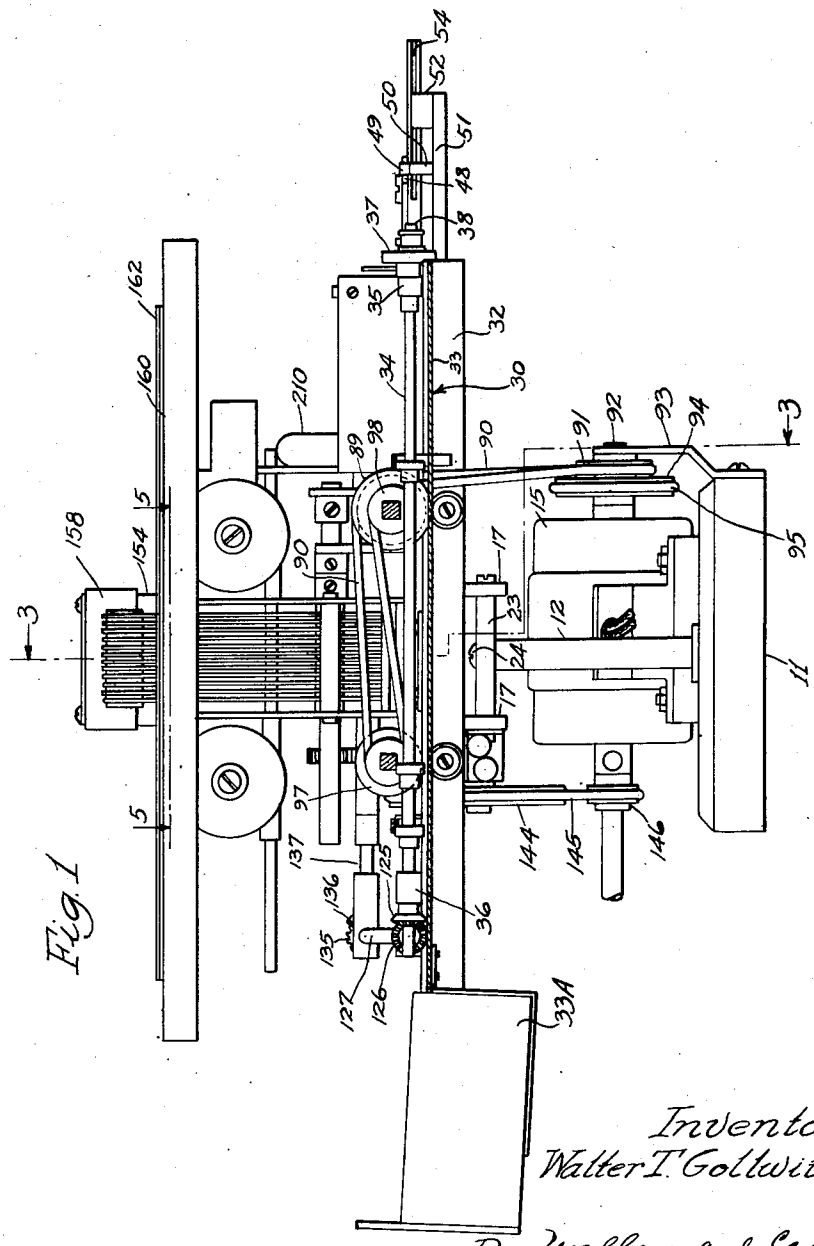


Fig. 1

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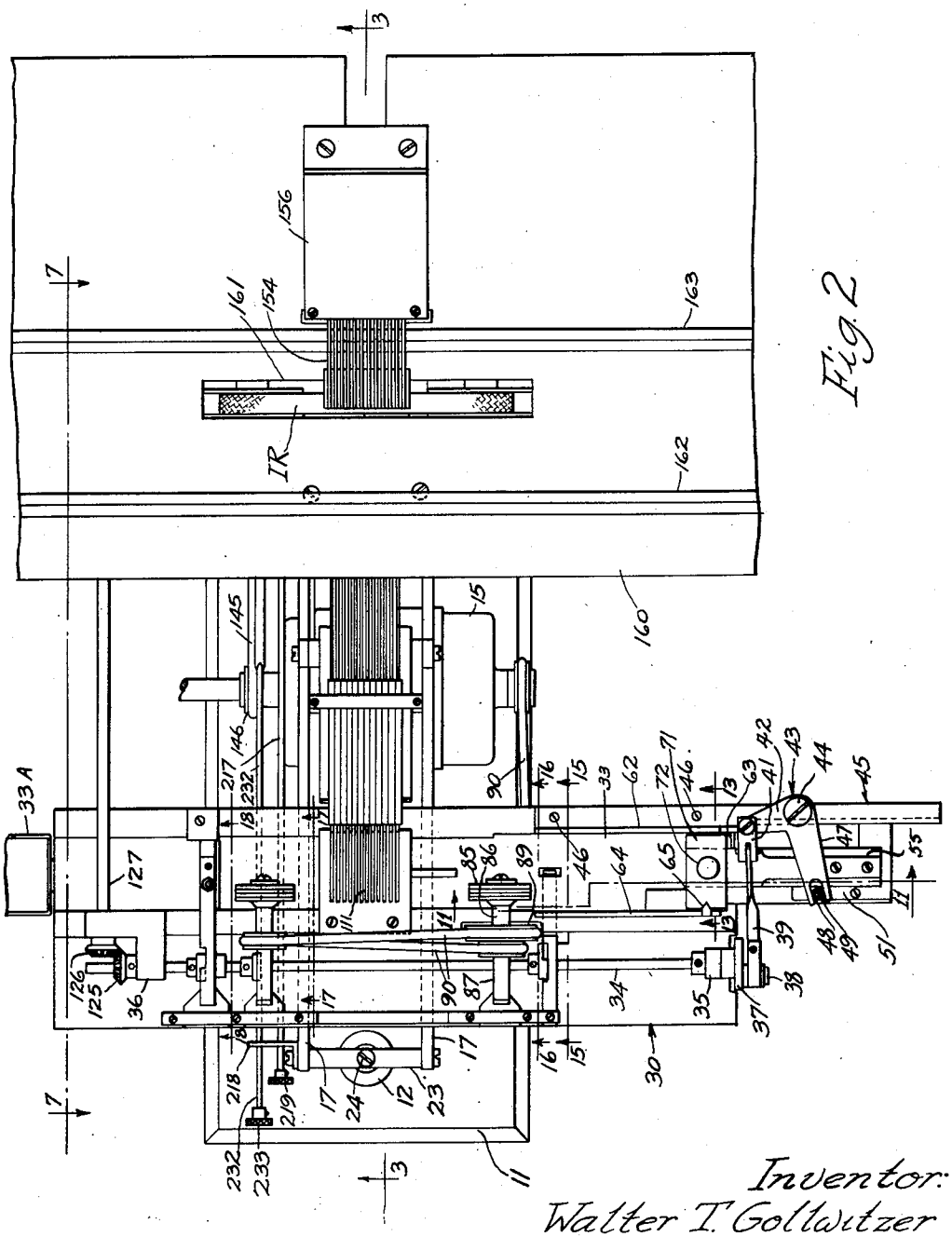


Fig. 2

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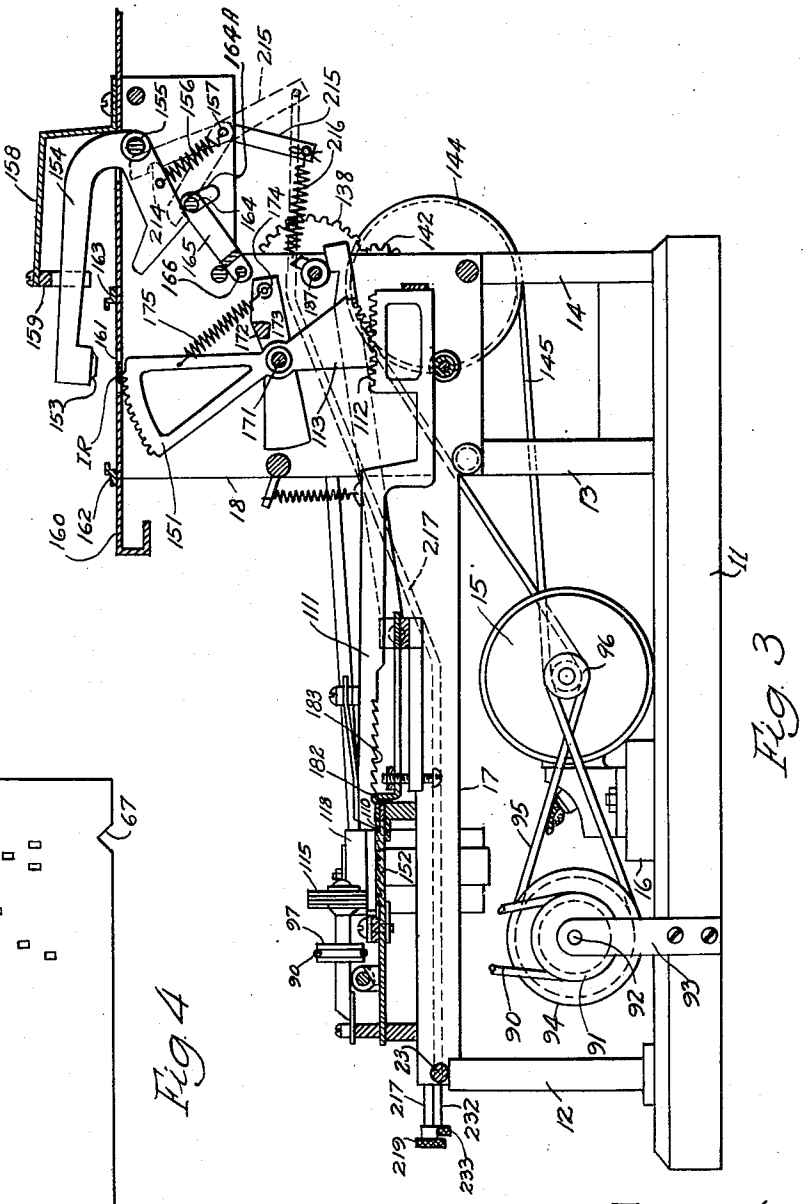


Fig. 3

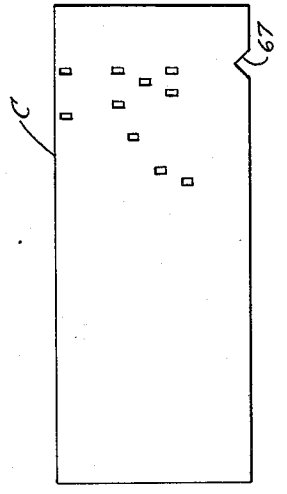


Fig. 4

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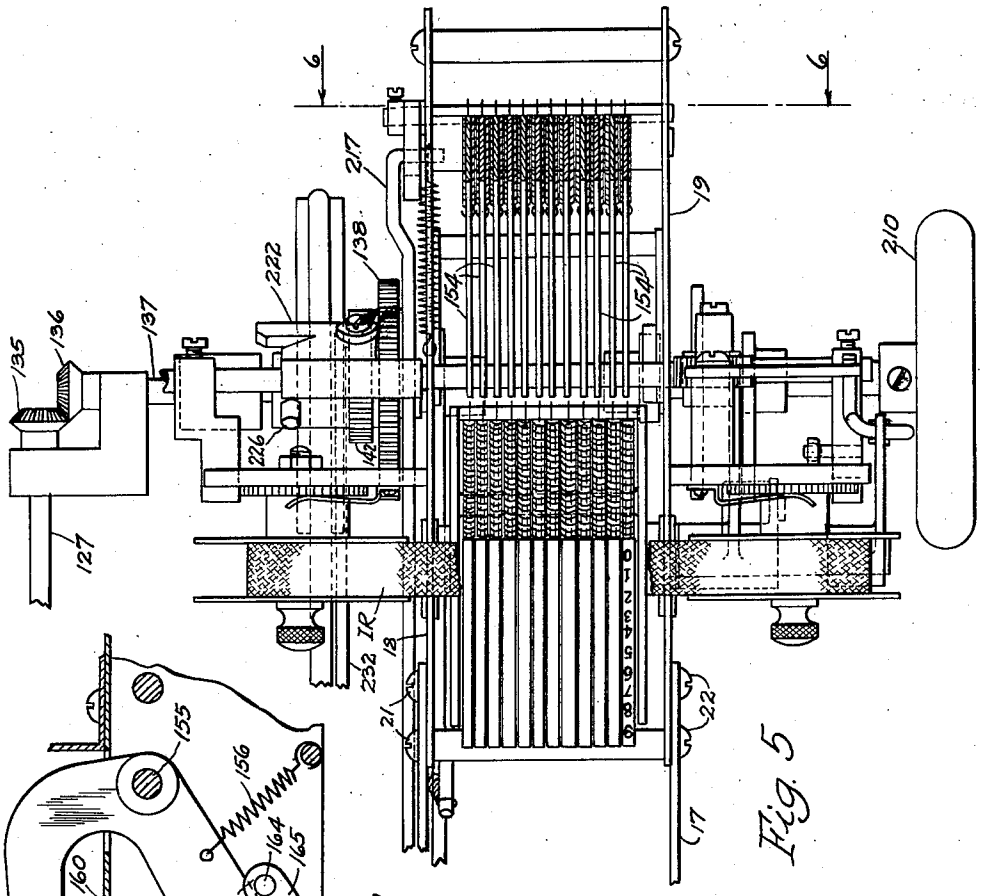


Fig. 5

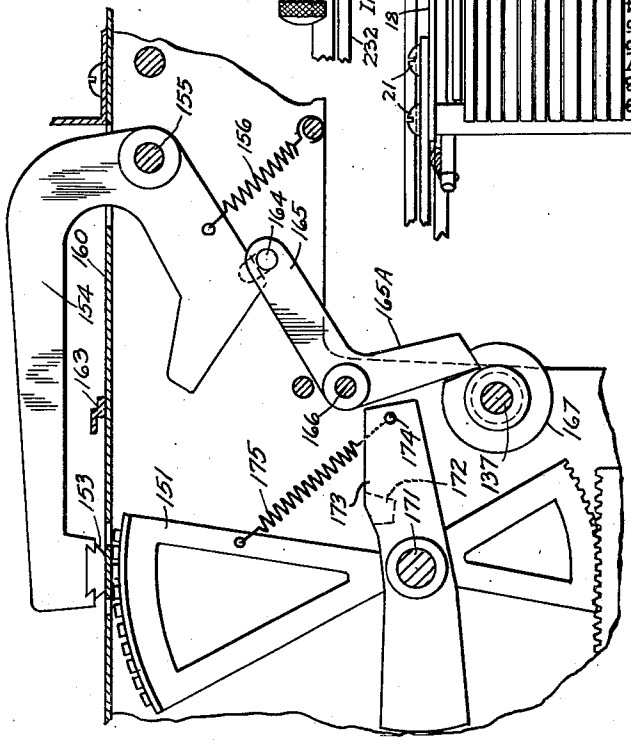


Fig. 5A

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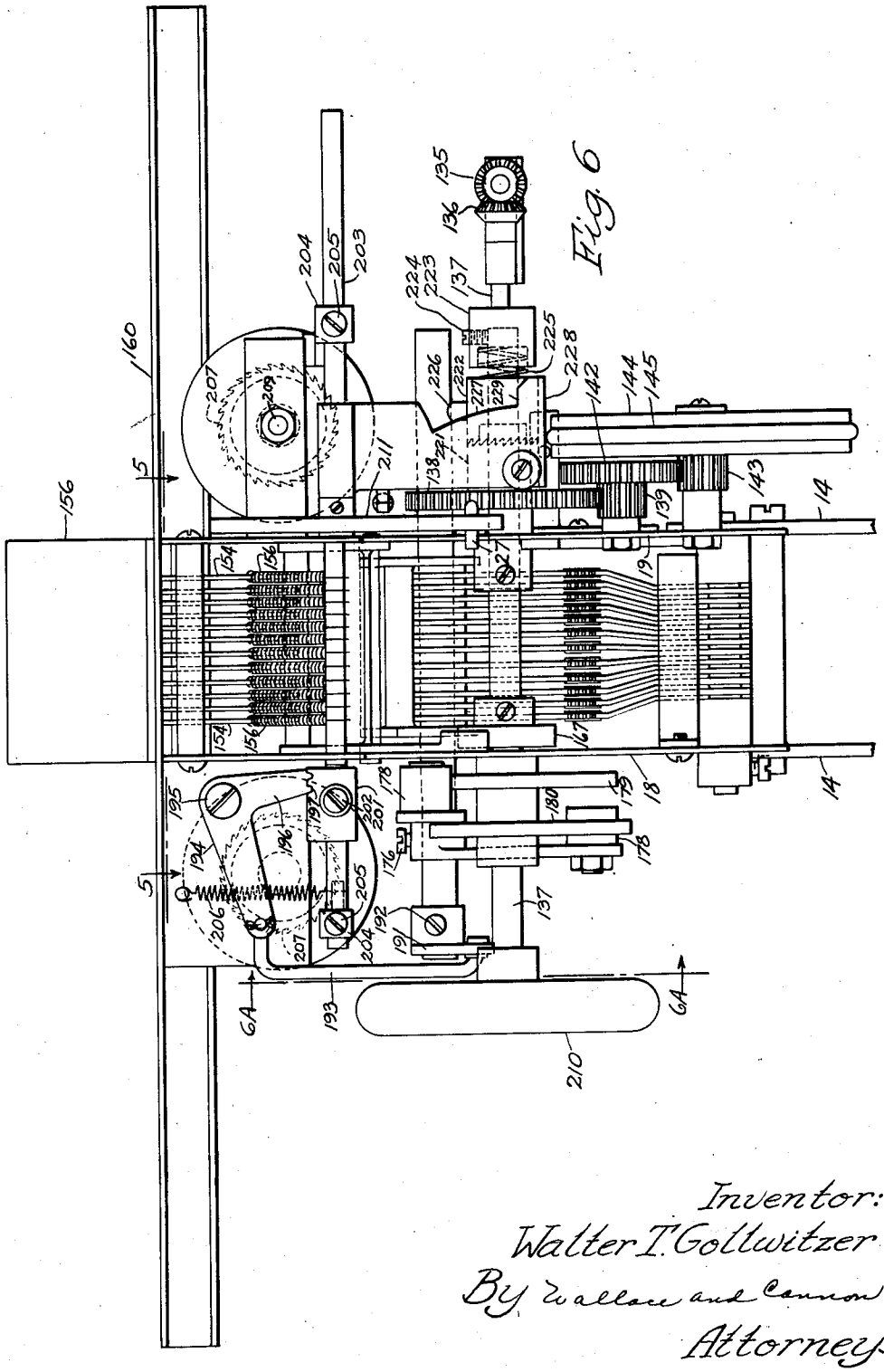


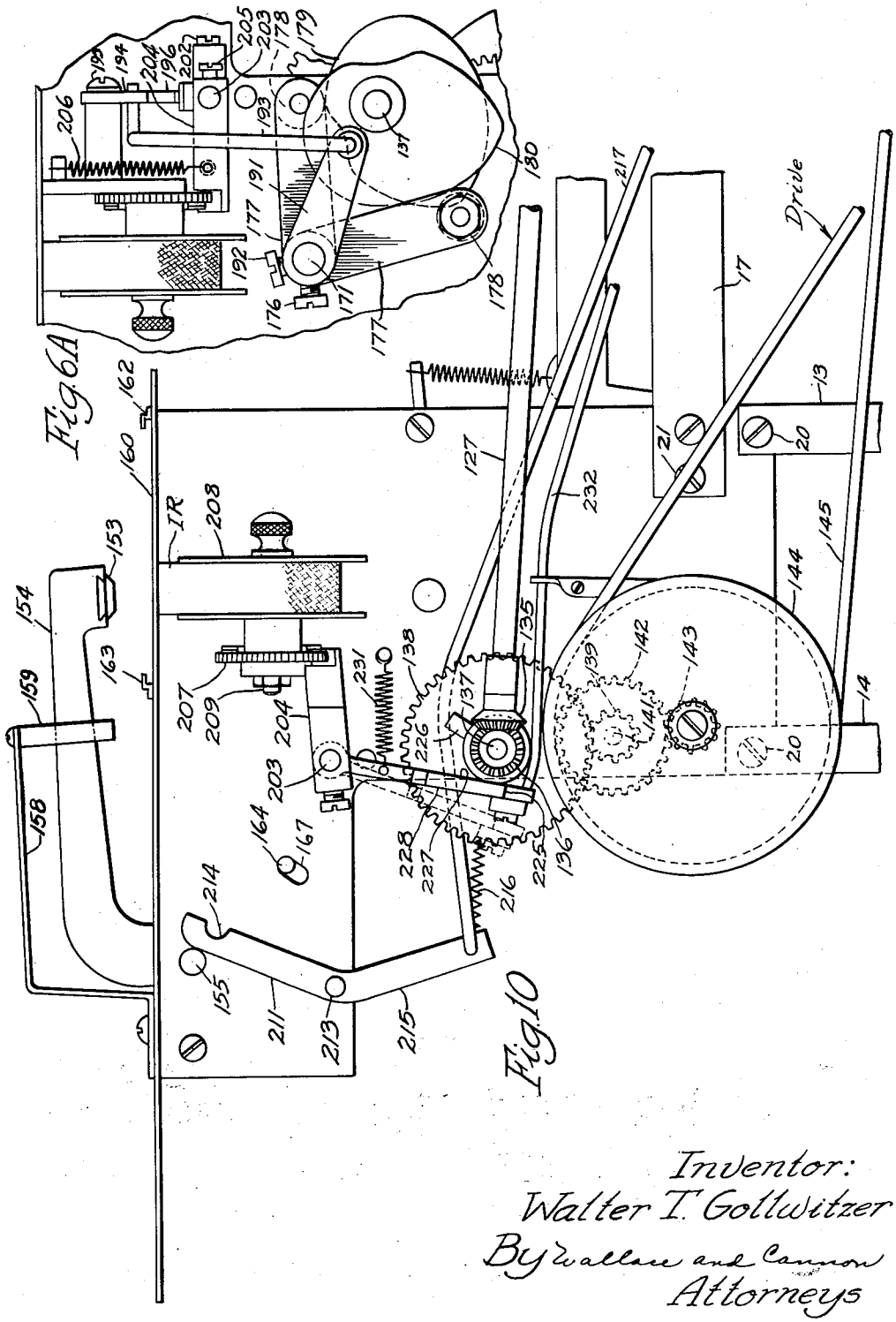
Fig. 6

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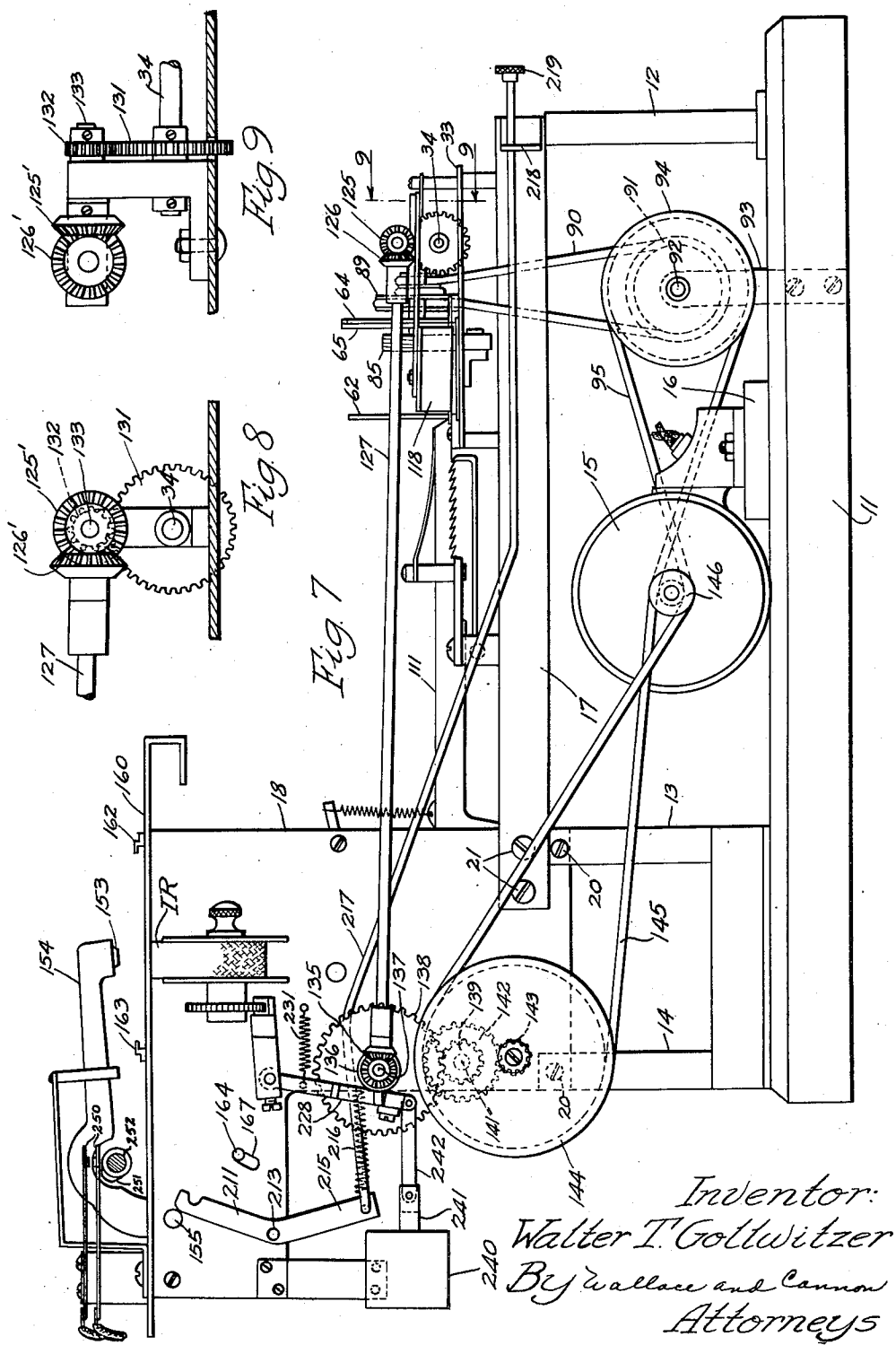


Fig. 9

Fig. 8

Fig. 7

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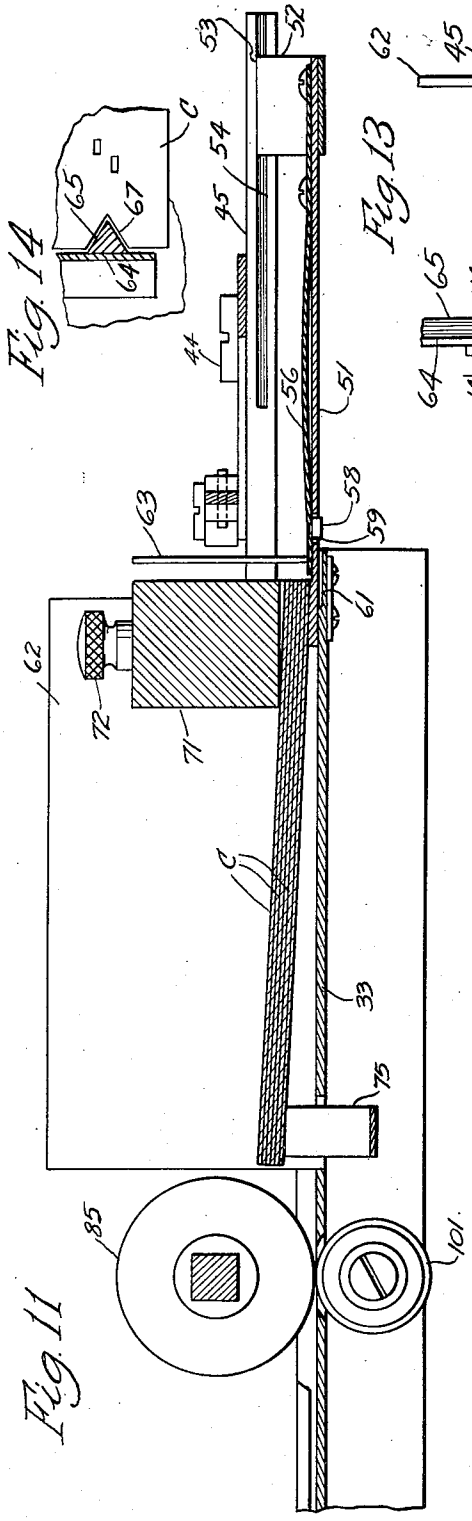


Fig. 11

Fig. 14

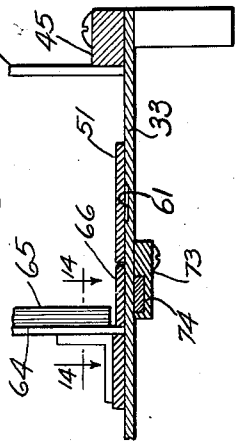


Fig. 13

Fig. 12

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Fig. 15

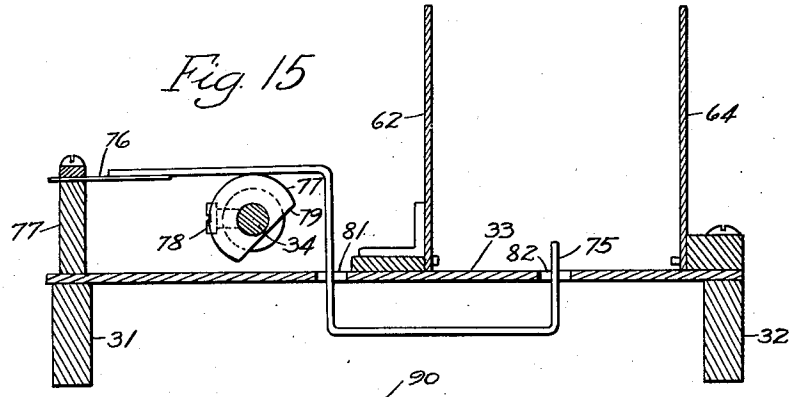


Fig. 16

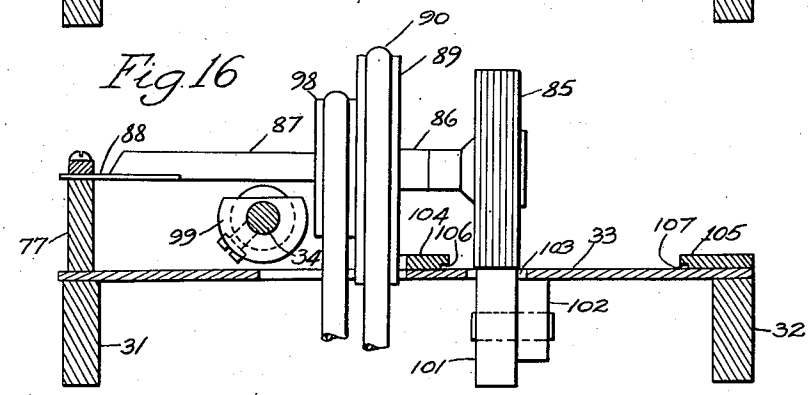


Fig. 17

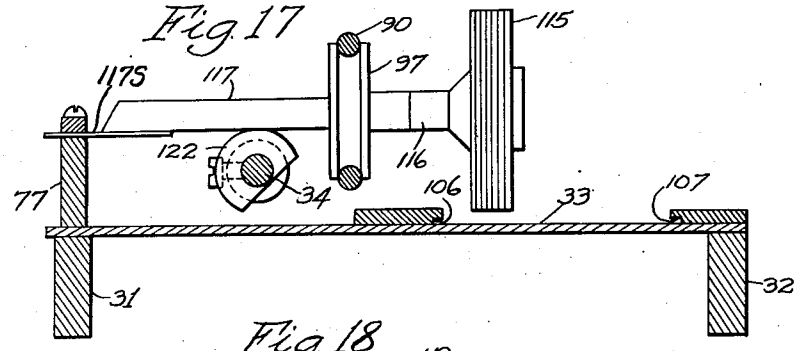
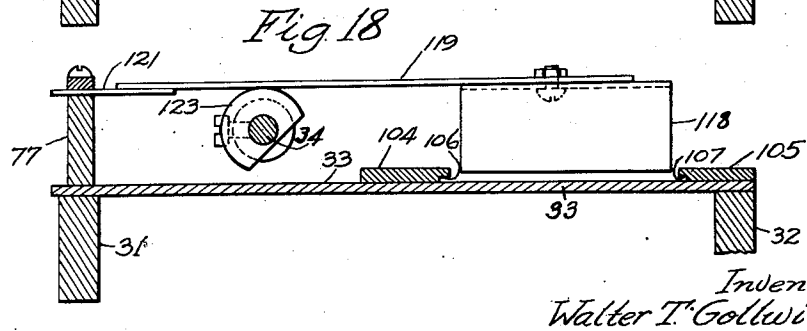


Fig. 18



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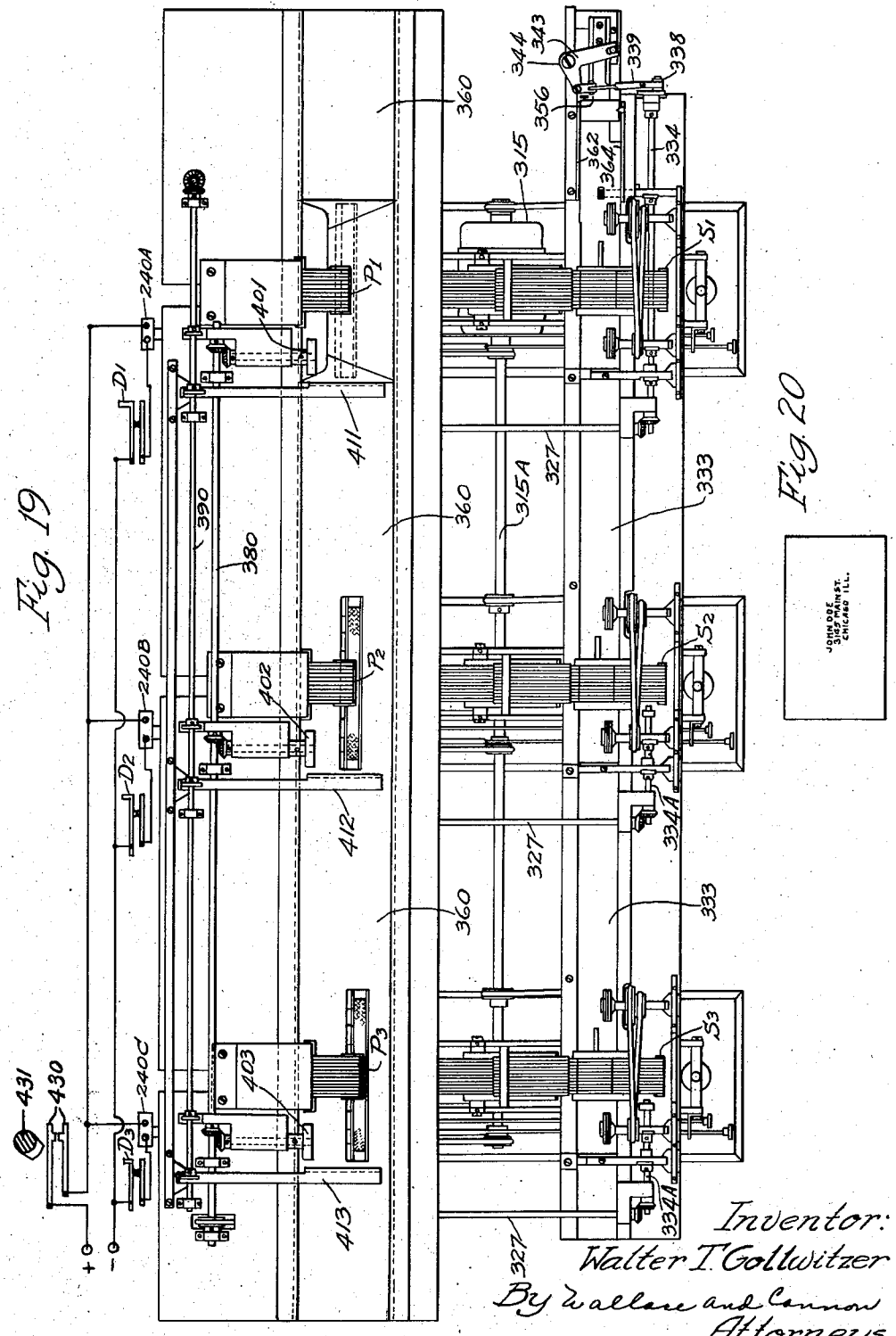


Fig. 19

Fig. 20

JOHN ORR
SHEET METAL WORKS
CHICAGO ILL.

Inventor:
Walter T. Gollwitzer
By Wallace and Cannon
Attorneys

Patented Aug. 5, 1952 2,605,699

UNITED STATES PATENT OFFICE

2,605,699

PRINTING MACHINE

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

Application May 27, 1946, Serial No. 672,581

3 Claims. (Cl. 101—93)

1

This invention relates to a printing machine and more particularly to a printing machine which is adapted to print changeable data such as names and addresses, or variable data, such as numerical quantities, amounts of money and the like. More particularly, this invention relates to machines for printing data of the aforesaid character under the control of record members such as perforated cards or other control devices which are fed into a control position seriatim in synchronism with the feeding of sheets or the like to a printing station.

In certain types of business enterprise, particularly where printed forms embodying changeable and/or variable data must be issued periodically, it is highly advantageous to effect such printing automatically under the control of record members such as perforated cards which determine the positioning of printing members for each sheet or article printed.

It is an object of my invention to print each sheet, envelope or other article or document under the control of a record member which is peculiar to that document by sensing such record member with mechanical devices which are so constructed as to control the setting of variable or changing printing elements at the printing station.

A further object of the present invention is to connect changeable or variable printing members to sensing mechanisms of the character mentioned above in such a manner that operation is accurate and can be carried on at a relatively high rate of speed. For the purpose of controlling such printing members the present invention utilizes certain sensing means which are more particularly described and are claimed, per se, in my co-pending application, Serial No. 663,467, filed April 19, 1946, now U. S. Patent No. 2,508,603, patented May 23, 1950.

A further object of my invention is to combine variable printing members with sensing means of the type described in my aforesaid co-pending application in such a manner as to insure rapid and efficient operation properly timed with the feeding of control members such as perforated cards through the sensing position.

A further object of my invention is to feed record members such as cards bearing data representing perforations or other indicia in efficient and accurately controlled manner. This is accomplished by a feeding mechanism which is so designed and constructed as to insure the feeding of one and only one card at each cycle of the machine.

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Further objects of my invention are to improve the separation of cards and the like in a feeding mechanism to facilitate feeding thereof, to combine simple feeding elements in a novel manner to produce a highly efficient feeding mechanism for advancing cards or the like through various stations and to accomplish the foregoing with a minimum number of mechanical parts.

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

In the drawings:

Fig. 1 is a front elevation of a printing machine made according to my invention;

Fig. 2 is a plan view of the printing machine, with certain parts broken away;

Fig. 3 is a vertical sectional view from front to rear of the machine taken substantially on the line 3—3 of Figs. 1 and 2;

Fig. 4 is a plan view of a perforated card which may be used as a control member in the printing machine;

Fig. 5 is a horizontal sectional view showing the upper part of the machine, this view being taken substantially on the lines 5—5 of Figs. 1 and 6;

Fig. 5A is a fragmentary elevational view of certain printing elements, parts being shown in section;

Fig. 6 is a vertical sectional view taken across the rear part of the machine and looking forward, substantially along the line 6—6 of Fig. 5;

Fig. 6A is a fragmentary elevational view of operating elements for part of the printing mechanism, taken substantially on the line 6A—6A, Fig. 6;

Fig. 7 is a left side elevational view of the machine, certain parts being shown in section and this view being taken substantially along the line 7—7, Fig. 2;

Fig. 8 is a detail view of certain elements shown in the upper right hand part of Fig. 7;

Fig. 9 is a detail elevational view of the same

elements taken at right angles to the view shown in Fig. 8 and substantially along the line 9—9, Fig. 7;

Fig. 10 is an enlarged fragmentary elevational view similar to the left-hand part of Fig. 7, being on a somewhat larger scale and illustrating certain modifications of certain elements;

Fig. 11 is a vertical sectional view through a feeding mechanism for cards or the like taken substantially on the line 11—11, Fig. 2;

Fig. 12 is a view similar to Fig. 11 but showing certain parts in changed positions;

Fig. 13 is a transverse vertical section through the feeding mechanism shown in Figs. 11 and 12, this view being taken substantially along the line 13—13, Fig. 2;

Fig. 14 is a horizontal sectional detail view taken substantially on the line 14—14, Fig. 13;

Figs. 15, 16, 17 and 18 are each transverse sectional detail views showing various parts of the improved feeding mechanism for cards or the like, these views being taken substantially along the lines 15—15, 16—16, 17—17, and 18—18, respectively, on Fig. 2;

Fig. 19 is a view showing a combination of the printing mechanisms which my invention comprises, arranged in series to print complementary matter sequentially; and

Fig. 20 is a plan view showing a sheet bearing data printed by the mechanism of Fig. 19.

The printing mechanism which embodies my invention is mounted upon a suitable supporting base 11, as best shown in Figs. 1, 3 and 7. Supported on the base 11 are vertically upstanding posts or column members 12, 13 and 14 for supporting upper frame members and various operating parts. A driving motor 15 which may be an electric motor of any appropriate size and type is secured by suitable means to a supporting block 16 which may be mounted on the base 11.

Above the base 11 and spaced therefrom by the vertical columns 12, 13 and 14 are a pair of horizontal parallel frame members 17. At the rear of the machine, shown at the left in Fig. 7 and at the right in Fig. 3, an upper frame structure is mounted above the columns 13 and 14, this structure comprising a pair of parallel spaced vertical plates 18 and 19 which mount various operating elements to be described hereinafter. The plates 18 and 19 may be secured to the posts or columns 13 and 14 by any suitable means such as screws or bolts 20.

The rear ends of the bars 17 are secured to the plates 18 and 19 by any suitable means such as the screws 21 and 22. A horizontal bar 23 extends between and is rigidly secured to the forward ends of the bars or beams 17. At its midpoint the bar 23 is mounted on the top of the vertical post or column 12 to which it is secured as by a screw 24.

Extending along the front of the machine is a feed table for perforated cards or the like which are to be fed into a sensing position where, through sensing means and other connecting elements to be described hereinbelow, the printing members are set selectively into printing positions. After the cards are so sensed they are fed out of sensing position along the same feeding table by means and in a manner to be described hereinafter. The feed table is designated generally by the reference character 30 and it comprises a pair of spaced horizontal bars 31 and 32 which extend parallel with the front of the machine and across the beams or frame members 17 to which they are secured in any appropriate manner. A flat member 33 which is mounted on and secured to the bars 31 and 32 constitutes the table surface, as best shown in Figs. 15 to 18.

At the right end of the table, as seen by an operator facing the machine and as best shown in Fig. 1, means are provided for supplying cards or similar control members C which are provided with indicia to be sensed. As shown in Fig. 4, such cards or control members may be provided with perforations at selected positions to indicate indicia which is to be set up in the printing elements of the machine. It will be understood, however, that the indicia might be in the form of protuberances or other distinctive elements formed on a flat or substantially flat member and being capable of sensing by mechanical sensing elements such as those described in detail in my aforesaid copending application, Serial No. 663,467.

As shown in Fig. 1 and in the left-hand part of Fig. 2, the sensing station is located about the middle of the table, in the length thereof, and a receiving hopper 33A is provided at the delivery end of the table.

A rotatably mounted shaft 34 is mounted above the table and in spaced parallel relation therewith in suitable bearings 35 and 36. This shaft extends substantially the full length of the table and controls and operates various mechanisms associated with the feeding and advancing of the control cards C. At its right end, as shown in Fig. 1, the shaft 34 carries a disc 37 which bears an eccentric crank pin 38. The disc 37 is secured to the shaft 34 for rotation therewith.

A pitman 39 is connected at one end to the crank pin 38 and extends rearwardly of the machine, its rear end being connected to a link 41. The link 41, as best shown in Fig. 2, is pivotally connected to an arm 42 of a bell crank 43 which is pivoted on a stud 44 for oscillation in a horizontal plane. The stud 44 is mounted on an auxiliary or extension frame member 45 which is secured as by screws 46 to the rear edge of the table top and its supporting bar 32. The bell crank 43 is oscillated when the pitman 39 is reciprocated by rotation of the shaft 34. The shaft 34 is rotated by means to be described hereinbelow.

The free arm 47 of bell crank 43 is slotted as indicated at 48 to receive a roller 49 carried on a stud 50 which is mounted on a slidably mounted horizontal plate 51. The plate 51 is provided on its rear edge and near the outer or right end thereof, as seen in Figs. 1, 11 and 12, with a vertical extension 52, and this vertical extension terminates in a horizontal flange portion 53 which is bent rearwardly to engage a guide slot 54 in the forward vertical face of the extension frame member 45. Oscillation of the bell crank, therefore, causes the plate 51 to move alternately to the right and to the left, the plate extension 52, 53 serving to guide movement of such plate in a horizontal plane.

The plate 51 has a longitudinal recess 55 in its upper face in which a leaf spring 56 is secured as by screws 57. This leaf spring functions as a feed plate, as will be more fully described below. It is so arranged as to be normally self-biased toward the supporting plate 51 so that it lies substantially flush but projecting slightly above the surface of plate 51. The amount of this projection is equal to or just slightly less than the minimum thickness of one of the cards C. Near its left end, as seen in Figs. 11 and 12, the leaf

spring 56 carries a rivet 58, the head of which is mounted in and extends through an opening 59 in the supporting plate 51. The head is somewhat thicker than the part of plate 51 which underlies the leaf spring 56. Plate 51 is adapted to reciprocate over and to ride upon the top surface of the plate 33 which constitutes the feeding surface of the table. At its extreme right end, as shown in Figs. 11 and 12, and aligned with the head or rivet 58 the plate 33 is provided with a groove 61 which is so shaped as to receive the rivet head as the plates 51 and 56 are advanced to the left, as seen in these figures. This groove becomes shallower toward the left end and finally merges with the top of the table so that as the plates 51 and 56 move to the left, the rivet 58 is raised thereby lifting the forward end of the feed plate 56 into more effective feeding relationship with the lowermost card C in the stack of cards.

The stack of cards C is retained in feeding position by a hopper which comprises a rear wall 62, an upright part 63 at the right end of the stack, as seen in Figs. 11 and 12, and a front wall member 64, shown in Figs. 2, 13 and 14. The front wall member 64 has secured thereto a vertical bar 65 which, as shown in Fig. 14, is triangular in cross section and is located so that its lower end clears plate 66, which constitutes part of the bottom of the hopper at this point, by an amount equal to or very slightly greater than the thickness of a single card C. As shown in Figs. 4 and 14, each of the cards as C is provided with a notch 67 of a size and shape to accommodate the bar 65. Cards of this specific character are more fully described in a co-pending application filed jointly by the present inventor and John H. Gruver, Serial No. 648,075, filed February 16, 1946, now Patent No. 2,521,118. Since the side plates 62 and 64 are spaced apart a distance which is equal to the width of a card C, cards can only be put in the hopper when properly oriented, that is, when the notch 67 in each card will properly engage the triangular bar 65.

The bar 65, therefore, together with the underlying plate 66 and with the cooperation of the side walls 62 and 64, constitutes a feed gate which controls the feeding of cards by the feed plate 56 in such a manner that only one card can be fed at a time. The parts are so arranged that the end of the plate 51 when in its extreme right hand position, as shown in Figs. 11 and 12, is never fully withdrawn from under the stack of cards. Hence the feed plate 56 is always in position to engage the bottom card of the stack and this is the only card that is free to be fed out below the lower end of the bar 65.

In order that cards will always be firmly positioned against the forward end of the supporting plate 51, for engagement with the feed plate 56, a weight 71 is provided. This weight may be equipped with a suitable handle, as shown at 72. The upright bar 63 at the right end of the hopper, as seen in Figs. 11 and 12, prevents the block from sliding to the right as the feeding mechanism is operated.

As shown in Fig. 13, a channeled bar 73 is secured to the bottom of the plate 33 and the channeled position thereof slidably receives a tongue member 74 which extends from and is secured to the plate 51. Engagement of the tongue member 74 with this channel, together with the sliding engagement between the flange 53 and the slot 54, as previously described, keeps the sliding plate 51 in proper alignment with the table top.

Near the left hand or exit end of the hopper, as seen in Figs. 11 and 12, there is mounted a flexing device 75 which is operated at each rotation of the shaft 34 to lift the left end of the stack of cards, as viewed in these figures, and flex them somewhat so as to make certain that the lowermost card will be engaged by the feed plate 56. As shown in Fig. 15, the member 75 comprises a flat bar which is bent at three points and is secured at its front end to a leaf spring 76. The spring 76 is secured by appropriate means to an auxiliary front bar 77 mounted above and secured to the front edge of the table and the supporting bar 31. A cam 77 on shaft 34 is fixed to rotate with the shaft as by means of a set screw 78. This cam has a flat portion 79 which permits the leaf spring 76 to lower the member 75 during a part of each cycle of the feeder. This occurs at the time that the feed plate 56 is pushing the bottom card out of the stack into the bite of feed rollers. Subsequently, rotation of the cam 77 raises the cards to the position shown in Fig. 11. The table top 33 has two openings 81 and 82 through which vertical portions of the bent bar 75 are extended, as shown in Fig. 15.

As shown in Figs. 2 and 16 a first feed roller 85 is mounted in a position to engage the advancing end of the bottom card as it is pushed out of the stack by the feeding plate 56 in the manner described above. The feed roller 85 is mounted on a sleeve 86 for rotation therewith, the sleeve 86 being mounted on a non-rotatable shaft 87. At its forward end the shaft is secured to a leaf spring 88 which is anchored to the bar 77 in the same manner as the leaf spring 76 which mounts the flexing bar or member 75, as described above. A belt pulley 89 is secured to the sleeve 86 for driving the roller and a belt 90 which passes about this pulley is driven by a pulley 91 supported on a jack shaft 92 mounted in a bracket 93, as shown in Figs. 1 and 3. The pulley 91 is secured to a larger pulley 94 which is driven by a belt 95 which passes about a pulley 96 on the motor 15. The belt 90 also passes forward, as shown in Fig. 1, about another pulley 97 which drives another feed roller to be described presently. Returning, the belt 90 passes over a small idler pulley 98 which is mounted freely on the shaft 87 beside the pulley 89. By the means just described, the feed roller 85 is continuously driven but it is effective to advance a card only when it is in the lowered position, as shown in Fig. 16, that is, when the flat portion of a cam 99 on shaft 34 is disposed so as to lower the feed roller 85 into cooperating position with respect to a small idler roller 101 which is rotatably mounted on a bracket 102 beneath the table top and has its periphery extending through a slot 103 in the table top to a position substantially flush with or very slightly above the table surface.

To guide the cards C as they advance, undercut guide bars 104 and 105 are mounted on the feed table, one being suitably fastened thereto at either side of the feed path so as to keep the cards in proper alignment. The front and rear edges of the cards ride in the grooves 106 and 107, respectively, and thus the cards are presented squarely to the sensing station, the guide bars 104 and 105 being spaced apart a distance equal to the width of a control card C.

The feed roller 85 in cooperation with the underlying idler 101 advances a card C into sensing position under a series of sensing elements

or teeth 110, each of which is carried by a sensing bar 111. These bars are specifically described in my aforesaid co-pending application, Serial No. 663,467, and are shown in outline in Figs. 3 and 7. By means described more particularly in my aforesaid co-pending application and including the rack members 112 and 113, Fig. 3, the sensing bars are operated to move across the surface of each card as it is in sensing position and to sense perforations or other indicia therein or thereon to position the arcuate rack members 113 which in turn position printing characters in a manner to be described more fully hereinbelow. Upon the sensing element 110 encountering an indicium on the card or other record member C, the sensing bar 111 rocks in a vertical plane to engage locking means described below.

During the time that sensing is taking place, as previously described above, the advance end of the card C to be sensed is positioned against a front stop or positioning member and under another feed roller which at an appropriate time is lowered to carry the card out of sensing position and deliver it to the receiving hopper 33A. As shown in Fig. 17, the feed roller is indicated by the reference character 115 and it is mounted on a sleeve 116 which in turn is carried by a shaft 117 secured by leaf spring 117S to the front bar 77 in the same manner as feed roller 85, previously described. The pulley 97, which is driven by belt 90 in the manner described above, rotates the sleeve 116 and the feed roller 115. As shown in Fig. 18 a stop finger 118 is positioned in the path of the advancing cards at a point where it will hold them properly and accurately in sensing position during operation of the sensing fingers 111. This finger comprises a vertical plate mounted on a horizontal bar 119 carried by a leaf spring 121 also secured to the front bar 77. The feed roller 115 and the stop finger 118 are raised and lowered at appropriate times in the feeding cycle by cams 122 and 123, respectively, mounted upon the shaft 34. It will thus be seen that all of the mechanisms which feed the card from a stack of cards to and through sensing position and into a receiving hopper are controlled by elements operated from the shaft 34. A card or control device C, to be sensed, is retained in sensing position while the sensing fingers 111 are slid across the face thereof. When an indicium, such as a perforation in a card, is sensed the sensing finger immediately rocks slightly and is locked against further movement across the card. This locking is accomplished by means and in a manner fully described in my aforesaid co-pending application, Serial No. 663,467. Locking the sensing bar against movement obviously positions the racks 112 and 113 in a definite position.

Shaft 34, which controls the various feeding elements described above, has keyed thereto a bevel gear 125 at its left end as seen in Fig. 1. This gear meshes with a bevel gear 126 on a shaft 127 which extends rearwardly of the machine. The shaft 127 is driven in a manner to be described presently, so that shaft 34 is rotated in proper timed relation with operating elements of the printing unit per se. In this manner, and as fully described hereinbelow, the feeding of cards or the like C is accurately synchronized with printing operations.

As shown in Figs. 1 and 2, the bevel gears 125 and 126 are of the same size so that the shafts 34 and 127 rotate at the same speed. With this arrangement a card is fed for each impression of the printing unit, to be described hereinafter. However, for some purposes it is desirable to print the data sensed more than once as, for example, on the body and stub of a check, receipt, utility bill or the like. In such cases it is desirable that the gear ratio be changed so that only one card will be fed to sensing position for every two or three, or possibly more operations af the printing mechanism.

Accordingly, and as shown in Fig. 7, this arrangement may be modified to provide slower operation of the feed mechanism with respect to certain other parts of the machine including the printing mechanisms. As shown in Figs. 8 and 9 the shaft 34 carries a relatively large spur gear 131 which meshes with a small spur gear 132 carried by a jack shaft 133. In this instance the bevel gear 125', carried by the jack shaft just mentioned, meshes with a similar bevel gear 126' on the rearwardly extending shaft 127. Shaft 127 is driven by bevel gears 135 and 136, the latter being mounted on the end of a cam shaft 137 which is carried by the frame members 18 and 19 previously described. Shaft 137 operates the printing mechanism in a manner to be described more fully below and it carries a large spur gear 138 which, as described hereinbelow, may be operably connected with the shaft through a clutch. As shown in Fig. 7, mounted on a jack shaft 141. Integral with the small spur gear 139 is a larger gear 142 which meshes with a small spur gear 143 mounted coaxially with and driven by a pulley wheel 144. The pulley is driven by means of a belt 145 from a small pulley 146 on the motor 15. By the means just described, various mechanisms of the machine including the printing unit and the card feeder are driven and it will be seen that a positive gear ratio is established between the feed mechanism and the printing mechanism which is operated by cams on the shaft 137 in a manner to be described hereinbelow. The feed rollers 85 and 115 which advance the cards C from station to station are not synchronized with the other parts of the machine, such synchronization not being necessary because the lowering of these rollers into cooperation with the cards is accurately timed by cams on shaft 34.

Referring now to Fig. 3, it will be noted that the arcuate racks 113, previously mentioned as cooperating with racks 112 to move the sensing bars 111 to sensing position, are integral with or secured to printing sectors 151. In that form of my invention shown in Figs. 1 to 18, inclusive, there are as many sensing bars 111 as there are rows of data or data positions on a card C to be sensed. Hence there are a similar number of rack members 113 and printing sectors 151 and each printing sector is adapted to be selectively positioned so as to present a desired character in printing position dependent upon the position at which the sensing bar 111 comes to rest in sensing movement across a card C. As mentioned above and shown in Fig. 3, and as more fully described in my aforesaid co-pending application, Serial No. 663,467, the sensing bars 111 slide across the surface of a card until they encounter a perforation therein when they drop into engagement with a notch in a serrated plate 152. This plate is provided with accurate serrations and is accurately positioned in the machine. Hence when a sensing bar comes into a stop position the printing sector 151 is positioned with a high degree of accuracy. For

example, the printing sector 151 may carry a set of digits therein from "0" to "9." A perforation in the card C may represent any one of these digits and when it is sensed the sensing bar 111 is locked in an accurately determined position so that the printing member 151 is also accurately set to dispose the desired printing character below an inked ribbon IR.

Control devices, such as perforated cards C, are subject to variations in size and it is not always possible to locate indicia such as perforations therein with a high degree of accuracy. Also, as cards of this character, and particularly paper cards, are handled repeatedly and passed through sensing mechanisms and other devices, the perforations frequently become distorted or enlarged. Since it is desirable that minor inaccuracies in the location and form of indicia on cards as C be not transmitted to printing members controlled by sensing devices, separately controlled locking means, other than the perforation in the card itself are provided. Thus the sensing tooth 110, on the end of a bar 111, which drops into a perforation on card C encounters an accurately located serration on the plate member 152 underlying the card C, which determines accurately the point at which the sensing bar 111 will be stopped in its transverse sensing movement. Minor inaccuracies in the location of the perforations in the card C have no effect on the accuracy with which the sensing bar is finally located, unless the inaccuracy is so great as to cause the sensing tooth on a bar 111 to engage the wrong serration in which case of course the card should be destroyed and a new one substituted.

The serrations shown on the lower side of the bars 111, as in Fig. 3, cooperate with other locking means, the details of such construction and operation being fully described in my aforesaid co-pending application, Serial No. 663,467.

It is important to note that the positioning of the sensing bars and of the printing elements which they control is only under general control of the indicia carried by the cards C, being under the specific control of the locking elements briefly described above and more fully described in the application just mentioned. In other words, an indicia, as a perforation in a card C, determines what printing character will be selected, but the exact movement of that printing character to a precise printing position is determined by the means which accurately locate and lock the sensing bar, as 111, in its final position. Direct connection between the sensing bar 111 and the printing member 151 makes sure that the printing member will be located with the same degree of accuracy as the sensing bar, the teeth of racks 112 and 113 being accurately formed for this purpose.

Another advantage of this construction, aside from the accuracy which printing members may be selectively positioned, results from the fact that the sensing bars are finally positioned by mechanical elements rather than by the cards C. Since these elements have appreciable mass, even though they may be made very light, cards of paper or the like would be damaged and rapidly destroyed if they were required to stop in sensing position the bars 111 moving under the force of springs as 175. Instead, the shock of stopping the bars and parts associated therewith is taken by the serrated plate 152 and other locking means and the cards C are saved from injury.

Above the inked ribbon, and aligned with each of the printing sectors 151, there is disposed a printing platen element 153 carried by a bell crank 154 which is mounted pivotally upon a shaft 155 in the upper rear portion of the side frames 18 and 19. There are as many platen elements 153 and bell cranks 154 as there are printing sectors 151, each platen element being individually movable to press an article to be printed, such as a sheet of paper, against the inked ribbon, causing an impression to be taken from the printing characters disposed beneath the inked ribbon by the sectors 151.

The bell crank levers 154 which carry the platen elements are each provided with a rather strong tension spring 156 connected between the bell crank and a stationary rod 157. Extending above the bell cranks 154 is a hood or shield 158 which carries a comb member 159 at its forward end, disposed so as to keep the bell cranks 154 properly separated and the platen elements 153 each aligned with its respective printing sector 151.

A substantially flat and horizontal printing table 160, Figs. 1, 2, 3, 7 and 10, is mounted on the frame members 18 and 19 at a height substantially flush or level with the tops of the printing sectors 151. This table is provided with an opening 161 through which the printing characters on the sectors 151 and the inked ribbon IR are exposed for cooperation with the platen elements 153. The table 160 supports the hood or shield 158 and comb member 159 mentioned above. Guide means 162 and 163 are provided for sheets, envelopes or other articles which are fed along the table to be printed with the data represented or controlled by the indicia on the cards or control members C. Normally the printing platens are held in raised position, as shown in Figs. 3, 7 and 10 by a bail member 164 carried by an arm 165 pivoted on a shaft 166. This bail member 164 contacts the lower ends of the bell cranks 154, as clearly shown in Fig. 3. As fully described in my aforesaid co-pending application, an arm 165A extends from the shaft 166 to a cam 167 carried by the shaft 137, Fig. 5A, and at appropriate times after the printing sectors have been set selectively in printing posision according to data sensed on the control cards C the cam permits the arm 165A to swing clockwise as shown in Figs. 3 and 5A, for example, and the bail member 164 swings downwardly in a slot 164A provided in each of the frame members 18 and 19. This permits the springs 156 to draw the bell cranks 154 which carry the platen elements downwardly quickly and forcibly so as to produce a printing impression on the lower side of the sheet or other article disposed over the printing sector 151 and lying between the guide members 162 and 163 on top of the upper table surface 160 which supports the article being printed. The platen elements are shown in printing position in Fig. 5A.

Means are provided for rotating the printing sectors 151 and the racks 113 which are integral therewith in both directions about the shaft 171 on which they are freely pivoted. Since the racks 112 are integral with the sensing bars 111 and are in mesh with the racks 113, rotary movement of the printing sectors is accompanied at all times by longitudinal sliding movement of the sensing bars 111. As best shown in Figs. 3 and 5A a bail member 172 is mounted on arms 173 fixed against rotation on the shaft 171. The arms 173 also carry a transverse rod 174. A tension spring 175 is connected between each of the printing sectors 151 and the rod 174.

Referring now to Fig. 6A, the shaft 171 has affixed thereto, as by set screw 176, a two armed lever 177 carrying at the end of each arm a cam follower roller 178. Each of the rollers 178 is adapted to cooperate with one of a pair of conjugate cams 179 and 180, carried by and fixed to the shaft 137. By the means just described the shaft 171 which carries the arms 173, bail 172 and rod 174, is rocked in alternate directions at appropriate times. When the shaft is rocked clockwise, as shown in Figs. 3 and 6A, the bail 172 is withdrawn from contact with the rear edges of the printing sectors 151 and the springs 175 are tensioned to urge the printing sectors to rotate clockwise also. This causes the sensing bars to move forward, the sensing element at the extreme front end of each bar sliding across a card C in sensing position (not shown in Fig. 3) until a perforation or other indicia borne by the card is encountered. As briefly explained hereinabove and as more fully described in my aforesaid co-pending application, Serial No. 663,467, the sensing bars are stopped in accurately defined positions and the various printing sectors likewise are positioned selectively, according to the data sensed, to print when the platens 153 are lowered to strike the upper surface of an article to be printed.

The printing sectors are retained in printing position by means more fully described in my aforesaid co-pending application, and including the locking elements 182 and 183, Fig. 3, until printing is accomplished. Thereafter, the conjugate cams 179 and 180, Fig. 6A, return tthe shaft 171 and arms 173 to their normal or zero positions counterclockwise, as seen in Figs. 3 and 6A, and the bail member 172 restores the printing sectors 151 and the sensing bars 111 to their zero positions. As each new card C to be sensed is fed into sensing position, these operations are repeated.

The platen elements 153, carried by bell crank levers 154, as previously described, are quickly withdrawn from impression position after printing is accomplished, this occurring before the printing sectors 151 are restored to their zero positions in the manner just described. In case it is desired to print the same data on separate sheets, or on different parts of the same sheet, the card C is retained in sensing position during a plurality of cycles of the shaft 137. The arrangement described hereinabove in connection with Figs. 8 and 9 provides for operation of shaft 137 a plurality of times while the card feeding mechanism is being operated only once. The number of operations for each card is obviously determined by the ratio of the spur gears 131 and 132. Where the ratio is to be one to one, the spur gears are eliminated and the drive is directly from shaft 127 to shaft 34 through bevel gears 126 and 125.

Any suitable means may be provided for feeding sheets to be printed along the table 160 over the opening 161 and between the guides 162 and 163. A mechanism suitable for this purpose is described in detail in my Patent No. 2,342,190 issued February 22, 1944. In those instances where a plurality of impressions are to be taken on a single sheet, suitable feeding means for advancing the sheet step by step may be provided. Since the feeding means for single printed sheets, or for advancing sheets step by step through the printing means of the present invention form no part of such invention, description thereof is unnecessary.

Means are provided in my improved printing machine for advancing the inked ribbon IR step by step so as to present a new portion thereof in printing position after each operation of the machine as is well known in the art. As shown in Figs. 6 and 6A, these means include an arm 191 secured to the shaft 171 as by a set screw 192 for rotation therewith. A substantially vertical link 193 has its lower end engaged in an opening in the end of arm 191 and its upper end is pivotally connected with one arm 194 of a bell crank pivotally mounted on a stud 195 secured to a part of the frame. The other arm 196 of the bell crank terminates in a short rack portion 197 which engages cooperating teeth on a block 201 secured by a set screw 202 to a transversely slidable rod 203. Near each end thereof the rod 203 carries a forwardly projecting pawl member 204 affixed non-rotatably to said bar as by a set screw 205. A tension spring 206 is attached to one of the pawl members, the upper ends of said spring being secured to a frame portion to urge said pawls upwardly into cooperation with ratchet wheels 207 which are secured non-rotatably to reels 208 for the inked ribbon IR. The reels 208 and ratchets 207 may be supported by suitable bolts 209 secured to an appropriate frame member. Reversing mechanism is provided as well known in the art, description thereof being unnecessary. When the shaft 171 is oscillated by the conjugate cams 179 and 180, the link 193 causes the bell crank 194, 196 to slide the rod 203 back and forth and the pawls 204 engage one or the other of the ratchets 207 to advance the ribbon in one direction or the other, depending upon the position of the reversing mechanism.

A hand wheel 210 is mounted to rotate with shaft 137 during normal operation and provide a manual means by which the printing mechanism may be operated when desired.

Manual means are provided, also, for locking the printing platens in their raised positions when it is desired to operate shaft 137 without printing. As shown in Figs. 3, 6 and 10 a two-armed lever 211 is pivoted on a stud 213 and its upper end has a notch 214 adapted to engage a projecting end of the bail 164 when the bar is rotated counterclockwise, as seen in Fig. 3, to the dotted line position. In this position the bail 164 is held up, against the force of springs 156, tending to pull the platen levers 154 down, and printing cannot take place. The lower arm 215 of lever 211 has attached thereto a tension spring 216, the forward end of which is secured to the frame to normally hold lever 211 in its inoperative position against the shaft 155 which serves as a stop to limit rotation thereof. A rod 217, connected to the lower end of the arm 215, extends to the front of the machine where it is slidably mounted in a bracket 218. A knob or knurled head 219 is provided on the end of the knob for pushing the lever into locking engagement with bail 164 when it is desired to prevent printing.

As previously noted, the cam shaft 137 is driven by the gear 138 through the intermediary of a clutch. This clutch is of the one revolution type and is similar to the clutch described in detail in my prior Patent No. 2,132,413, patented October 11, 1936. As best shown in Fig. 6, it comprises a toothed member 221 secured to gear 138 to rotate therewith, the gear and toothed member 221 being freely mounted for rotation with respect to shaft 137. A cooperating toothed member 222 is slid-

ably mounted on shaft 137 but is constrained to rotate therewith, as by a spline or a key, as well understood in the art. A collar 223 is fixed to the shaft 137 as by a set screw 224 and a compression spring 225 is interposed between the collar and the toothed member 222 to urge the member 222 into driving engagement with the member 221.

The toothed member 222 is provided with a projecting stud 226 which is adapted to cooperate with a cam shaped edge portion 227 of a hinged plate 228. As the parts are shown in Fig. 6, the stud 226 advances toward the observer and encounters the cam shaped edge portion 227 toward the close of a cycle of operation. As it does so, cam 227 moves the stud to the right, as seen in Fig. 6, compressing spring 225 and disengaging the clutch elements. At its terminus, the cam 227 merges into a stop shoulder 229 which holds the shaft against further rotation until the stud is released from stop 229 by moving plate 228 away from the clutch elements and allowing the stud to become disengaged therefrom. Plate 228 is pivotally carried on the rod 203, as best shown in Fig. 10. A spring 231 tends normally to hold the plate against the clutch elements but a push rod 232, secured to the lower part of the plate 228, and projecting to the front of the machine, affords a means for releasing the clutch for a cycle of operation. The front end of the push rod is provided with a suitable knurled head or knob 233. When the knob 233 is pushed inwardly, plate 228 swings to the dotted line position shown in Fig. 10, clearing the stud 226 to permit the clutch to engage. Upon release, spring 231 swings the plate 228 back against the clutch elements and the operation of shaft 137 is discontinued upon completion of a complete single cycle. However, the knob 233 may be held in continuously and in this case operation of the shaft 137 will be continued without interruption until release of the declutching mechanism just described.

The mechanism just described requires manual release of the declutching plate 228 for each cycle of operation of the machine. For some types of operation, as where sheets are fed by hand to printing position, this is desirable, but it is normally preferred to feed sheets automatically and it is desirable that operation be automatic and continuous, subject to interruption if there is a failure in the feeding of a sheet to printing position or a card to sensing position. An arrangement for this purpose is shown in Fig. 7 where a solenoid 240 has its plunger 241 connected by a link 242 to the plate 228. Normally, for continuous operation of the machine, the solenoid is activated just before the close of each cycle to draw the plate 228 out of the path of the stud 226 and thereby trip the machine for another cycle. Any interruption in current to the solenoid at this time, however, releases the solenoid plunger so that the spring 231 can draw the plate 228 into position to separate the driving elements of the clutch.

Current may be supplied to solenoid 240 from any suitable source. Preferably a sheet controlled interrupter is incorporated in the electric circuit so that failure to feed a sheet to printing position will cause interruption of current to the solenoid in a manner well known in the art.

The electric circuit may include a pair of electric contacts 250 which are adapted to be closed periodically as by a cam 251 mounted on a shaft 252 which comprises a part of an automatic sheet feeding mechanism not shown. The cam 251 closes the contacts once each cycle near the end of such cycle to activate the solenoid and withdraw plate 228 to permit the clutch to be engaged for another cycle. Should some other part of the circuit be interrupted at this time, as by failure of a sheet feeding or advancing operation, solenoid 240 is not activated even though contacts 250 are closed and automatic operation will not be resumed until the cause of the interruption is ascertained and removed. If desired, the sheet feeding mechanism may be similarly controlled by a solenoid activated single revolution clutch, such an arrangement being described in my aforesaid Patent No. 2,342,190.

In Fig. 19 an arrangement is shown wherein three printing units of the character described hereinabove may be arranged in tandem to print three lines of dissimilar data on a single article, such as a sheet or envelope. For example, this arrangement may be used for printing a three line name and address on an envelope, postcard, bill or the like, as shown in Fig. 20. For this purpose control members, such as the cards C described above, may be provided with three separate groups or fields of indicia, each of which is adapted for sensing by a separate group of sensing elements.

Thus Fig. 19 represents a plan view of an arrangement wherein a single continuous feed table 333 for control cards extends through three separate sensing stations S1, S2 and S3, and a continuous feed table 360 for sheets or other articles to be printed extends through three printing positions P1, P2 and P3.

The printing unit P1 and sensing unit S1 may constitute a single printing machine of the type described hereinabove. Likewise the printing unit P2 and sensing unit S2 may comprise another substantially complete machine and the printing unit P3 and sensing unit S3 may comprise a third machine. Preferably all of these machines are driven by a single motor 315 having an extended drive shaft 315A which drives the various mechanisms through belts and pulleys in the same manner as the single unit described in connection with Figs. 1 to 18 is driven.

Since the same cntrol cards are to be fed through all three sensing stations and articles to be printed are to be fed through all three printing stations in series, a single continuous feeding system is used for the cards and another for the articles to be printed. Thus as shown in Fig. 19, the feed system for the control cards comprises a hopper having side walls 362 and 364, a feed plate 356 reciprocated by a bell crank 343 pivoted on a stud 344, and various card advancing rollers operated by belt drive from the motor shaft 315A. The bell crank 343 is oscillated by a pitman 339 and an eccentric crank pin 338 identical with the pitman 39 and pin 38 previously described.

A separate cam shaft 334A is provided for each of the other two printing units, such cam shafts all being driven through bevel gearing by shafts 327 which are driven from cam shafts in the printing units, not shown but identical with the shaft 137 previously described. These shafts, in turn, are driven by gearing and belt drive means as described hereinabove, a separate one-revolution clutch being provided for each unit. A solenoid is provided for each of the clutches, such solenoid being connected and operated in the same manner as solenoid 240, Fig. 7. These solenoids are indicated diagrammatically at 240A, 240B and 240C.

A continuous feed table 360 is provided for

carrying articles to be printed through all three printing mechanisms, as previously noted. This system may comprise two continuous shafts **380** and **390** extending through all three units and driven by the printing machine. Shaft **380** drives feed rollers **401**, **402** and **403** by means of suitable bevel gearing. Since these are friction rollers it is not important that they be synchronized, in rotation, with the printing mechanism. The shaft **390**, however, is a cam shaft which raises and lowers the rollers **401**, **402** and **403** in timed relation to printing operations and it must be geared to the printing units for properly timed operation therewith.

Shaft **390** also controls stop members **411**, **412** and **413** which stop sheets, envelopes, or the like in proper position for printing. These elements may be operated by cams on shaft **390** in the same general manner as the stop finger **118**, Fig. 18, is operated.

In order that all the printing units and sensing units may be interrupted if any interruption or irregularity occurs in the feed of articles to be printed, or of control cards, the three solenoids **240A**, **240B** and **240C** corresponding to solenoid **240** are preferably connected in the electric circuit in such a manner as to be deenergized one at a time, depending upon where the sheet failure occurs. Thus, as indicated diagrammatically in Fig. 19, the three solenoids may be connected in parallel, each however being in series with a sheet detector D1, D2 and D3, respectively. A pair of contacts **430** are in series with the line and a cam **431** closes these contacts periodically in the same manner that cam **251** closes contacts **250** in Fig. 7.

With this arrangement, assuming that there is a failure to properly feed a sheet or envelope to the first printing unit P1, a sheet from station P1 can nevertheless be printed at stations P2 and P3 so as to be cleared from the machine before the second and third printing mechanisms cease to function.

It is believed that the operation of the single printing unit, as well as the combination of three units, will be clear from the foregoing description. Briefly, however, the operation of the machine is as follows:

The feed plate **56** feeds a control member such as a card C from the bottom of a pile thereof to a point where its advance end is positioned under the first feed roller **85**. At a properly timed point in the cycle of the machine the feed roller **85** is lowered to advance the card C into sensing position where it is accurately aligned with sensing fingers **111**. At this point the conjugate cams **179** and **180** on shaft **137** move the arms **173** and bail **172** away from the printing sectors **151**. As this occurs the springs **175**, which are individually attached to each of the printing sectors, cause the sectors to follow the bail **172** and through racks **113**, **112** they cause the sensing fingers or bars **111** to traverse the card C. As each of the fingers **111** encounters a perforation or other indicia on the card C, further movement is stopped and the finger, and the printing sector **151** geared thereto, are stopped, the printing sector thereby positioning a printing character, corresponding to the position of the indicia on the card C, beneath the inked ribbon IR.

After all the sensing bars **111** have been locked and the printing sectors thereby positioned for printing, the rotating shaft **137** brings the cam **167** to a point where its follower **165A** may drop off the abrupt shoulder on the cam. When this occurs, each of the springs **156** draws its associated bell crank **154** down sharply, striking the platen elements **153** against the article to be printed and producing an impression on its lower face from the printing characters through the inked ribbon IR. Subsequently, rotation of shaft **137** restores the platen arms **154** to their raised positions and the conjugate cams **179** and **180** restore the bail **172** and the printing segments **151** and sensing bars **111** to their normal zero positions.

If the machine is manually controlled it must be tripped for each cycle and this is accomplished by the operator pushing in the knob **233**. If the machine is automatic, as it usually is, particularly when articles to be printed are fed automatically, the machine is tripped by the solenoid **240** for each operation and its operation is continuous unless and until a sheet fails to be fed properly. The same control may, if desired, be extended to the card feeding system, so that continuous operation is dependent both upon feed of a card and feed of an article to be printed. This arrangement is not shown in the drawings but is believed to be obvious to those skilled in the art, since it involves only the use of conventional sheet detectors along the path of the card feed.

When three machines are connected in tandem, as for printing a name and address such as is indicated in Figs. 19 and 20, the cards C have three separate groups of data-representing indicia, one of which is sensed at each station S1, S2 or S3. One line of data, corresponding to the indicia sensed at station S1, is printed by the first printing unit P1. A second line of data is printed at station P2, corresponding to the indicia sensed at station S2 and a third line is similarly printed at station P3. Obviously the number of printing units employed could be varied as desired.

When it is desired to print data more than once on a single sheet, the feed mechanism for control cards C is geared to operate through only one cycle for each sheet. Thus if each sheet is to be printed with the same data at two or at three positions thereon, as might be done in printing checks and stubs, utility bills and stubs, and the like on a single sheet, the feeder for the control cards operates only once for each two or each three operations of the printing and sensing mechanism. Gearing between the shaft **127** and shaft **34** is appropriately selected for the particular purpose of the machine.

While I have described my invention as being used particularly in connection with perforated control cards and with sensing bars **111** of a particular type, it will be understood that any type of control or record member which can be sensed mechanically may be employed therein, suitable modifications being made in the sensing means as more fully pointed out in my aforesaid copending application, Serial No. 663,467.

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

I claim:

1. In a record controlled printing machine, a sheet guideway along which a sheet may be fed into a succession of printing stations, sets of set-

table printing elements disposed at the respective printing stations in different line spacing positions extended longitudinally of said guideway and in stepped relationship transversely of the sheet guideway, a record guideway extended parallel to said sheet guideway and having a plurality of sensing stations disposed at spaced points therealong, sets of sensing means at the respective sensing stations disposed at positions for sensing different portions of a record at the different sensing stations, and means operatively connecting the sensing means of the respective sets of sensing means to the settable printing elements of said sets of printing elements.

2. In a record controlled machine of the character described, a guideway along which a sheet to be printed may be fed, plural printing stations for the sheet arranged in tandem along the guideway, a second guideway along which an article bearing representations of different parts of a record to be printed on the sheets may be fed, plural sensing stations each paired to a printing station and each disposed adjacent the second guideway, each printing station comprising settable type elements under control of sets of sensing means in the corresponding paired sensing station, one sensing station adapted to sense representations corresponding to one part of the record and another sensing station adapted to sense representations corresponding to another part whereby the corresponding printing stations print one part of the record and then another on the sheet, means for successively feeding the article to be sensed first to one sensing station and then to another, and means for successively feeding the sheet to be printed first to one printing station and then to another accordingly as the article is fed from one sensing station and then to another.

3. In a record controlled printing machine of the character described having printing stations associated with sensing stations, a guideway along which an article to be printed may be successively fed first to one printing station and then to another, each printing station comprising settable type elements disposed in the guideway, a second guideway along which a member carrying dissimilar representations of parts of the record to be printed on the article may be successively fed first to one sensing station for sensing the representations corresponding to one part of the record and then to another sensing station for sensing representations corresponding to another part of the record, the printing stations and sensing stations being connected in pairs, the type elements in each printing station being settable in accordance with the representations of the record sensed at the corresponding sensing station, means in the second guideway for successively feeding the said member first to one sensing station and then to another, means in the first-named guideway for successively feeding the said article to be printed first to one printing station and then to another, means in the second guideway for locating the said member first at one sensing station and then at another, and means operating the settable type elements to print the record in succession as the said member is located successively at the sensing stations.

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