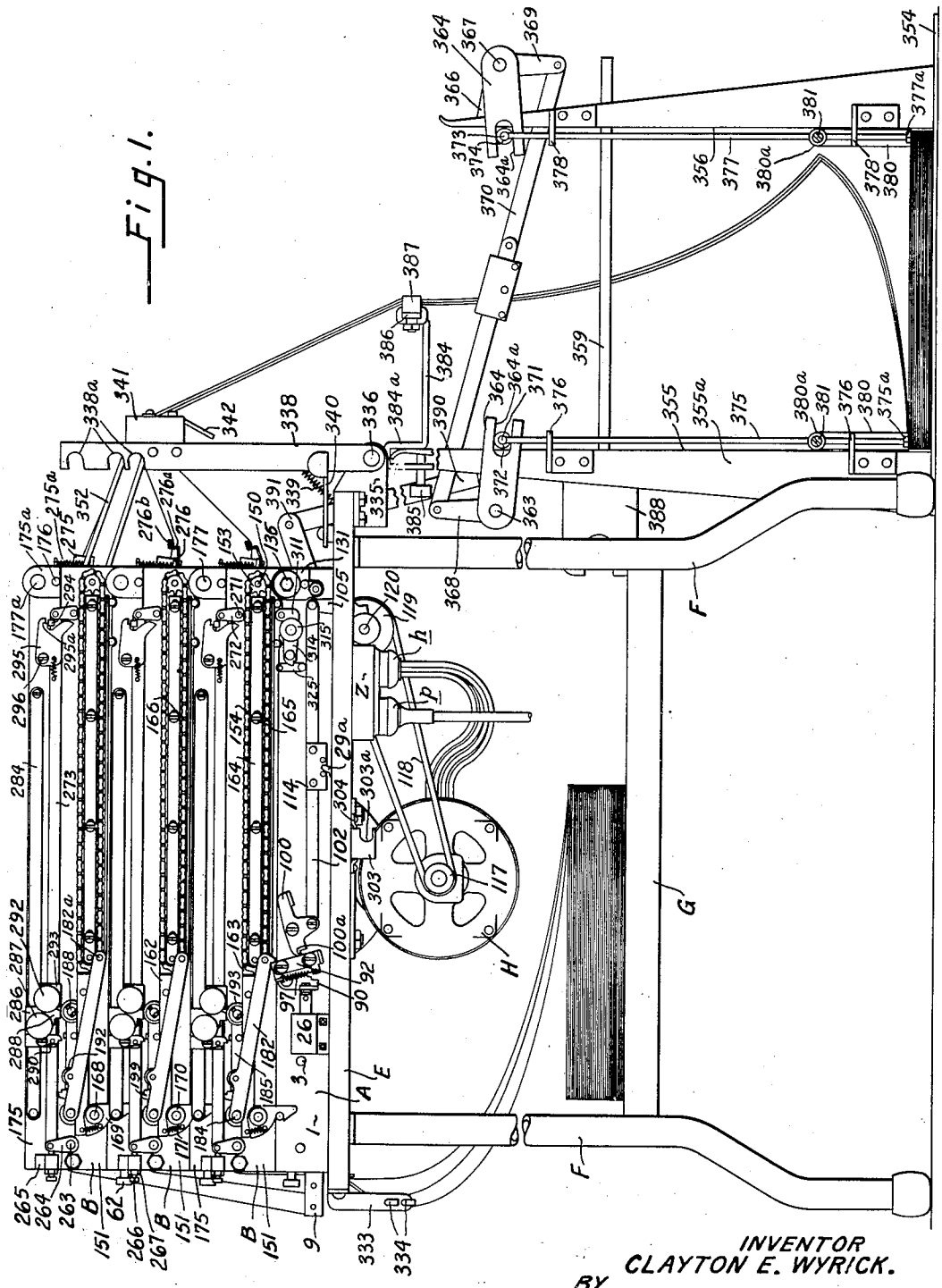
Jan. 23, 1940. C. E. WYRICK 2,187,722

PRINTING MACHINE

Filed Aug. 29, 1936 21 Sheets-Sheet 1

Fig. 1.



INVENTOR
CLAYTON E. WYRICK.
BY
ATTORNEYS

Jan. 23, 1940. C. E. WYRICK 2,187,722

PRINTING MACHINE

Filed Aug. 29, 1936 21 Sheets-Sheet 2

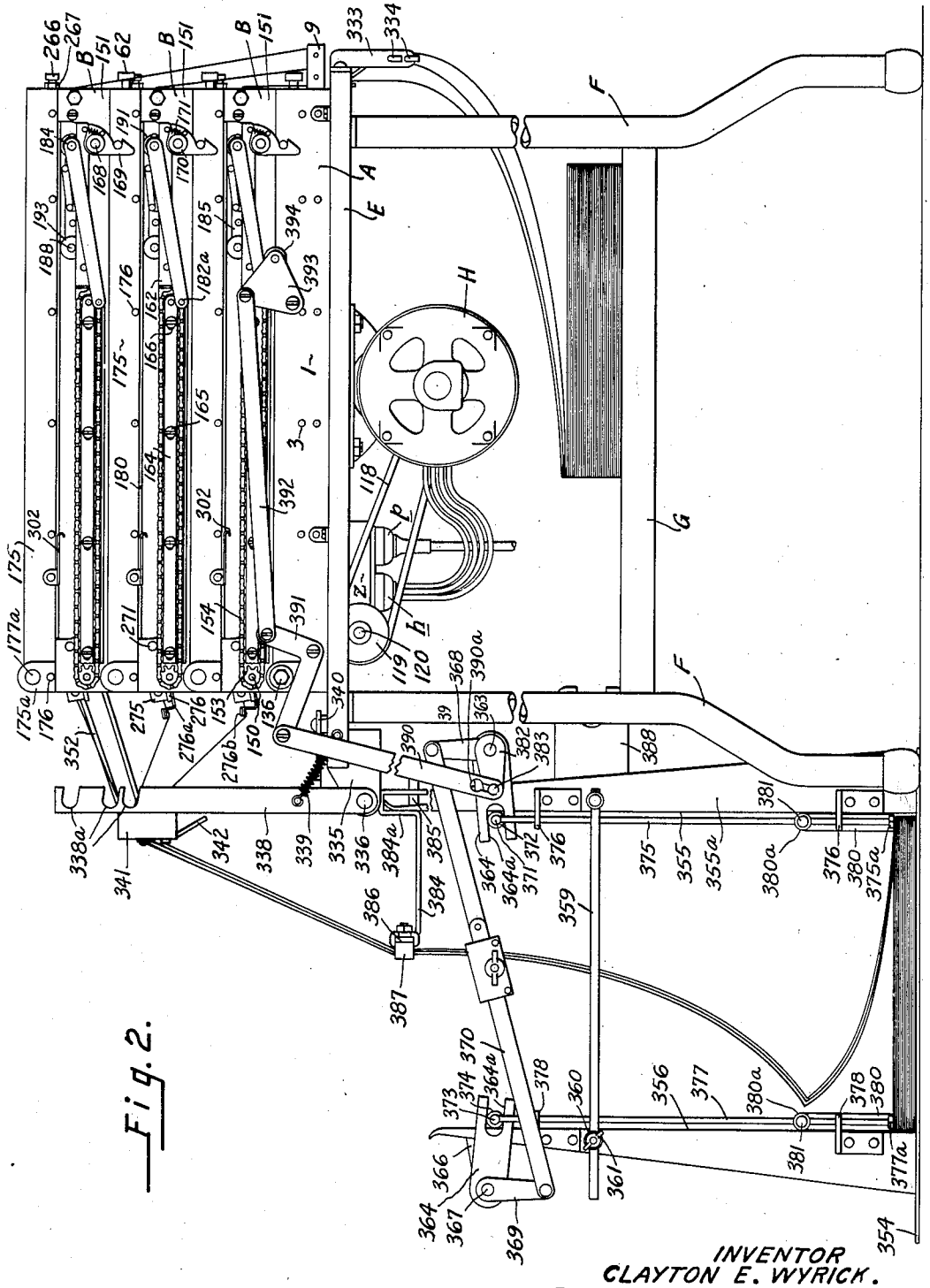


Fig. 2.

INVENTOR
CLAYTON E. WYRICK.
BY
ATTORNEYS

Jan. 23, 1940. C. E. WYRICK 2,187,722

PRINTING MACHINE

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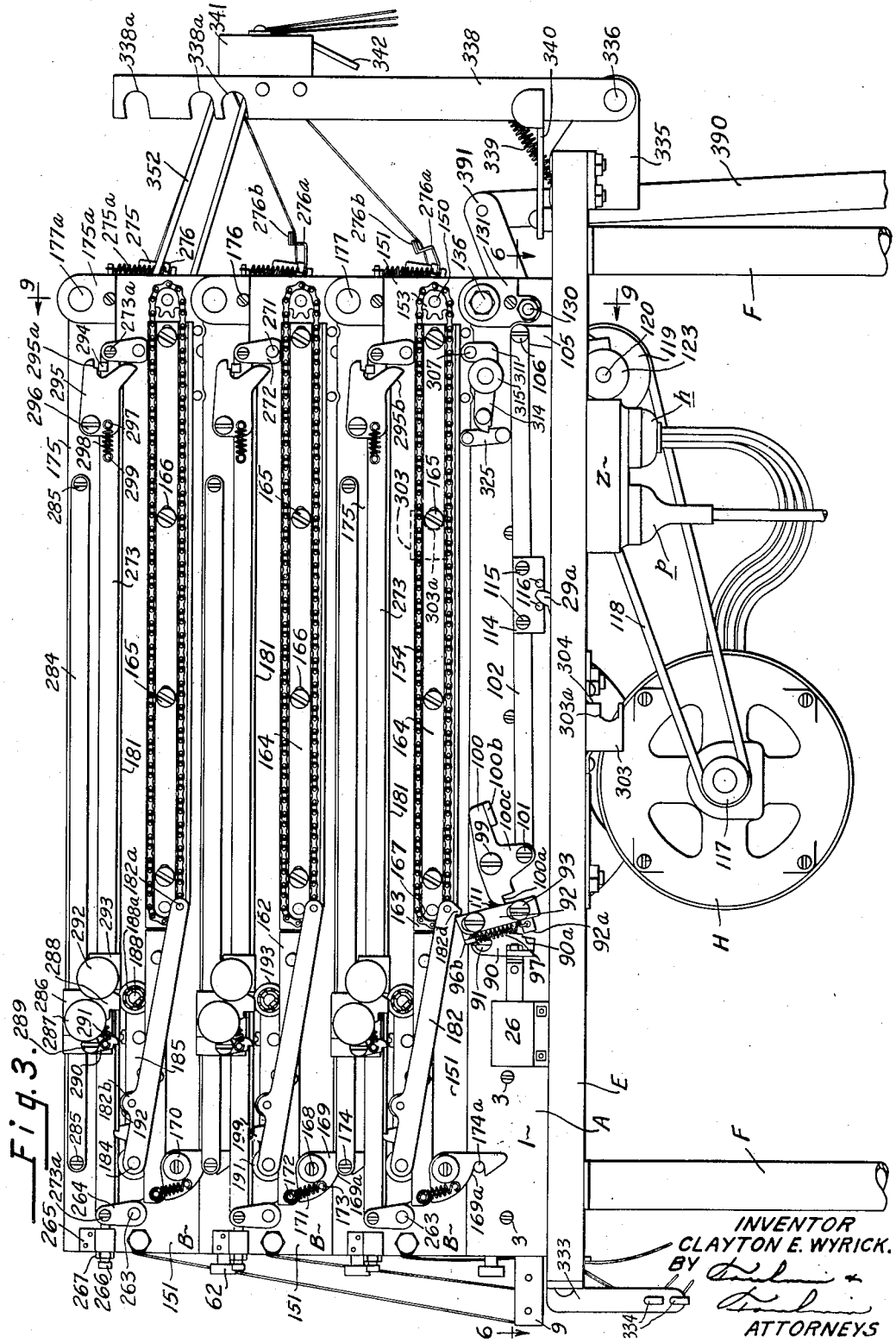


Fig. 3.

INVENTOR
CLAYTON E. WYRICK.
BY
ATTORNEYS

Jan. 23, 1940. C. E. WYRICK 2,187,722

PRINTING MACHINE

Filed Aug. 29, 1936 21 Sheets-Sheet 4

Fig. 4.

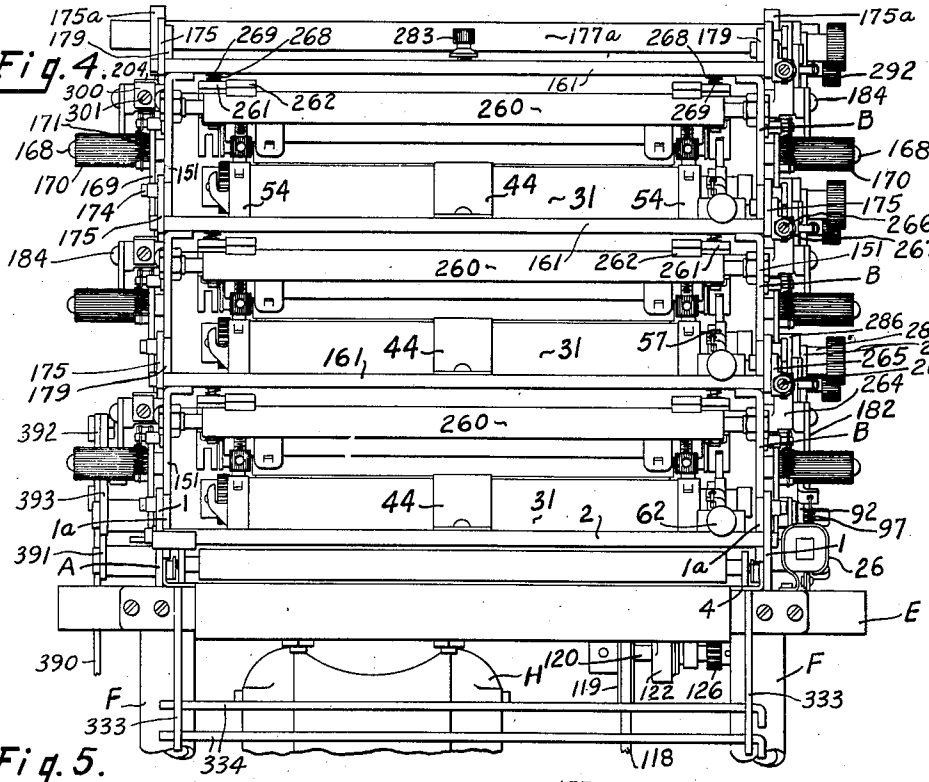
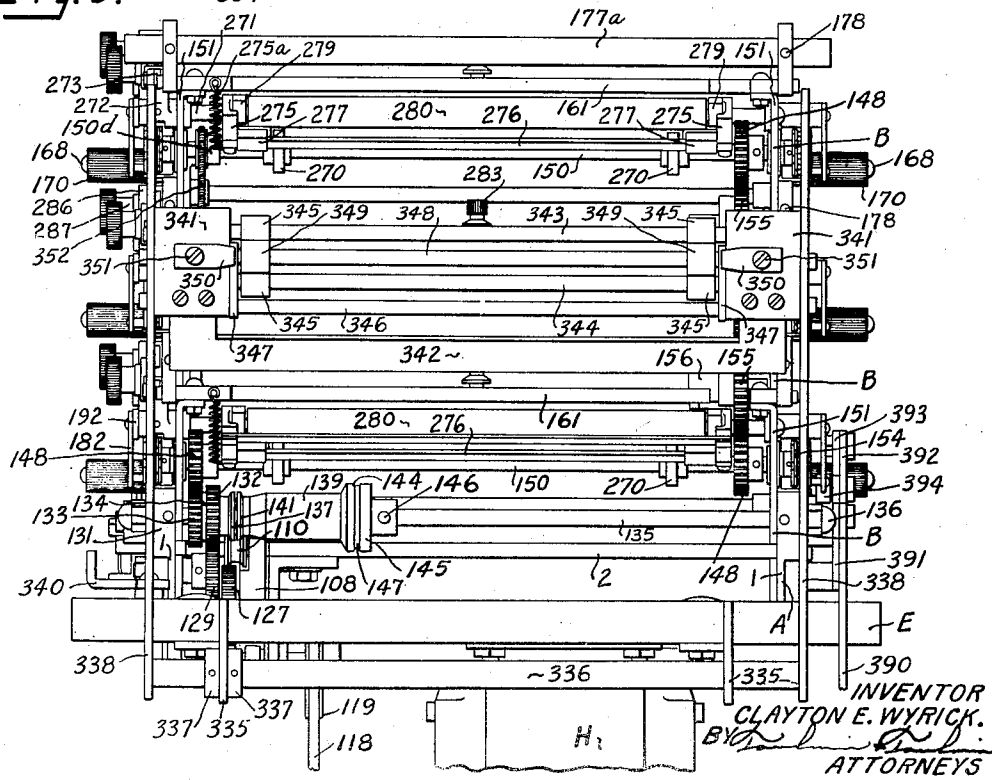


Fig. 5.



Jan. 23, 1940. C. E. WYRICK 2,187,722

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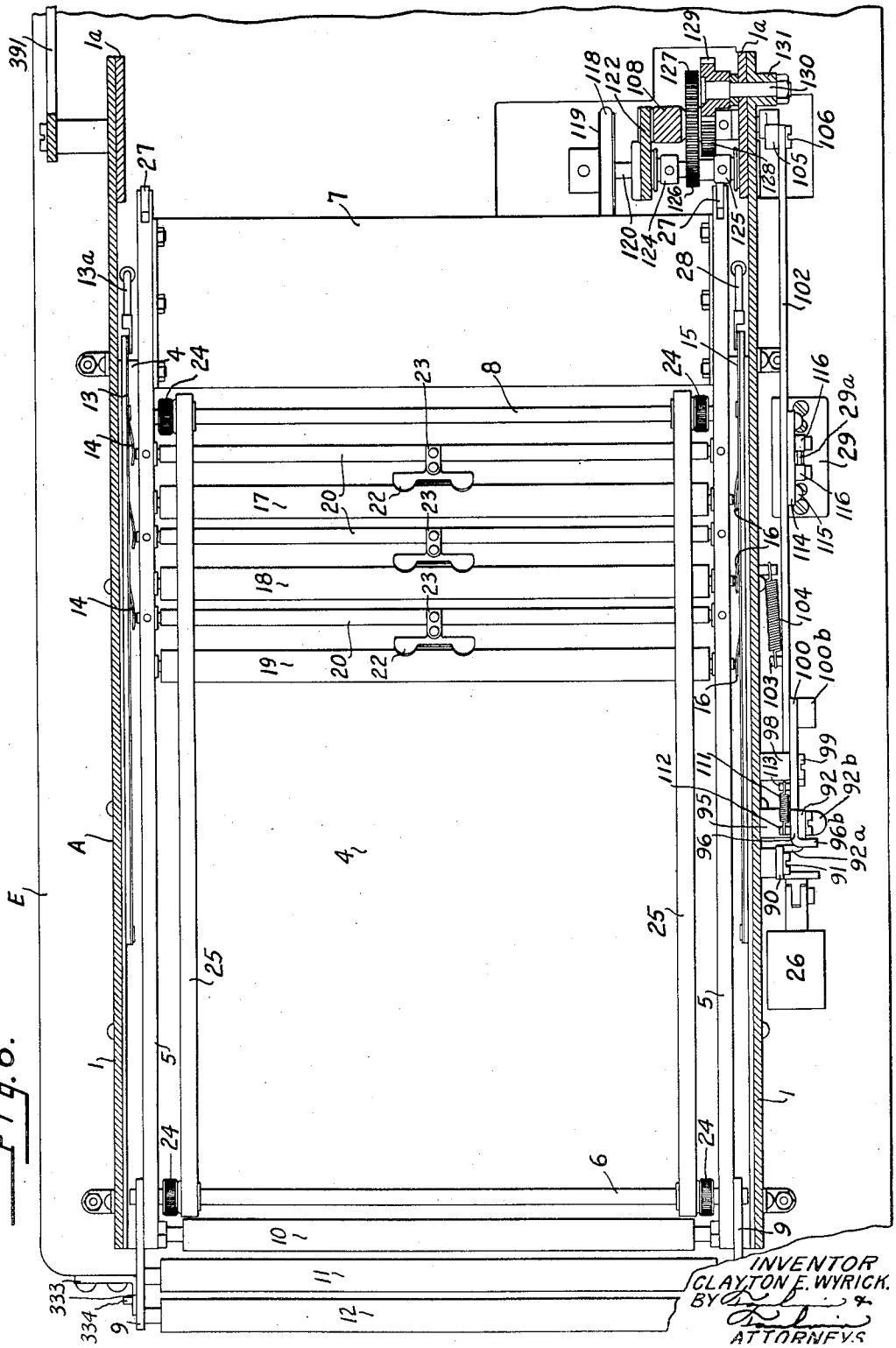


Fig. 6.

Jan. 23, 1940. C. E. WYRICK 2,187,722

PRINTING MACHINE

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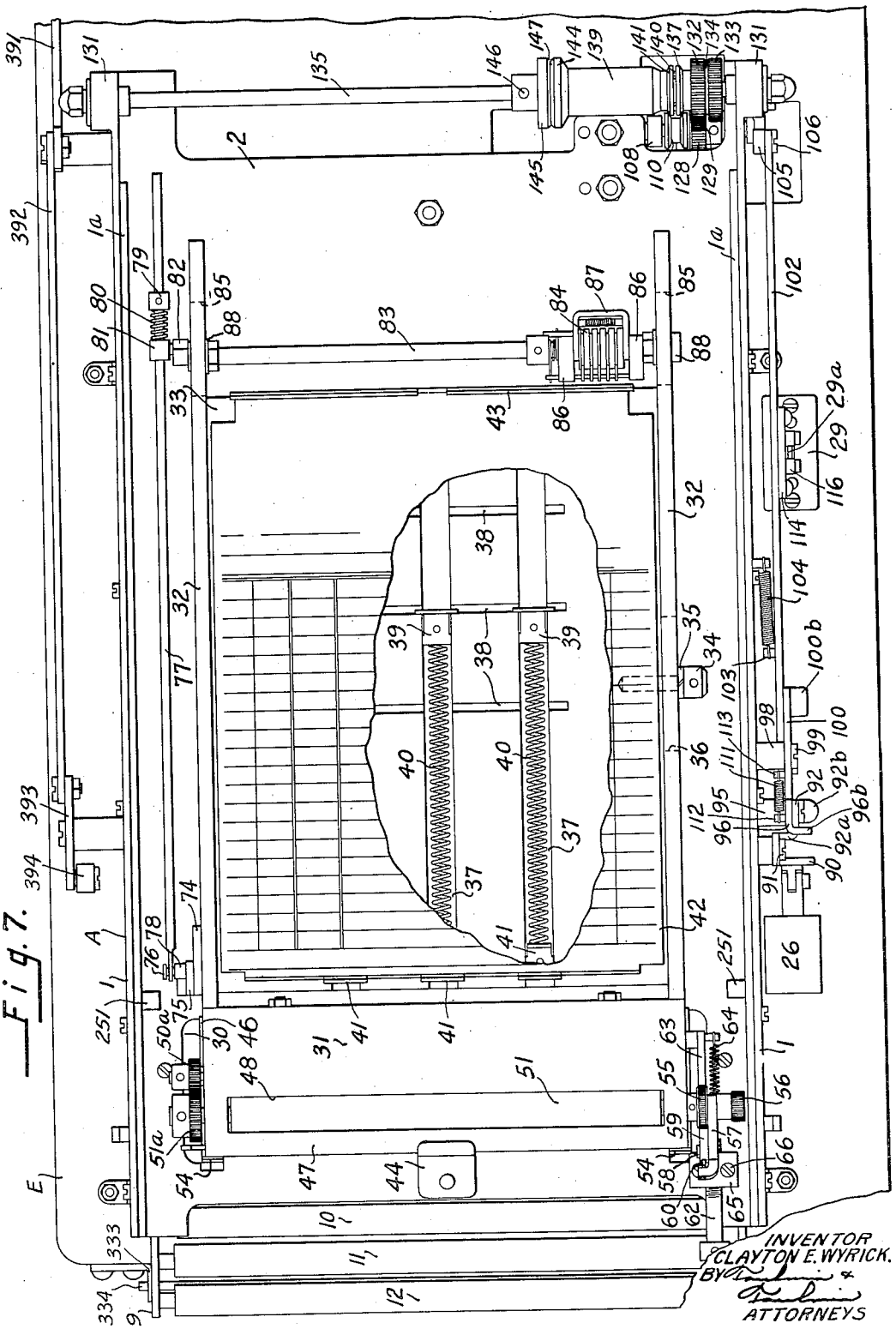


Fig. 7.

INVENTOR
CLAYTON E. WYRICK.
BY
ATTORNEYS

Jan. 23, 1940. C. E. WYRICK 2,187,722

PRINTING MACHINE

Filed Aug. 29, 1936 21 Sheets-Sheet 7

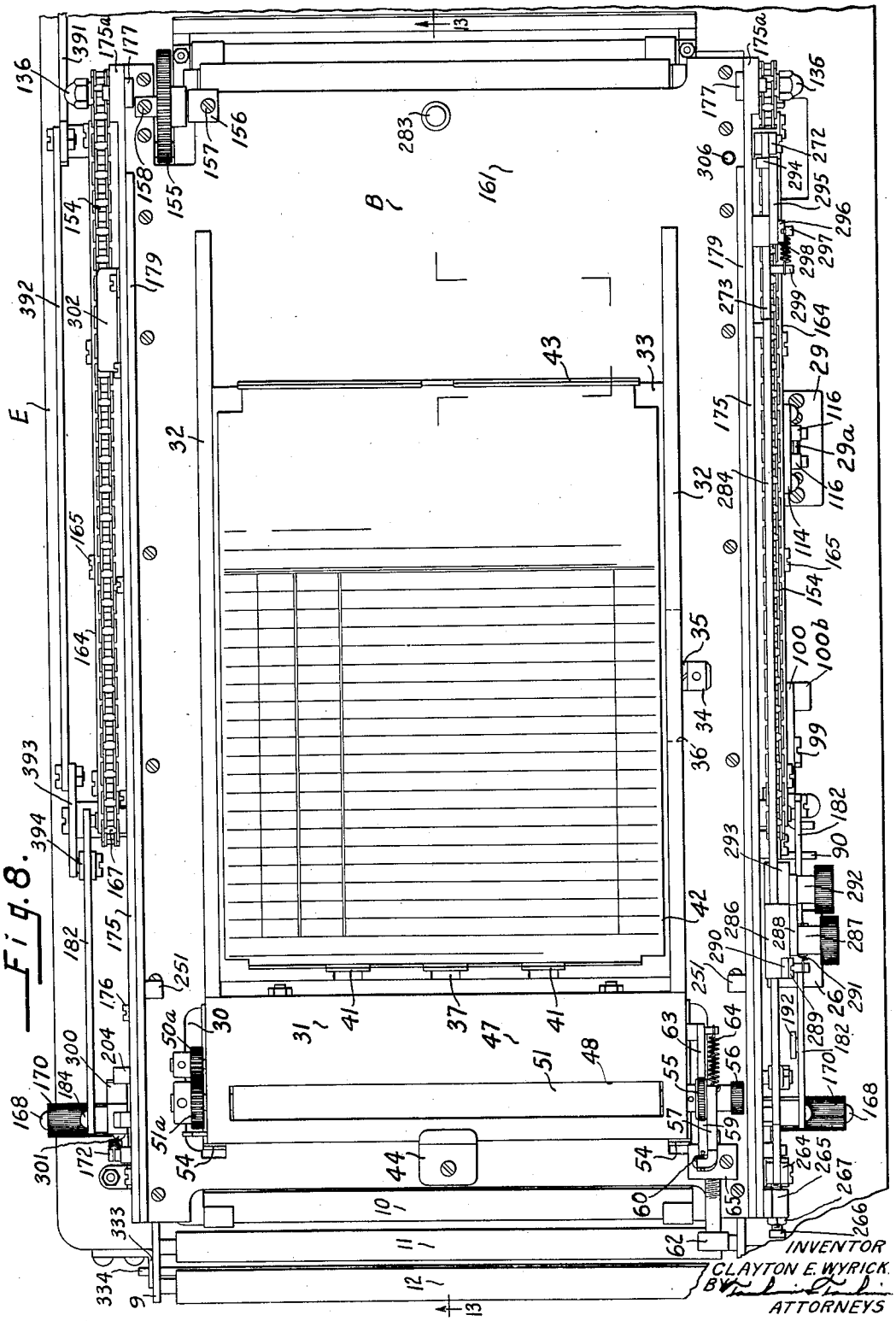


Fig. 8.

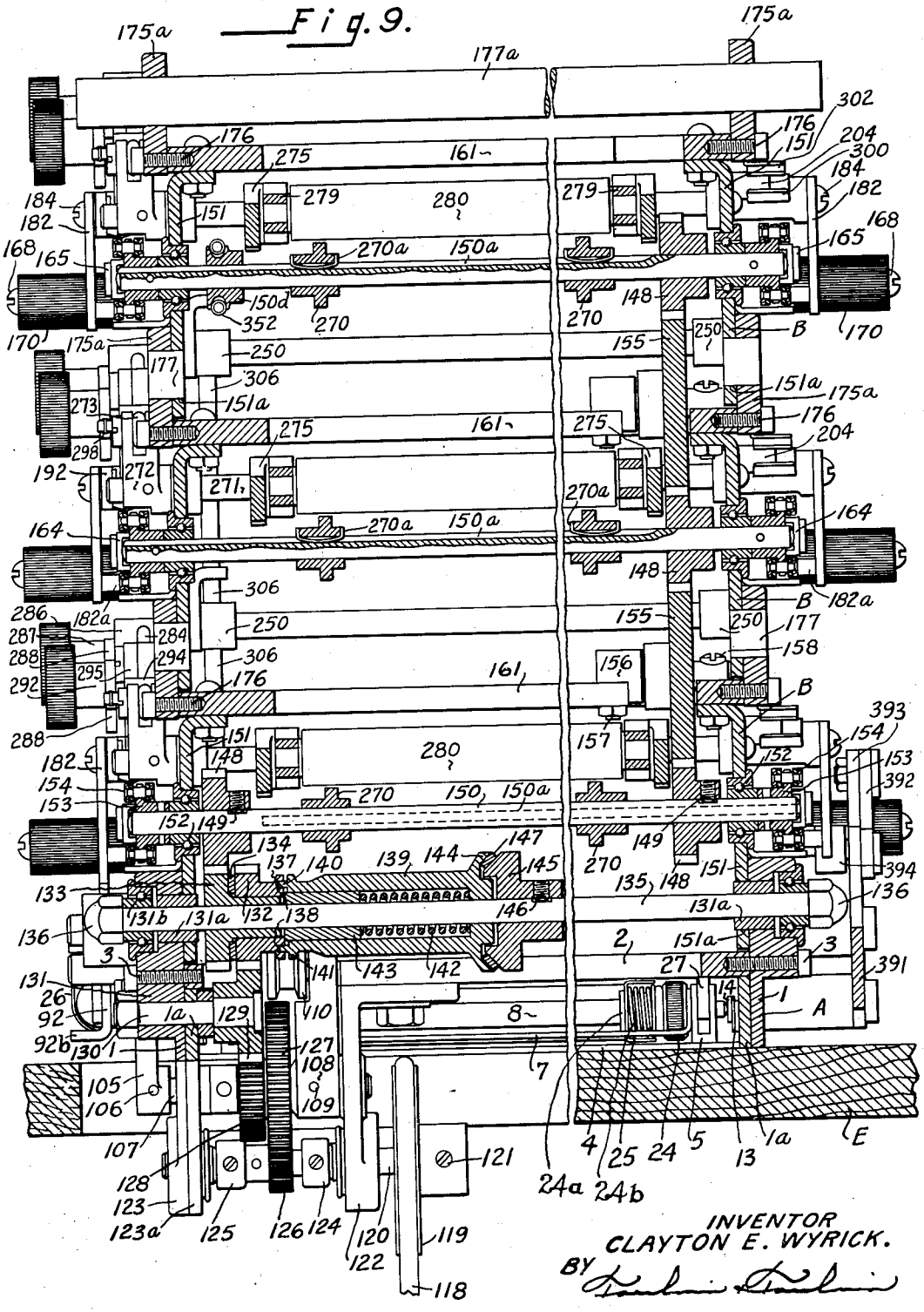
INVENTOR
CLAYTON E. WYRICK
BY
ATTORNEYS

Jan. 23, 1940. C. E. WYRICK 2,187,722

PRINTING MACHINE

Filed Aug. 29, 1936 21 Sheets-Sheet 8

Fig. 9.



INVENTOR
CLAYTON E. WYRICK.
BY
ATTORNEYS

Jan. 23, 1940. C. E. WYRICK 2,187,722

PRINTING MACHINE

Filed Aug. 29, 1936 21 Sheets-Sheet 9

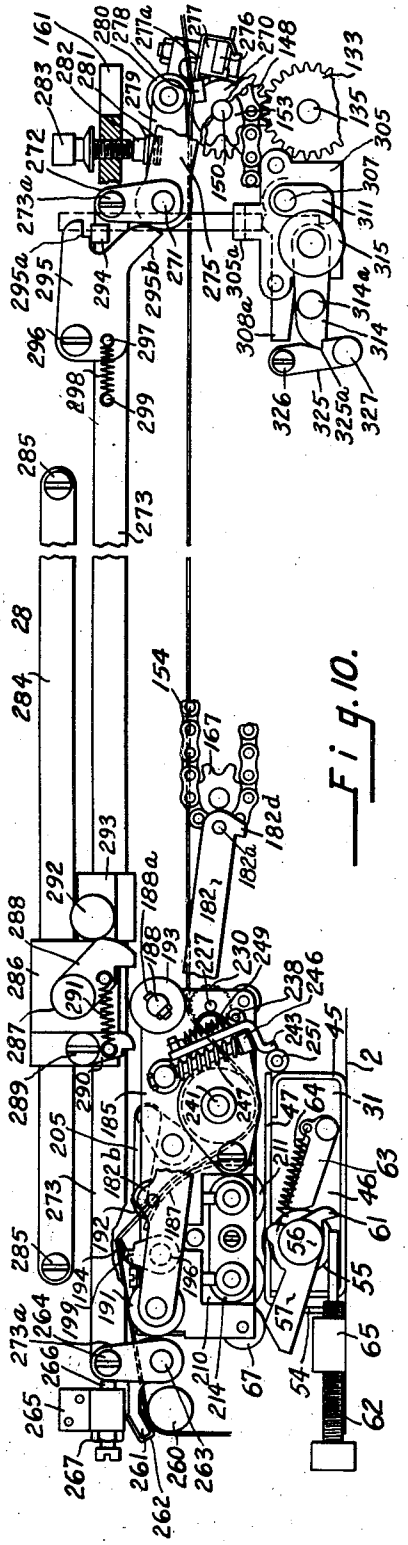


Fig. 10.

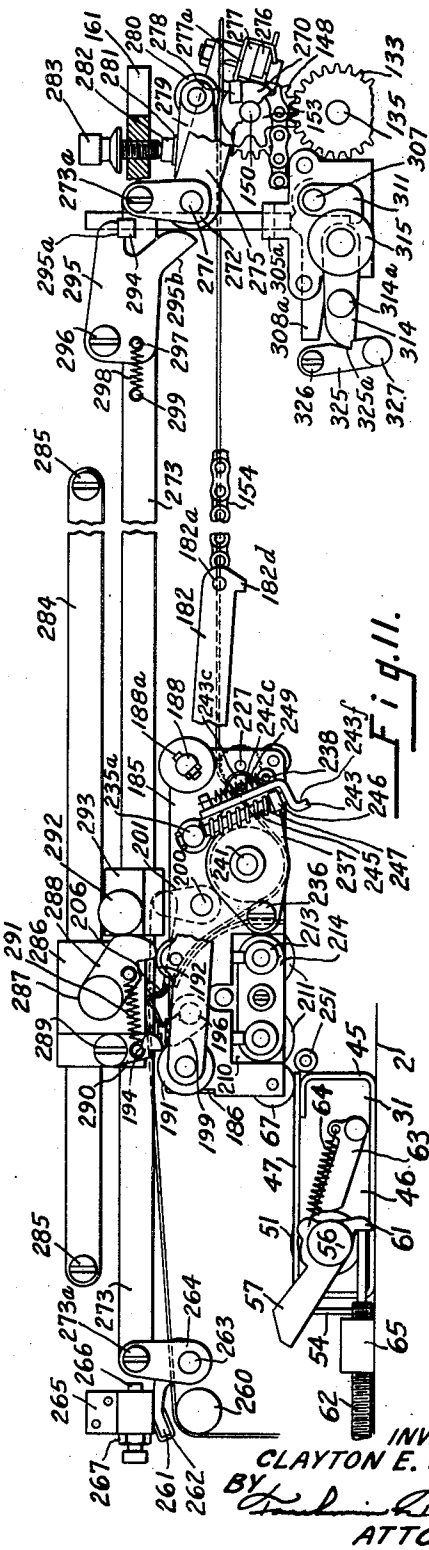


Fig. 11.

INVENTOR
CLAYTON E. WYRICK.
BY
ATTORNEYS

Jan. 23, 1940. C. E. WYRICK 2,187,722

PRINTING MACHINE

Filed Aug. 29, 1936 21 Sheets-Sheet 10

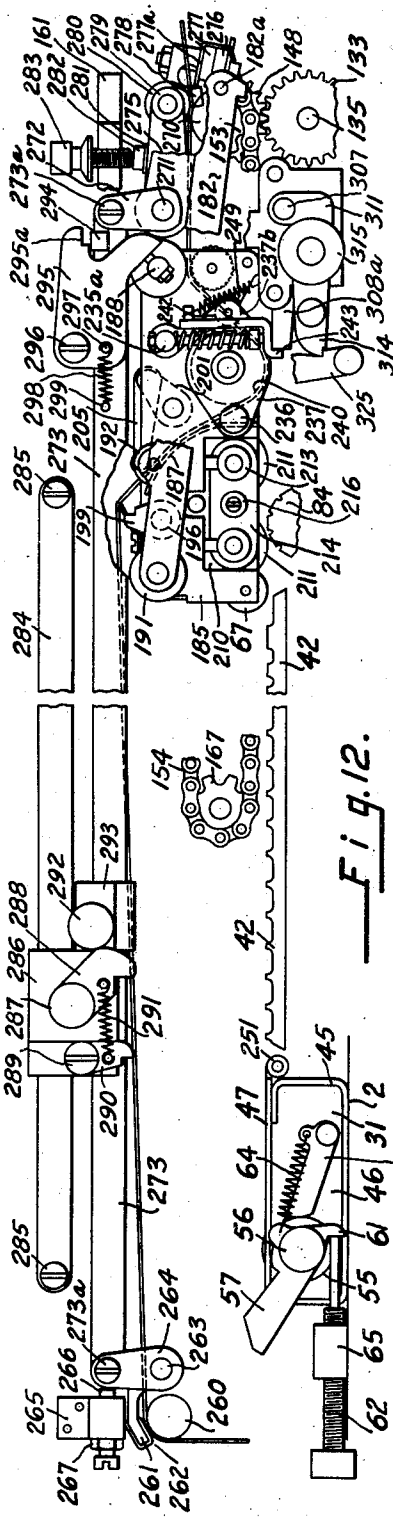


Fig. 12.

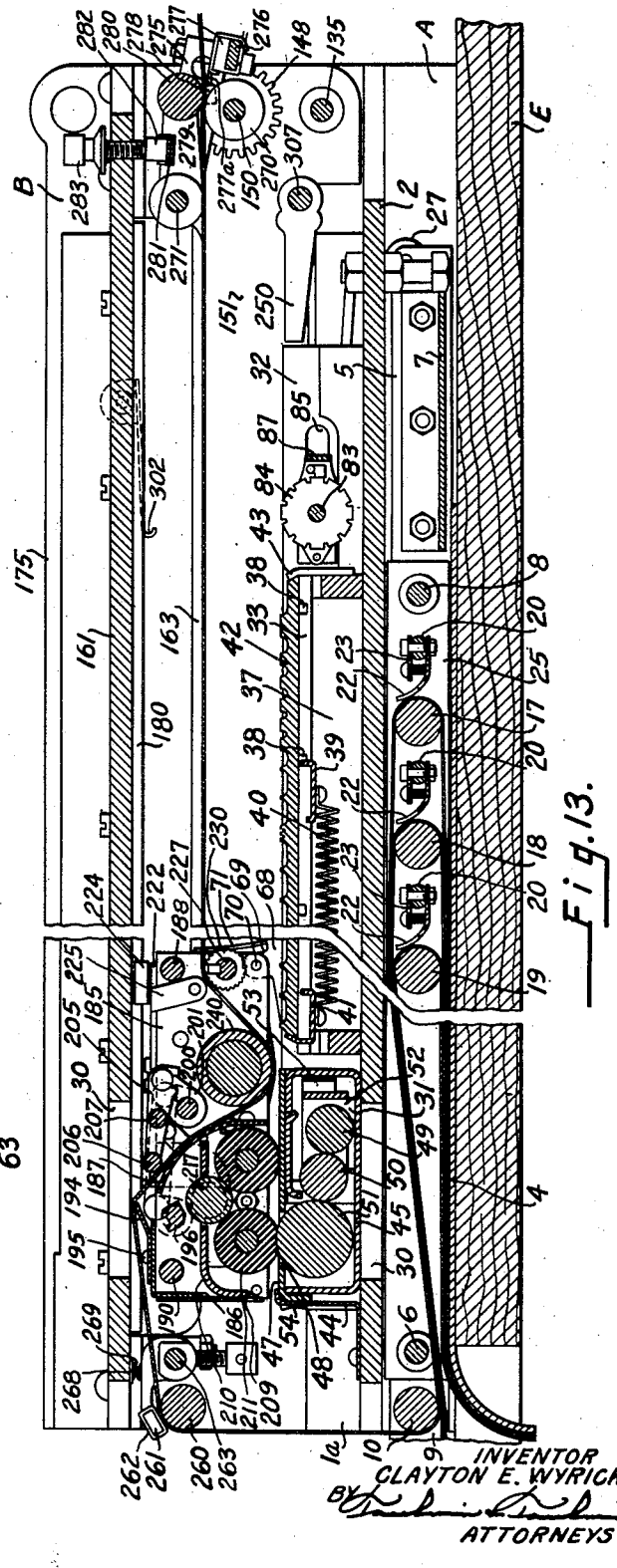


Fig. 13.

INVENTOR
CLAYTON E. WYRICK.
BY
ATTORNEYS

Jan. 23, 1940. C. E. WYRICK 2,187,722

PRINTING MACHINE

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Fig. 14.

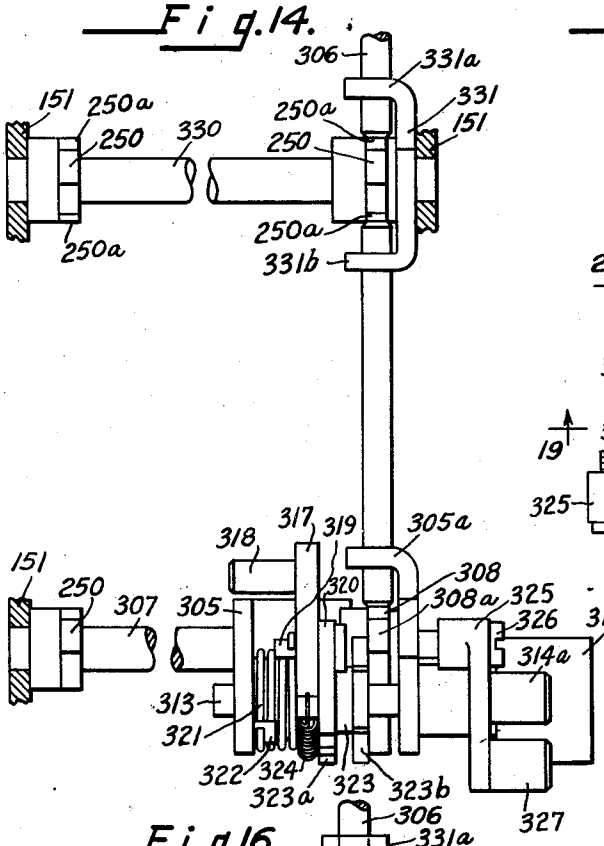


Fig. 15.

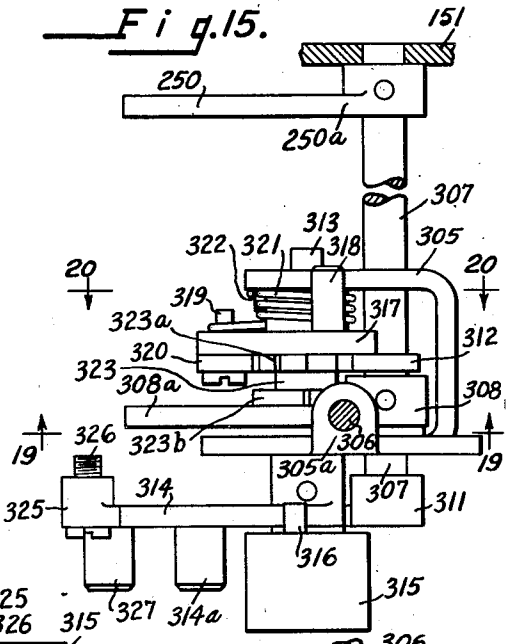


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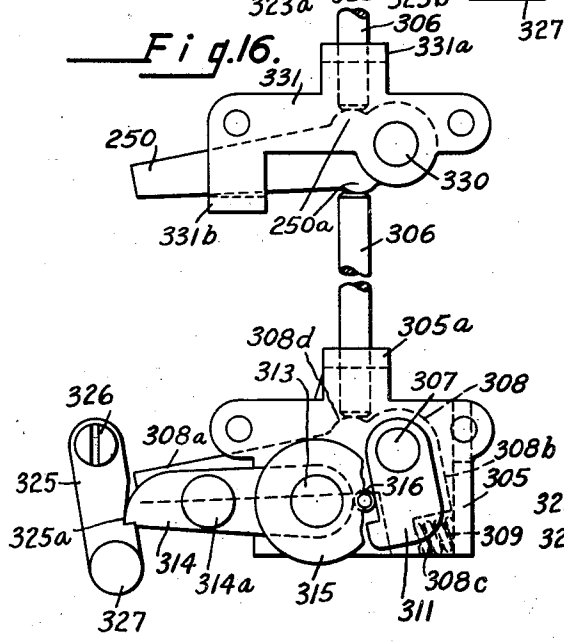
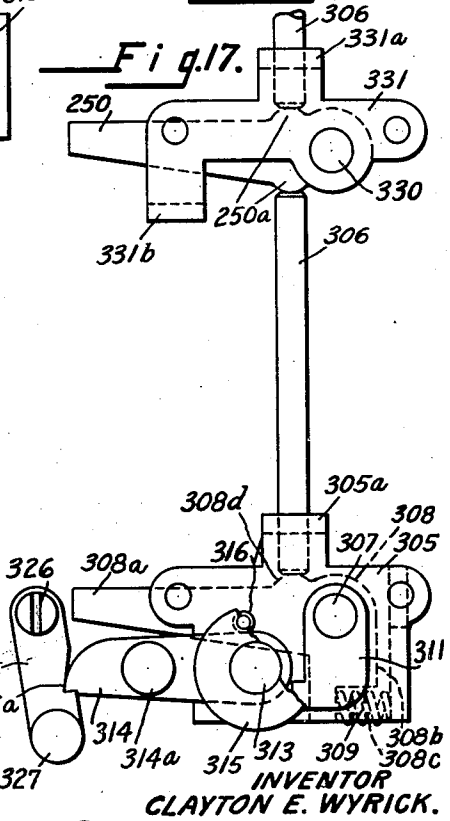


Fig. 17.



INVENTOR
CLAYTON E. WYRICK.

BY

ATTORNEYS

Jan. 23, 1940. C. E. WYRICK 2,187,722

PRINTING MACHINE

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Fig. 18.

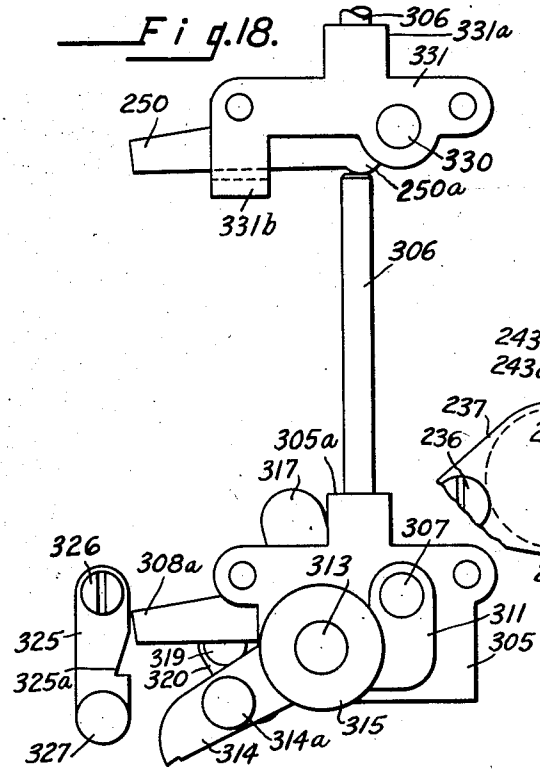


Fig. 19.

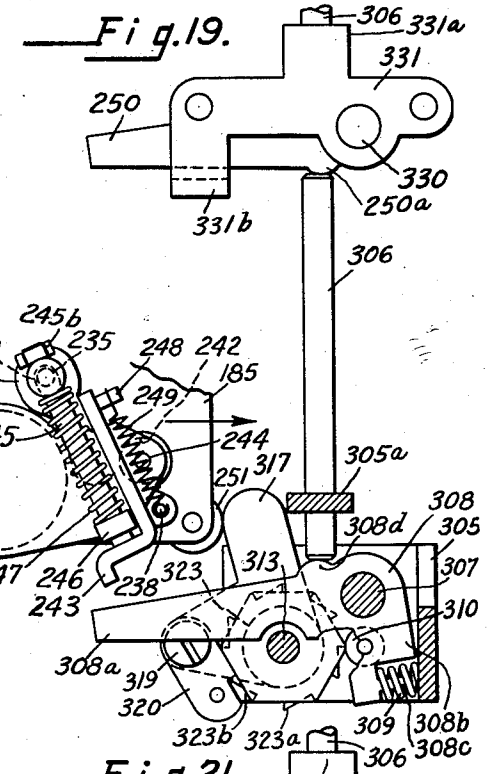


Fig. 20.

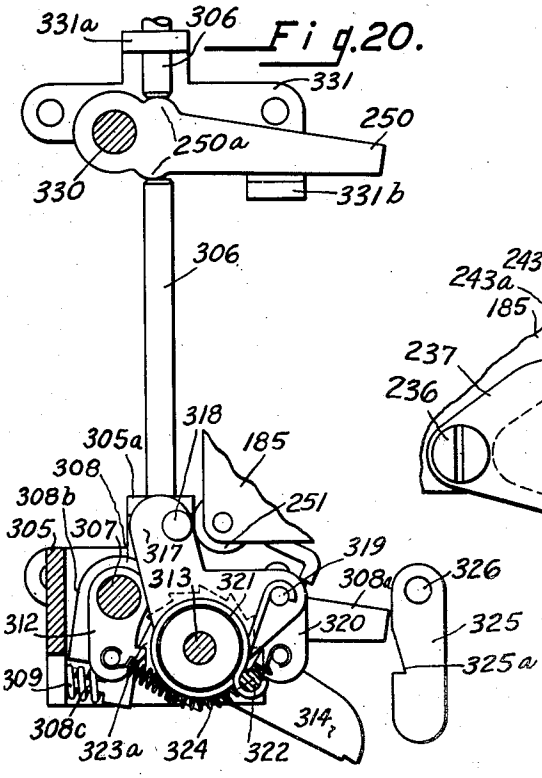
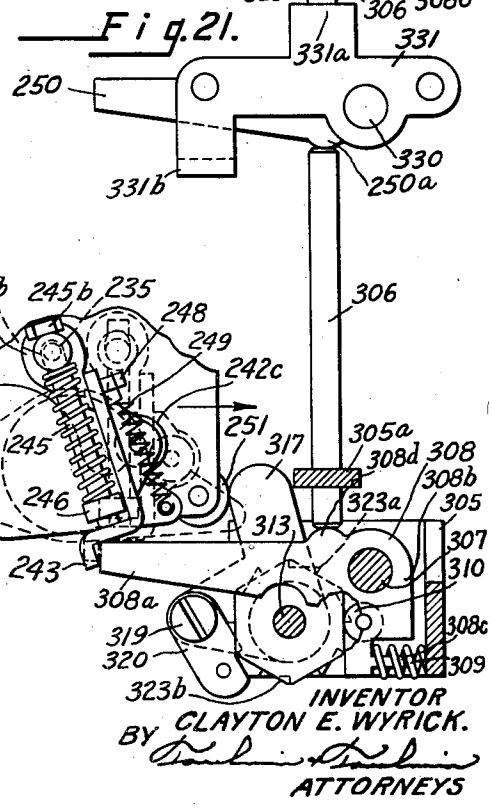


Fig. 21.



INVENTOR
CLAYTON E. WYRICK.
BY
ATTORNEYS

Jan. 23, 1940. C. E. WYRICK 2,187,722

PRINTING MACHINE

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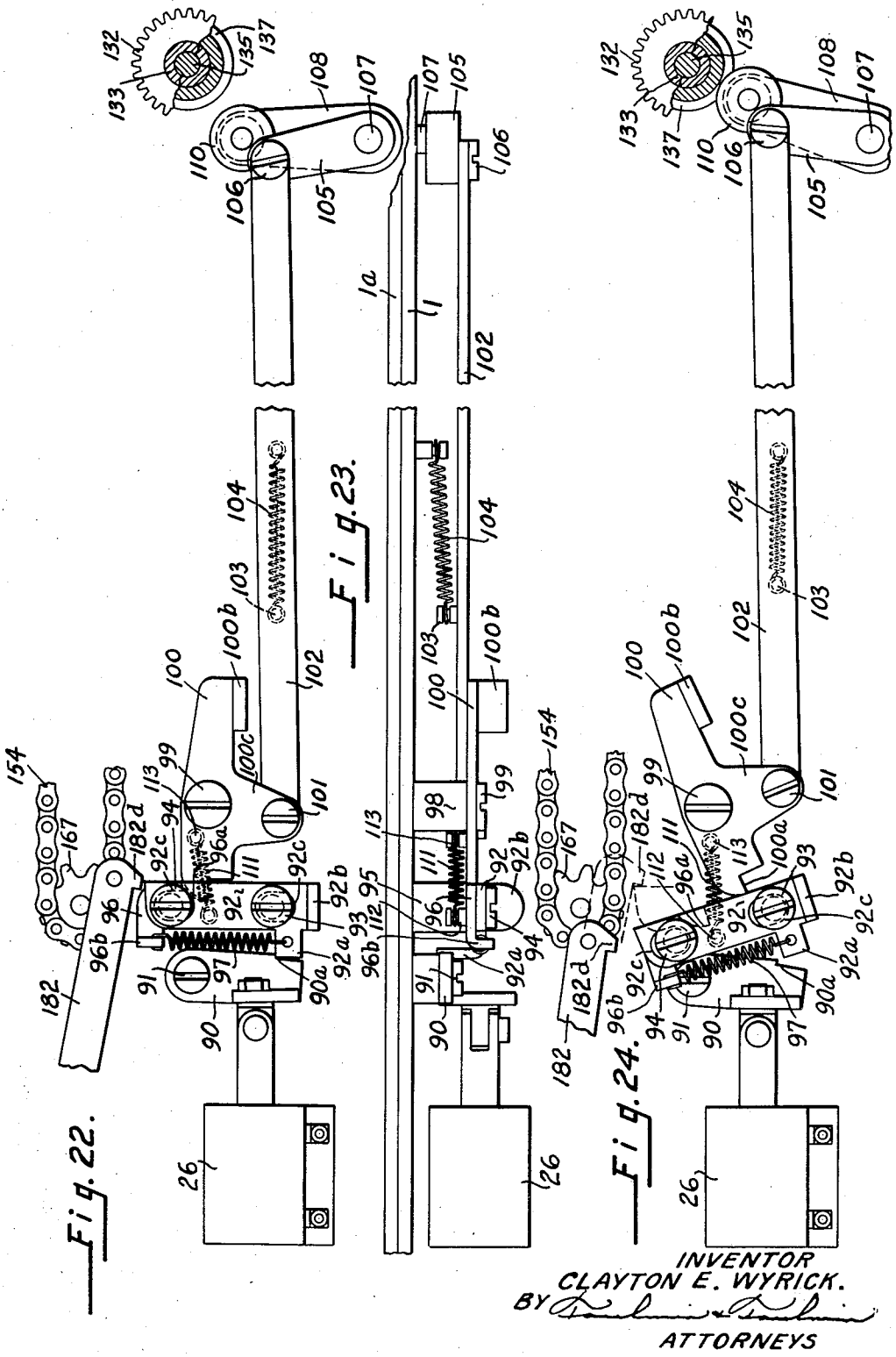


Fig. 22.

Fig. 23.

Fig. 24.

INVENTOR
CLAYTON E. WYRICK.
BY
ATTORNEYS

Jan. 23, 1940. C. E. WYRICK 2,187,722

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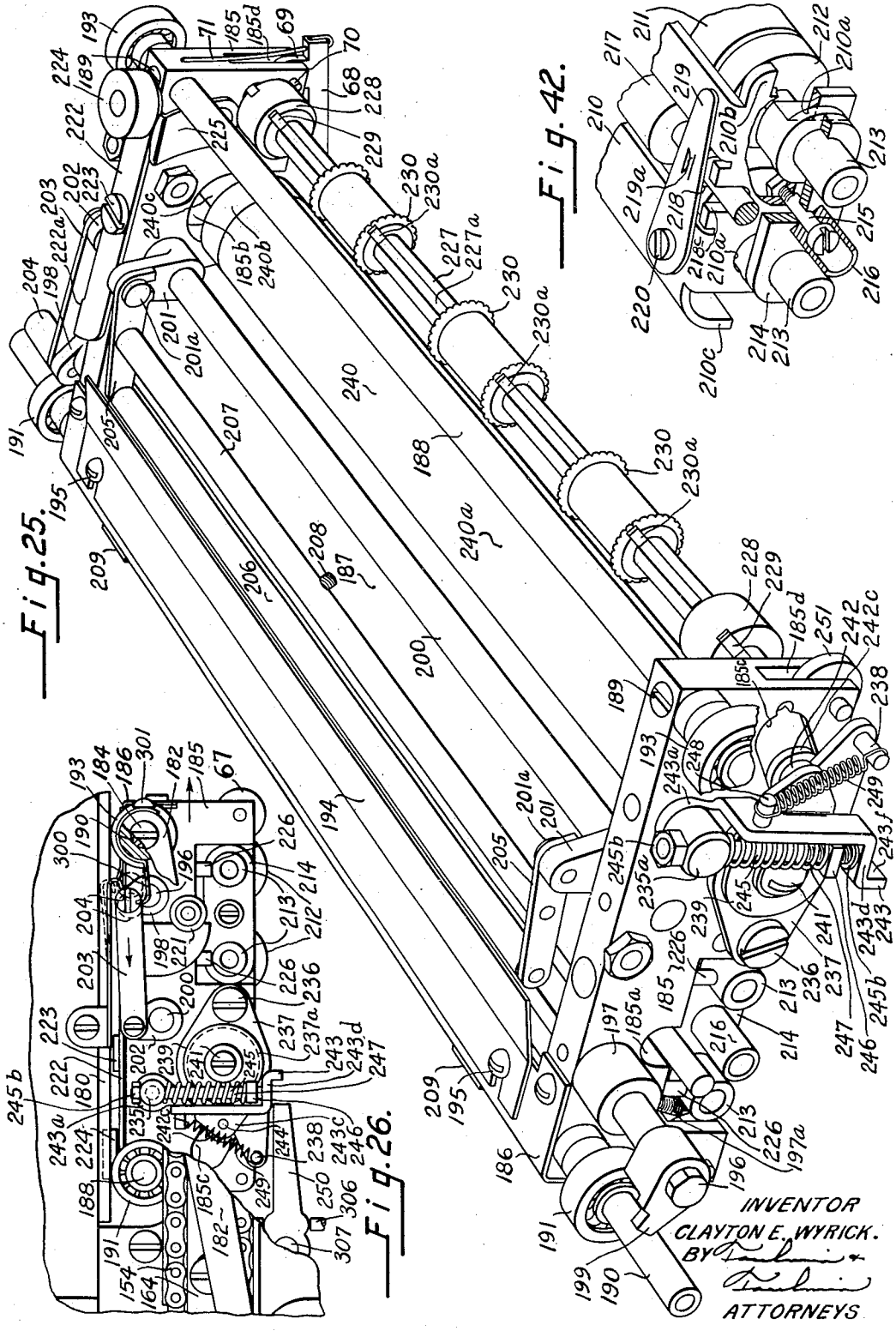


Fig. 25.

Fig. 42.

Fig. 26.

INVENTOR
CLAYTON E. WYRICK.
BY
ATTORNEYS

Jan. 23, 1940. C. E. WYRICK 2,187,722

PRINTING MACHINE

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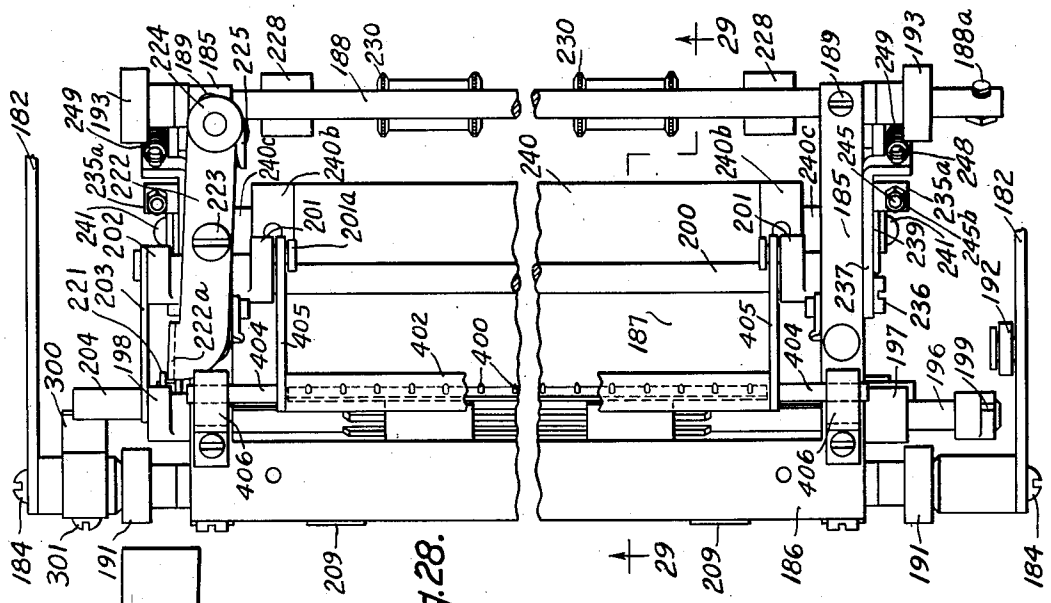


Fig. 28.

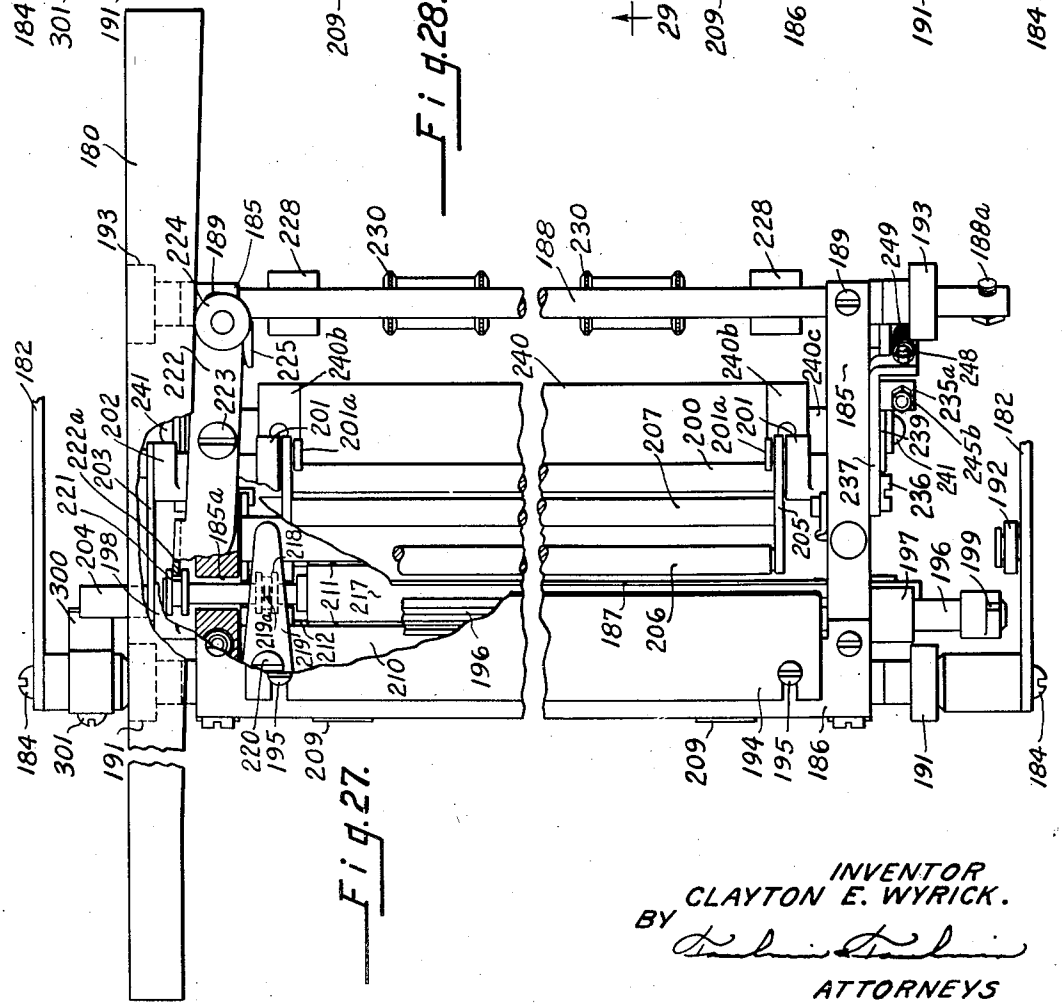


Fig. 27.

INVENTOR
CLAYTON E. WYRICK.
BY
ATTORNEYS

Jan. 23, 1940. C. E. WYRICK 2,187,722

PRINTING MACHINE

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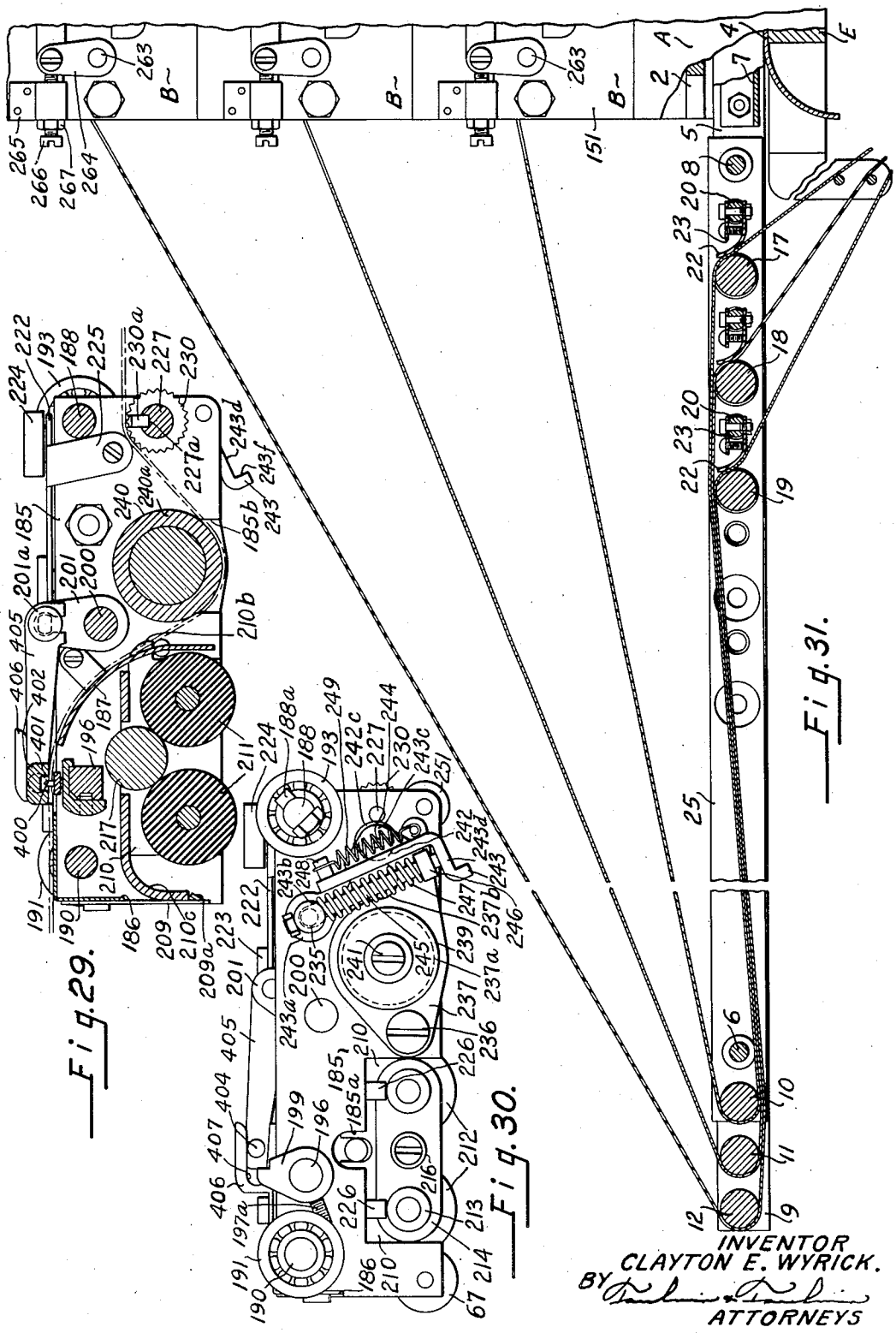


Fig. 29.

Fig. 30.

Fig. 31.

INVENTOR
CLAYTON E. WYRICK.
BY
ATTORNEYS

Jan. 23, 1940. C. E. WYRICK 2,187,722

PRINTING MACHINE

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Fig. 32.

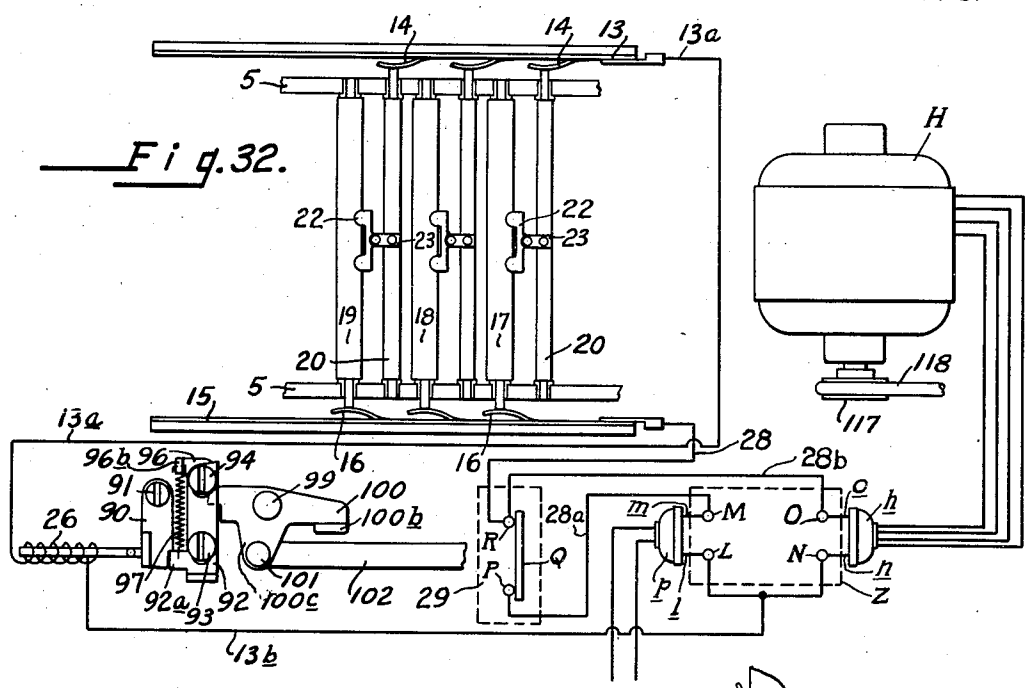


Fig. 33.

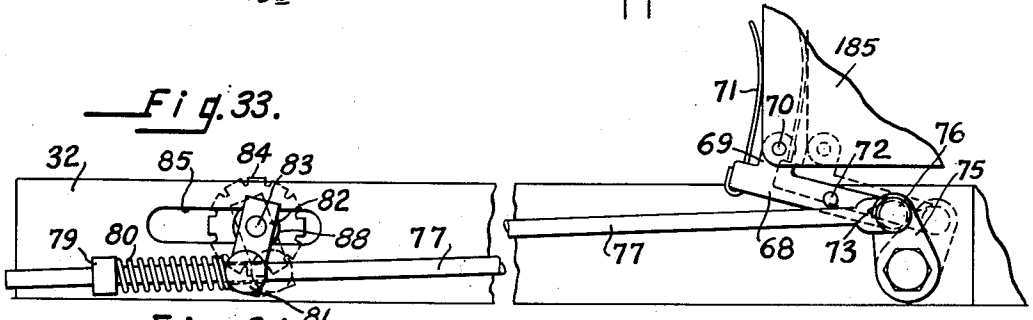
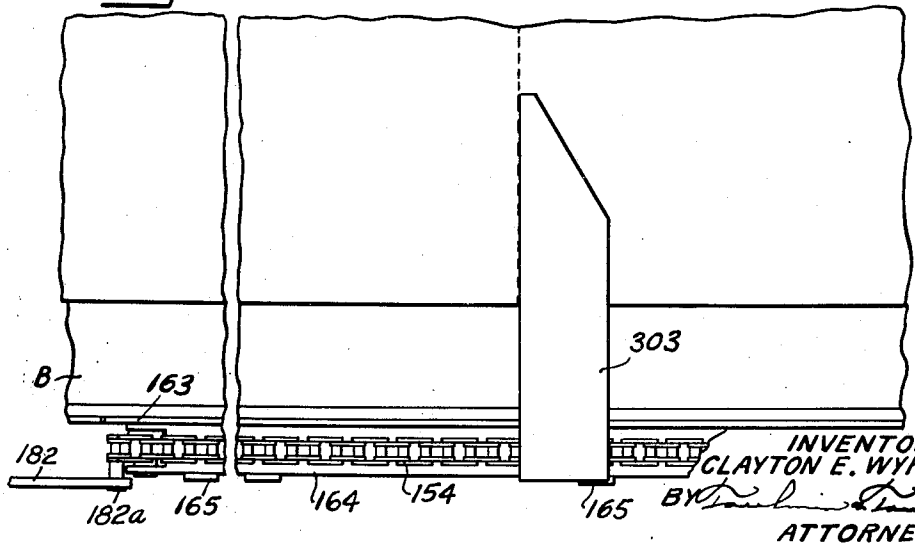


Fig. 34.



INVENTOR
CLAYTON E. WYRICK.
BY
ATTORNEYS

Jan. 23, 1940. C. E. WYRICK 2,187,722

PRINTING MACHINE

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Fig. 35.

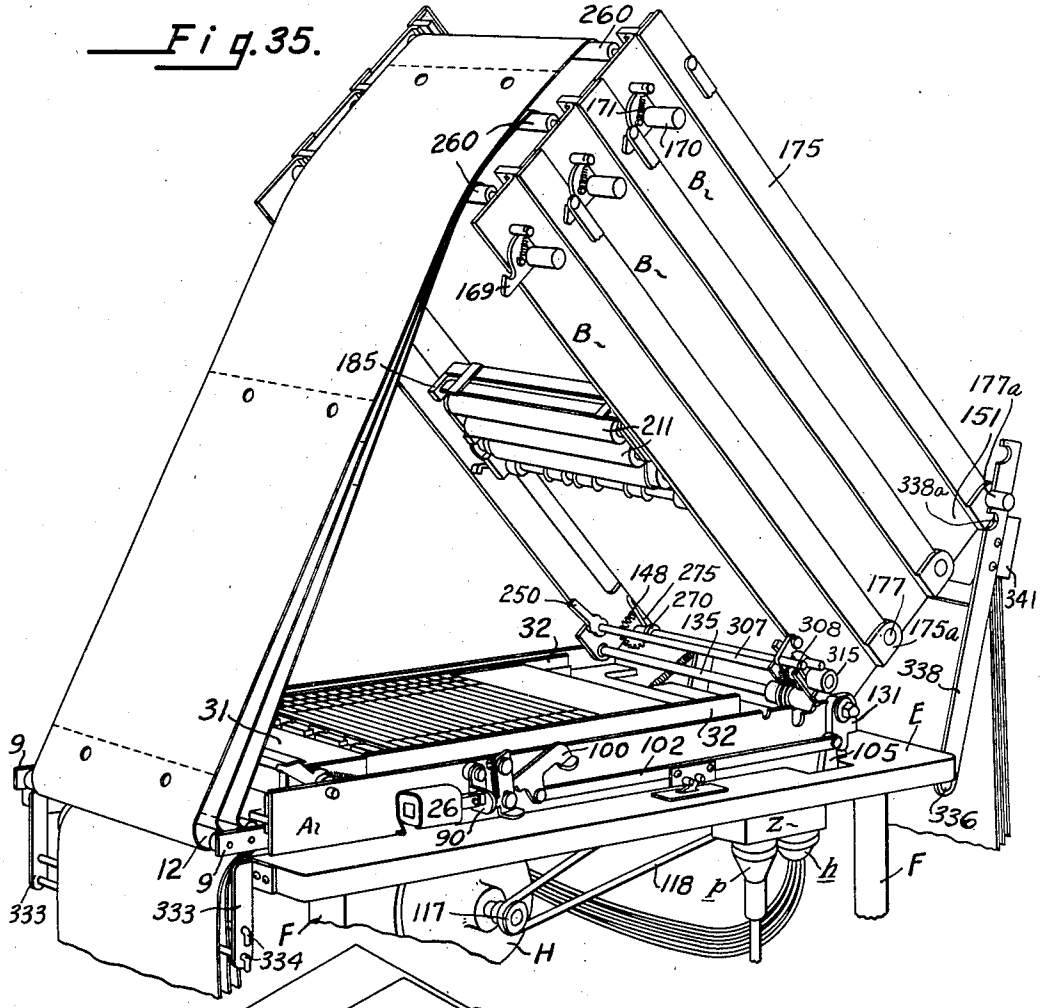
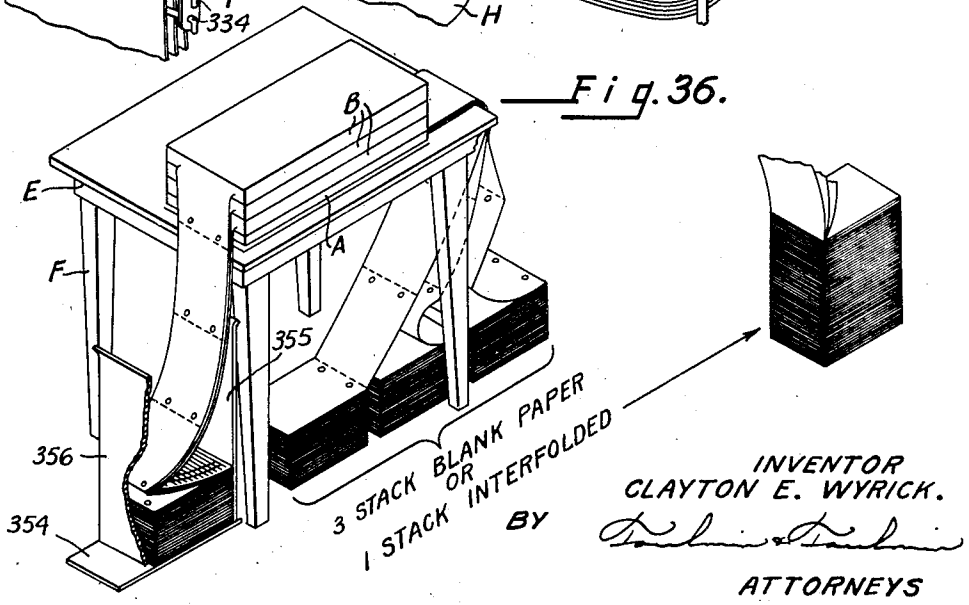


Fig. 36.



INVENTOR
CLAYTON E. WYRICK.

BY

ATTORNEYS

Jan. 23, 1940. C. E. WYRICK 2,187,722

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Fig. 37.

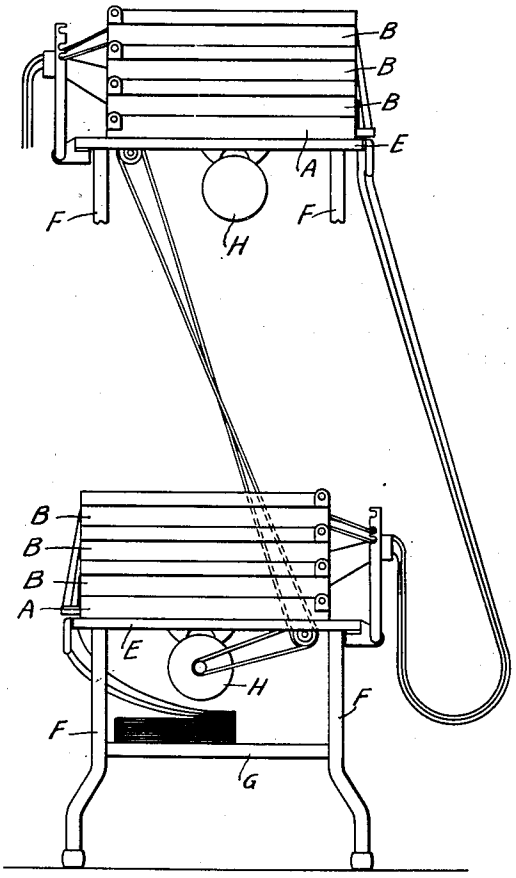
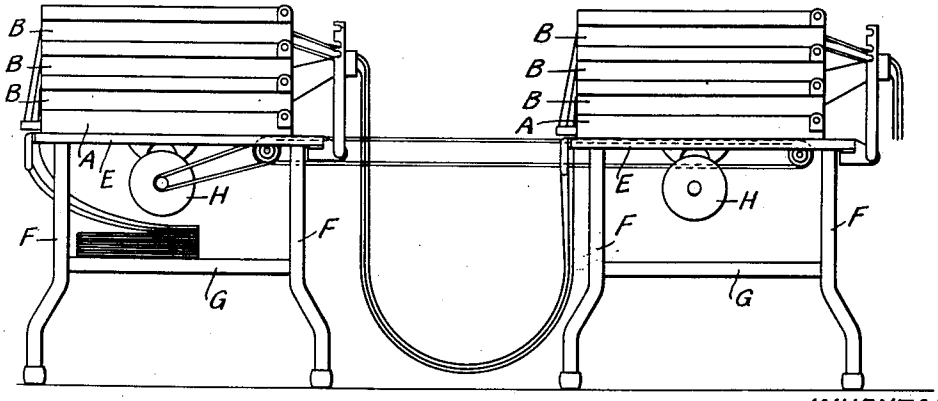


Fig. 38.



INVENTOR
CLAYTON E. WYRICK.
BY
ATTORNEYS

Jan. 23, 1940. C. E. WYRICK 2,187,722

PRINTING MACHINE

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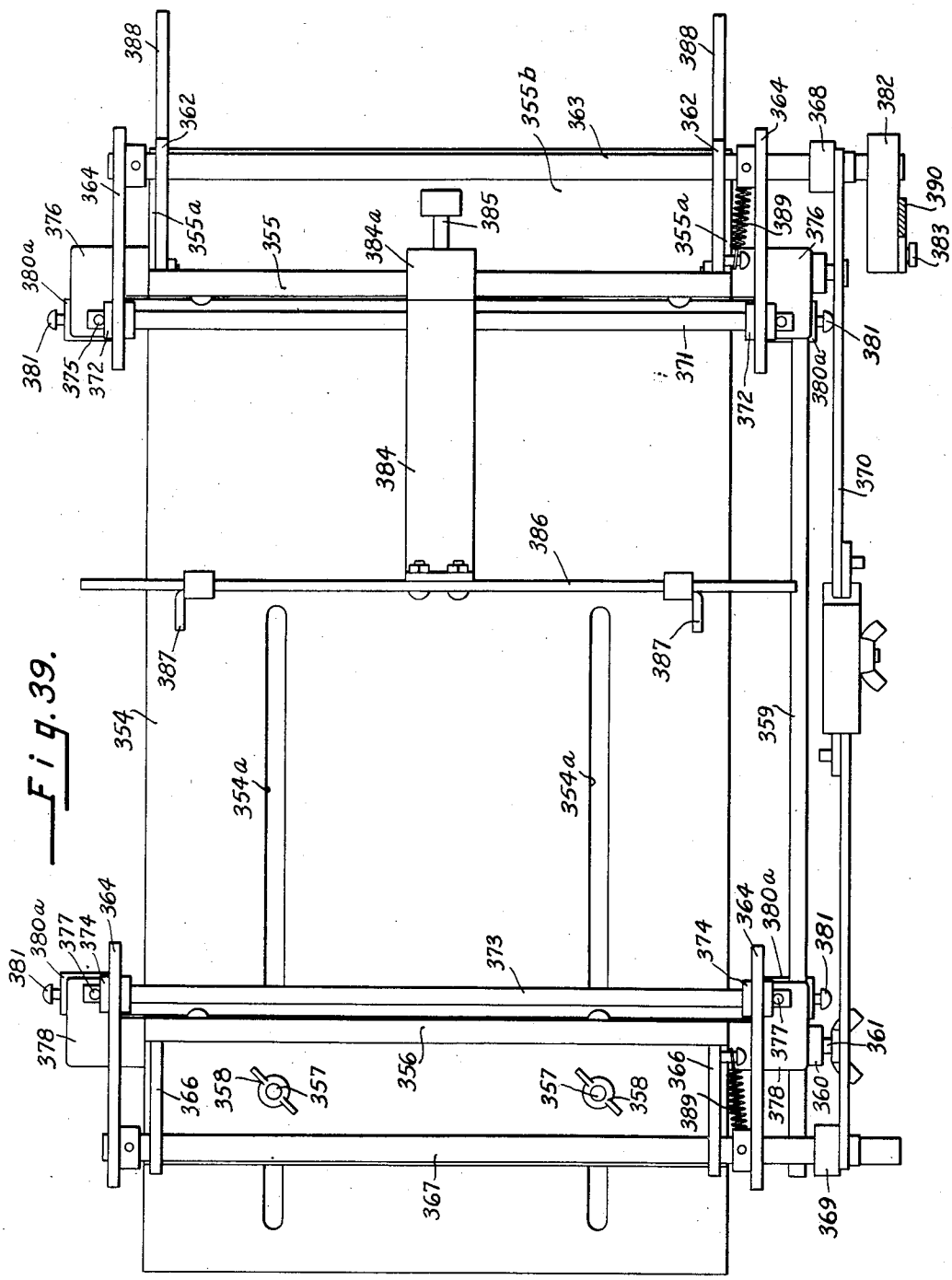


Fig. 39.

INVENTOR
CLAYTON E. WYRICK.
BY
ATTORNEYS

Jan. 23, 1940. C. E. WYRICK 2,187,722

PRINTING MACHINE

Filed Aug. 29, 1936 21 Sheets-Sheet 21

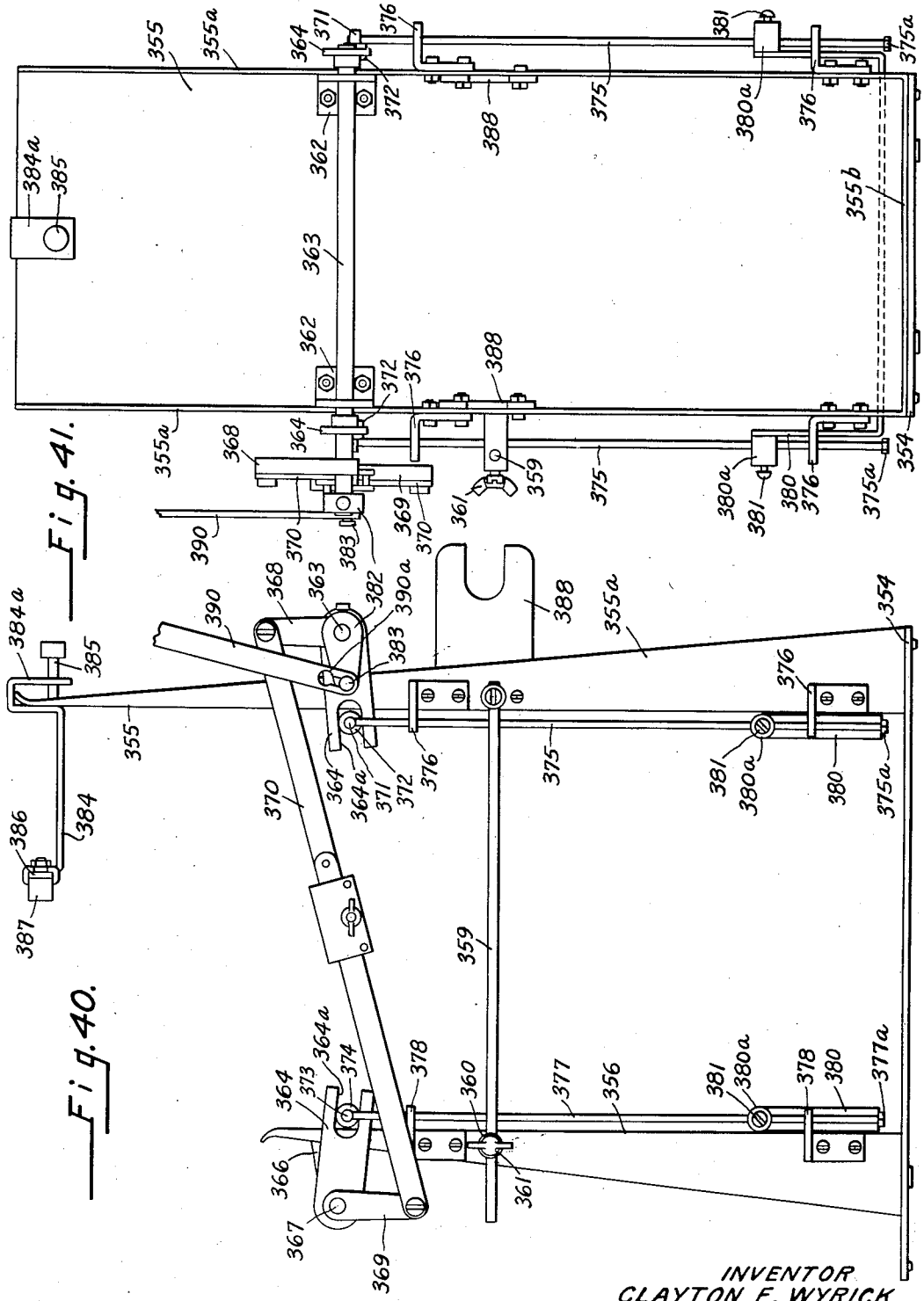


Fig. 41.

Fig. 40.

INVENTOR
CLAYTON E. WYRICK.
BY Fairbanks & Fairbanks
ATTORNEYS

Patented Jan. 23, 1940 2,187,722

UNITED STATES PATENT OFFICE

2,187,722

PRINTING MACHINE

Clayton E. Wyrick, Wyandotte, Mich.

Application August 29, 1936, Serial No. 98,514

48 Claims. (Cl. 101—260)

This invention relates to printing machines and particularly to such machines for the printing of forms or designs on one or more sheets, strips or webs of paper or the like.

It is an object of this invention to provide a machine in which one or a plurality of strips, sheets or webs of paper or the like may be simultaneously fed and printed.

It is a further object of this invention to provide in such a machine a base unit having one or more printing units superposed thereon and pivotally connected thereto, whereby they may be swung upwardly on the base unit in order to afford free access to the parts of the respective units.

It is a further object of this invention to provide in such a machine a base unit having an aligning chamber with aligning means slidably mounted therein and having a plate disposed above the aligning chamber and provided with means for supporting a printing plate adapted to cooperate with the superposed printing unit.

It is a further object of this invention to provide means of attachment of said printing plate to the base unit whereby it may be speedily removed from and attached thereto or whereby another printing plate having different dimensions may be readily and speedily substituted therefor.

It is a further object of this invention to provide in such a machine printing units comprising frames having superposed chambers separated by a transverse roof plate, the lower of said chambers being equipped with means for feeding a sheet, strip or web of paper or the like through the machine and for cooperation with the printing plate disposed therebelow to print forms upon the sheet, strip or web of paper fed by it through the machine.

It is a further object of this invention to provide means in the second chamber, which is superposed above the first and separated therefrom by the roof plate for supporting a type plate in the same manner in which the type plate is supported on the base section for cooperation with means in the printing chamber of the printing unit superposed next thereabove.

It is a further object of this invention to provide a construction of printing units wherein one unit or any portion thereof may be substituted for another unit or a corresponding portion thereof, and whereby the units may be readily and easily detached from one another for the purpose of increasing or decreasing the capacity of the machine.

It is a further object of the invention to provide means comprising a drive train so situated and located in the respective units as to be undisturbed by the operation of swinging one or more of the respective printing units upwardly with respect to the supporting structure whereby to gain full view and access to the parts of the units.

It is a further object of this invention to provide reciprocating means in the form of a carrier in the printing chamber of each unit which, during its reciprocation, cooperates with mechanisms mounted in stationary position to cooperate therewith to perform the various functions necessary to clamp the web in the unit in a stationary manner, to release the web, to advance the web, to again clamp the web, to bring the web progressively into contact with a printing plate to print a form thereon and which, while feeding, transfers ink from an ink supply means to the surface of the printing plate and which also causes operation of a counter means as well as, under certain conditions of operation, operation of a print control means to cause printing of the web in each alternate cycle of operation only.

It is a further object of this invention to provide such a machine which is of sectional unit character, each sectional unit being substantially a complete printing unit in itself, whereby a multiplicity of sectional units may be, with facility, assembled to provide for the printing of a multiplicity of sheets, strips or webs simultaneously.

It is a further object of this invention to provide such a machine having means whereby the series of sheets, strips, or webs, when printed in multiple, will discharge from the machine in superposed relation and the impressions made upon the webs within the machine will be in registering relation.

It is a further object of this invention to provide such a machine wherein the sectional units are hingedly and removably attached together so that one section may be swung away from the adjacent section to provide for easy access to the various parts, as well as for the changing of type plates, forms or the like, inking mechanisms, etc., as well as to facilitate threading of the sheets, strips or webs in the machine.

It is a further object of this invention to provide such a machine having automatic means for feeding one or a plurality of sheets, strips or webs through the machine in consecutive, predetermined lengths, means whereby the web may

be processed or printed as it travels through the machine and means for engaging said preprocessed marks in subsequent runs for color work or other purposes, whereby the impressions made in the re-run will register as required, relative to the preprocessed marks.

It is a further object of this invention to provide such a machine in which the web measuring mechanism, ink transfer means and an impression roller are mounted in a common carrier assembly and adapted for reciprocation over the printing type or form at a constant speed to insure smooth action in inking the type, feeding, and printing the sheet, strip or web.

It is a further object of this invention to provide means in such a machine, whereby the stopping mechanism is so arranged that, one being adjusted, the machine stops consistently with the carrier assembly at a predetermined position, so that the cycle of inking, feeding, and printing of the web will always have been completed before the machine ceases to operate.

It is a further object of this invention to provide such a machine comprising a lower major frame structure and one or more upper major frame structures, between each of which frame structures is arranged a group of elements necessary to the process of printing and an arrangement of mechanisms through which sheets, strips, or webs of paper or the like may be fed to receive impressions, and to provide said frame structures with interconnecting means, by means of which they may be easily swung apart to provide convenient access to the mechanisms and the sheets, strips, or webs.

It is a further object of this invention to provide such a machine wherein the lower major frame structure is provided with means for aligning and guiding one or more sheets, strips, or webs of material to be printed, which sheets, strips, or webs are each to be threaded through and printed in one of the upper major frame structures, the guiding and alignment of said sheets, strips or webs insuring that they will follow a true course when fed through the printing mechanism.

It is a further object of this invention to provide such a machine wherein a plurality of frame members (each divided into a chamber for containing a printing plate and ink supply means superposed above a chamber adapted to support reciprocating means for the purpose of transferring ink from the ink supply means to the printing plate for feeding a sheet, strip or web of paper or the like through the machine and for printing thereon impressions from the printing plate) are swingably secured one to the other with the lower chamber of one in cooperating relation with the upper chamber of the other.

It is a further object of this invention to provide a machine comprising a plurality of similar, easily removable units, each adapted to print a web simultaneously with the printing of the other webs by the other respective units.

It is a further object of this invention to provide such a machine in which the printing operations for the respective webs occur simultaneously.

It is a further object of this invention to provide such a machine in which the length of feed in each feeding cycle of the respective units may be varied independently of that of the other units, whereby forms of varying length may be printed on the respective webs simultaneously.

It is a further object of this invention to provide, in such a machine, means for adjusting the length of feed of each unit irrespective of the length of feed of the other units and indicating means for facilitating such adjustment in a predetermined manner.

It is a further object of this invention to provide common operating means between the respective detachable units whereby they may be simultaneously operated from a common source of power.

It is a further object of this invention to provide in such a machine means for automatically causing power release upon jamming of the machine.

It is a further object of this invention to provide in such a machine means whereby to cause automatic shut-down when one or more of the respective webs to be printed is torn or exhausted.

It is a further object of this invention to provide in such a machine means for printing forms at predetermined distances on the respective webs from flat plates or flat type forms.

It is a further object of this invention to provide means for securing such plates in the machine for easy replacement and detachment therefrom.

It is a further object of this invention to provide means whereby to carry out a sequence of feeding and printing operations comprising, first, engaging the web, second, moving the web forward a predetermined distance to accomplish a desired amount of feed thereof, third, disengaging the web, and fourth, pressing the web progressively against a flat type member supported therebeneath upon the return stroke of the feeding mechanism.

It is a further object of this invention to provide a sequence of operations in the printing of forms upon webs comprising engaging the web and moving it forward a predetermined amount, while simultaneously inking a type plate supported therebeneath, releasing the web and pressing the web against the inked type plate by applying pressure, progressively in a direction opposite to the direction of feed, to the side of the paper opposite the type plate.

It is a further object of this invention to provide means for securing the web in a predetermined stationary position while making an impression thereon.

It is a further object of this invention to provide means for automatically releasing the holding means at the end of each printing cycle and prior to the beginning of the feeding stroke.

It is a further object of this invention to provide in single units, means for feeding the web or webs, means for transferring ink from ink fountains to the printing plates and means for pressing the webs against the respective plates during the printing cycle.

It is a further object of this invention to provide ink fountain means adapted to deliver a predetermined amount of ink to the ink transferring means during each cycle of operation.

It is a further object of this invention to provide means for adjusting the quantity of ink supplied during each printing operation in a predetermined manner.

It is a further object of this invention to provide such means by which the application of ink to each of the ink transferring means in the respective units may be adjusted or totally prevented in a predetermined manner whereby to compensate for the use of inks of varying characteristics in the respective units, and/or for the

purpose of providing means whereby any one or more of the superposed webs passing through the machine may remain unprinted or be more lightly printed than the other webs traveling through the machine simultaneously.

It is a further object of this invention to provide means whereby the machine may be operated to print forms adjacent one another on the respective webs or spaced from one another by one or more form lengths, at the will of the operator.

It is a further object of this invention to provide in such a machine means whereby the printing mechanism may, at will, be prevented from operating while the feeding operations are continued, at the will of the operator.

It is a further object of this invention to provide, in such a machine, means whereby the operation of the feeding means of one or more of the units may be made inoperative, at will, independently of the feeding means of the other units of the machine.

It is a further object of this invention to provide a gauge plate adapted to cooperate with certain parts of the respective units whereby to provide indicia for properly aligning the respective webs longitudinally with respect to the unit preliminary to operation of the machine for the printing thereof.

It is a further object of this invention to provide in such a machine means for supplying a plurality of fan-folded webs in such a manner that they will be separated one from the other and supplied independently to the respective units whereby to prevent injury to the webs.

It is a further object of this invention to provide means whereby the machine may be operated to print a single web or a plurality of webs, at the will of the operator.

It is a further object of this invention to provide means for separating each of a plurality of fan-folded webs and supplying them independently to the machine and means for restacking the webs after printing in their original positions.

It is a further object of this invention to provide means for supporting a paper sheet on the printed side when the ink is wet without causing blurring of the matter printed thereon in wet ink.

It is a further object of this invention to provide such means in the form of rollers which are of rigid unitary construction.

Other objects and advantages will appear from the following description taken in connection with the drawings.

In the drawings:

Figure 1 is an elevational view of a printing machine according to my invention with attached stacker, as seen from the right side;

Figure 2 is a similar side elevational view, as seen from the opposite side;

Figure 3 is a side elevational view similar to Figure 1, enlarged for sake of clearance and with part of the supporting structure omitted;

Figure 4 is an end elevational view of the machine, as seen from the left of Figures 1 and 3, or as seen from the right of Figure 2;

Figure 5 is a similar end elevational view, as seen from the opposite or delivery end of the machine;

Figure 6 is a sectional view taken on the horizontal plane indicated by line 6—6 of Figure 3, showing the aligner and clutch operating means in top plan;

Figure 7 is a top plan view of the base frame with the printing frames and power connections therefor omitted for the sake of clearness;

Figure 8 is a top plan view of one of the printing sections of the machine, the other printing sections being omitted for the sake of clearness;

Figure 9 is an end elevational view in section of the machine taken along the line 9—9 of Figure 3;

Figure 10 is a diagrammatic view showing the cooperative relation of the carrier assemblies and other associated parts in the rearward position of the carrier;

Figure 11 is a view similar to Figure 10, showing the carrier partially advanced in its forward travel;

Figure 12 is a view similar to Figures 10 and 11, but showing the carrier in its foremost position in its trackway, at the end of its forward traverse;

Figure 13 is a side elevational view in section of the machine taken along the line 13—13 of Figure 8, with the parts in the position between that shown in Figure 12 and that shown in Figure 10, the traverse of the carrier being rearward;

Figure 14 is a front elevational view of the master print control and associated mechanism;

Figure 15 is a top plan view thereof;

Figure 16 is a side elevational view of the master print control and associated mechanism, showing the parts in position to prevent printing;

Figure 17 is a view similar to Figure 16, but showing the parts in position to cause the machine to print on each reciprocation;

Figure 18 is a side elevational view similar to Figures 16 and 17, but showing the parts in position to cause printing to occur on each alternate stroke of the carrier;

Figure 19 is a side elevational view in section taken along the line 19—19 of Figure 15 and showing the parts in the position of Figure 18;

Figure 20 is a side elevational view, partly in section, taken on the line 20—20 of Figure 15;

Figure 21 is a side elevational view similar to Figure 19, but showing the parts in their positions at a different portion of the cycle of operation in the operation of the machine to print on each alternate reciprocation of the carrier in its trackways;

Figure 22 is a diagrammatic view in side elevation of the clutch operating mechanism, showing the parts in position for continuous operation of the machine;

Figure 23 is a diagrammatic view similar to Figure 22, but in top plan;

Figure 24 is a diagrammatic view similar to Figure 22, but showing the parts in position to break the power train;

Figure 25 is a top perspective view showing the details of the carrier assembly;

Figure 26 is a diagrammatic view in end elevation of the carrier assembly as seen from the left side of the machine, showing the cooperation of parts to unclasp the web in the carrier, certain of the parts being broken away for the sake of clearness;

Figure 27 is a top plan view of the structure shown in Figure 25, a part of the structure being broken away for the sake of clearness;

Figure 28 is a top plan view of a modified form of carrier;

Figure 29 is an elevational view in section of

the carrier shown in Figure 28, taken along the line 29—29 of Figure 28;

Figure 30 is a side elevational view of the structure shown in Figures 28 and 29;

Figure 31 is a sectional view in side elevation of the aligner withdrawn from the aligning chamber for ease of threading the paper webs therethrough, a part of the end of the machine being shown in full;

Figure 32 is a diagrammatic view of the electrical circuit connecting the aligning mechanism, the clutch operating mechanism and the drive motor;

Figure 33 is a diagrammatic view showing the operation of the counter upon reciprocation of the carrier;

Figure 34 is a diagrammatic plan view of the means for adjusting the sheets in proper aligned relation in the machine, in superposed registering relation with respect to one another;

Figure 35 is a perspective view of the structure shown in Figure 3, with the printing units swung into elevated position above the base unit, details of a portion of the operative structure having been omitted for the sake of clearness;

Figure 36 is a view in perspective showing diagrammatically how webs from separate stacks or from the same stack may be restacked into superposed registering relation;

Figure 37 is a diagrammatic view showing one procedure which may be followed in printing webs on opposite sides;

Figure 38 is a diagrammatic view showing the procedure followed in printing one side of the webs with differing form material or printing in different colors;

Figure 39 is a plan view of the stacker shown in side elevation in Figures 1 and 2;

Figure 40 is a side elevational view of the structure shown in Figure 39;

Figure 41 is an end elevational view of the structure shown in Figure 40, as seen from the righthand side of Figure 40, looking toward the left; and

Figure 42 is a view in perspective, partly broken away, of the construction of the ink transfer rollers and supporting frame.

Referring to the drawings in detail and with reference particularly to Figures 1 to 5, 7 and 13, I have shown, as illustrative of my invention, a machine comprising a base frame, generally designated A, which is mounted on a table E which is supported on legs F which are braced by means of braces G, and which supports on the underside of the table E the motor H. Any other suitable source of power may be supplied, if desired. (Figures 1 and 2). The base frame A contains the aligning chamber and supports a type plate and three unit assemblies, generally designated B, the lower of which is pivotally secured at the rear end of the base frame A in a manner which will be hereinafter clearly described. The printing units B are identical, save for the fact that the first or lower printing unit only is equipped with a master print control for controlling the printing operations of the superposed printing units and a driving clutch for connecting and disconnecting the machine to the driving means.

Base Frame

(Figs. 1 to 6, 9 and 35)

The base frame comprises a pair of longitudinal side plates 1 having a horizontally disposed plate member 2 disposed therebetween and to the longitudinal sides of which it is attached by means of screws 3. Disposed between the side plates 1, spaced from and parallel with the plate member 2, is an aligner supporting plate 4 (Figures 6 and 13) which, in conjunction with the side plates 1 and plate member 2, form the aligning chamber. Longitudinal rails 1*a* which are fastened to the inside surfaces of the side plates 1, above and below the plate member 2, provide grooves for receiving the sides of the plate member 2 and retaining it in parallelism with the aligner support plate 4.

Aligning Means

(Figs. 6, 13, 31 and 32)

With reference particularly to Figures 6 and 13, it will be seen that the aligner of my invention comprises a framework made up of a pair of side members 5, which are secured together in spaced relation by means of the brace rod 6 rigidly secured therebetween at the forward end of the rail and the plate bracket 7 rigidly secured therebetween at the rear end of the rail. Just forward of the plate bracket 7 and secured between the rails 5 in the same manner as the brace rod 6 is the brace rod 8. Rigidly attached to the forward ends of the respective rails 5 are bracket members 9 which are adapted to support the forward guide rolls 10, 11 and 12 for free rotation. In the aligning chamber, at the left side, is secured to the side plate 1 a conductor plate 13 which is insulated therefrom and which has a plurality of conducting contacts 14 secured to the inner side thereof. (Figure 6). A similar conducting plate 15 having conducting contacts 16 is attached to the righthand side plate 1 in like manner. Journaled for free rotation and having the end pintles thereof insulated from the respective rails 5 are rear guide rolls 17, 18 and 19 respectively. The right hand pintles of these rear guide rolls extend outwardly and into contact with the conducting contacts 16 on the conductor plate 15. Secured rearwardly of each of the rear guide rolls 17, 18 and 19 is a conducting rod 20. Each of these conducting rods is insulated from the rails 5 and has its left end in contact with the conducting contacts 14 of the conductor plates 13. The conductor rods 20 are secured against rotation in the rails 5 by means of set screws. The left-hand conductor plate 13 is connected by means of wire 13*a* to the solenoid 26 while the conductor plate 15 is connected by means of wire 28 to a solenoid operated switch, generally designated 29. See diagram, Figure 32. Adjustably mounted on each conducting rod 20 by means of clamp 23 is a rear guide roll contactor 22 which, when properly adjusted, will resiliently contact each of the respective rear guide rolls 17, 18 and 19. As will clearly appear from Figure 32, when one lead of a circuit is connected to the conductor plate 13 and the other lead to the conductor plate 15, the path of the circuit through the aligner will be, for instance, from a conductor plate 13 through contacts 14 to the conductor rods 20 and thence through guide roll contactors 22 to the respective rear guide rolls and thence through conducting contacts 16 to the conductor plate 15 and thence to the second circuit lead. When paper webs are inserted between the respective rear guide roll contactors 22 and the respective rear guide rolls, these circuits will be opened and this is the normal operation of the circuit in the aligner as the circuits are utilized as a safety means which are adapted, when closed by contact of any one of the rear guide roll contactors 22 with any one of the respective rear guide rolls to cause the

power of the machine to be shut off for a reason which will hereinafter clearly appear.

Slidably mounted on each of the brace rods 6 and 8 is a pair of members 24 which are adapted to support edge guides 25, which edge guides are provided with suitable apertures so that they will clear the rear guide rolls 17, 18 and 19 and the conductor rods 20. Any number of such apertures may be provided in order to accommodate any desired number of rear guide rolls and conductor rods for increasing the capacity of the machine. A like number of apertures is provided in the rails 5 for the same purpose. The edge guides are pressed inwardly to a common stop 24a on their supporting member by springs 24b received in a peripheral groove of members 24, the details of which members 24 are clearly shown in Figure 9. The capacity of the machine may be increased by adding more of these members and a like number of forward guide rolls at the front of the aligner to accommodate added paper webs upon the increase of the capacity of the machine by adding additional printing frames. It will be understood that, when it is desired to operate the machine to feed fewer numbers of webs than is accommodated by its ultimate capacity, the circuit closing of any desired rear guide roll contactor 22 may be prevented by the interposition of a piece of paper between the contactor and the roll with which it cooperates or by suitable adjustment of or removal of the contactor from its supporting conducting rod 20.

The edge guide support members 24 are supplied with suitable means for resiliently urging the edge guides 25 inwardly, whereby to prevent misalignment of paper webs traveling therebetween. The edge guides may be adjusted transversely of the aligner by means of the sliding engagement of the members 24 with the respective brace rods, upon which they are mounted. This enables the machine to accommodate webs of widely varying widths. The rails 5 are each provided at their rear ends with anti-friction means comprising rollers 27 in order to provide for ease in sliding the aligner into and out of the aligning chamber.

Type Mounting

(Figs. 7, 8, 13 and 35)

As shown particularly in Figures 7 and 13, the plate member 2 is provided adjacent its forward end with a transverse aperture 30 which is adapted to accommodate the bottom of the ink fountain mechanism, generally designated 31. Extending longitudinally of the plate member 2 and attached thereto by means of screws is a pair of type rails 32 which have their forward ends terminating adjacent the transverse slot 30 in the plate member 2 and which are adapted to receive therebetween a type base 33 which is secured in position longitudinally of the plate member 2 by means of the screw 34 and lock washer 35, which screw 34 extends through a slot 36 in the righthand type rail 32 and is screw-threadedly received in the type support 33. By releasing the screw 34, the type support 33 may be adjusted longitudinally of the type rails and longitudinally of the plate member 2 and secured in adjusted position by again tightening the screw 34. The type support 33 is provided with longitudinally disposed undercut slots 37 and a plurality of transverse slots 38 which are adapted to receive a transverse flange of each of the members 39 which are connected by means of tension spring 40 with a member 41 which is similar to member 39 and which is adapted to engage the forward edge of a type plate 42. The type plate 42 is adapted to rest upon the top face of the type support 33 with its rear edge in engagement with an upstanding flange member 43 which may be made integral with the type support or rigidly attached thereto. The members 39 may be engaged in any desired one of the transverse grooves 38 to accommodate type plates of various lengths.

In order to remove and replace the type plates 42, it is merely necessary to slide them toward the front of the machine on the type support 33 against tension of the springs 40 and after having removed the rear edge from engaging position with the flange member 43, swinging the rear end of the plate upwardly and then sliding the tilted plate to the rear of the machine until the tension in springs 40 is released, at which point the type plate 42 may be removed from engagement with the members 41. To insert a new plate it is merely necessary to tilt the forward end of the plate and bring it into engagement with the members 41 and then to slide the tilted plate toward the front of the machine against tension of the springs 40 until the rearmost edge of the plate is forward of the flange member 43; the rear end of the plate is then lowered into contact with the type support 33 and, when the type plate 42 is then released by the operator, the members 41, by means of the tension in springs 40, are allowed to urge the printing plate 42 toward the rear of the machine until the rear edge thereof is in engagement with the undercut portion of the flange mmeber 43, at which time the type plate 42 is securely attached to the top of the type support 33 which may, as pointed out above, be adjusted longitudinally of the plate member 2.

The ink fountain assembly 31 is adapted to have its rear edge in engagement with the forward ends of the type rails 32 and in order to retain this assembly securely in position an upstanding substantially L-shaped spring clamp member 44 is attached to the plate member 2 adjacent the forward edge of the aperture 30. This spring clamp 44 securely retains the ink fountain assembly in position, as may be clearly seen with reference to Figure 13.

Ink Fountain Assemblies

(Figs. 7, 8, 10, 11, 12 and 13)

The ink fountain assemblies in the various units are all identical and only one will be described. With reference to Figures 7, 10, 11, 12 and 13, and particularly Figures 7, 12 and 13, it will be seen that the ink fountain mechanisms, generally designated 31, comprise box-like ink containers with bottom and sides formed of one integral plate 45 and ends formed of relatively thick plates 46. A cover plate 47 having a transverse aperture 48 is suitably attached to the top of the container. The container has rotatably mounted therein three rolls, designated 49, 50 and 51 respectively. The rolls 49 and 50 are rotatably secured in rearwardly extending flanges of a substantially U-shaped frame 52, which frame is urged rearwardly by means of springs 53 attached at the sides of the frame 52, so as to retain the roll 50 in close engagement with the roll 51. The rolls 50 and 51 have elongated pintles at the left, which extend through the lefthand end plate 46 of the container. To the ends of

these pintles are rigidly attached inter-engaging gears 50*a* and 51*a* respectively, whereby when the roll 51 is rotated in counterclockwise direction, as seen in Figure 13, the roll 50 is rotated therewith but in clockwise direction, as seen in that figure. The leftward extending pintle of the roll 50 is received in a slot (Fig. 7) in the lefthand plate 46, whereby the frame 52 and the contained rolls 49 and 50 may be removed bodily from the ink container. The top plate 47 is secured on the top of the ink container by means of the spring clamps 54.

As may be particularly clearly seen in Figure 7, the pintle of the roll 51 extends to the right and has rigidly secured thereto the ratchet member 55 and the rigidly attached handle portion 56. Rotatably mounted between the members 55 and 56 is a lever member 57 which carries a transversely disposed pin 58 on which is swivably mounted a click member 59 which is urged toward the teeth of the ratchet member 55 by means of the spring 60. At the lower end of the lever 57 is a short arm 61 which is adapted to cooperate with the adjusting screw 62 in a manner which will be hereinafter clearly described. Pivotally secured to the righthand plate 46 for engagement with the teeth on the ratchet member 55 is the pawl 63 which has connection with the lever 57 by means of the tension spring 64. The set screw 62 is screw-threadedly mounted in a block 65 which is secured by means of screws 66 to the top surface of the plate member 2 in such position as to align the set screw 62 with the short lower arm 61 of the lever member 57. As will appear most clearly from Figure 10, the lever 57 is engaged by the roller 67 of the paper carriage at the nd portion of its rearward stroke, whereby the lever 57 is swung to the left, as seen in Figures 10 to 13 inclusive, and the ink roll 51 is given an amount of counterclockwise rotary movement which depends entirely upon the adjusted "at rest" position of the lever 57, which is controlled by adjustment of the adjusting screw 62. A comparison of the positions of the lever 57 in "at rest" position (Figure 11) with that of Figure 10, in which it is depressed will indicate just how this rotation of the ink roll 51 occurs. By further withdrawing the adjusting screws 62, the "at rest" position of the lever 57 will more nearly approach the vertical, and the arcuate throw of this lever caused by the roller 67 will be increased, whereby to increase the degree of rotary movement of the ink roller 51.

As will clearly appear, the amount of ink presented by the ink roll 51 to the ink transfer rolls on the carrier assembly will vary directly with the amount of rotation of the ink roll 51, which is caused during each engagement of the roller 67 with the lever 57. The amount of this rotation is, as explained above, capable of being controlled entirely by the adjustment of the adjusting screw 62. By means of the click and ratchet mechanism, reverse movement of the ink roll 51 is prevented and provision is thus made for the advancement of the ink roll 51 a predetermined amount during each cycle of operation, which amount may be adjusted at will to compensate for the use of inks of different characteristics or for adjustment of the lightness or heaviness of the printing of the webs which travel through the respective units. As will clearly appear, the ink fountain means and adjusting screw 62 are identical and independently mounted in the respective units, whereby independent control of the printing in each unit is achieved.

With reference particularly to Figures 13 and 33, it will be seen that a lever 68 is pivotally attached at one end to the forward lefthand corner of the carrier assembly by means of an offset pivot arm 69 and pin or cotter 70. A simple elongated spring 71 is secured through an aperture in the forward or pivoted end of the lever 68 for the purpose of limiting its counterclockwise rotation about its pivot, as seen in Figures 13 and 33. Adjacent the middle portion of its length, the lever 68 is provided with a guide pin 72 extending transversely from the outer surface thereof. The rearward end of the lever 68 is provided with a notch 73. This comprises the counter-operating mechanism and is shown as applied only to the carrier assembly in the lower of the printing units B. The remainder of the counter mechanism is shown in Figures 7 and 33 and comprises a mounting plate 74 rigidly attached to the forward outer face of the lefthand type rail 32, upon which plate 74 is suitably pivoted at its lower end, an upstanding lever 75 having a screw 76 attached to its upper end, upon which screw 76 is pivotally mounted the thrust rod 77 and roller 78. The thrust rod 77 is disposed in a vertical plane which is parallel to that of the outer surface of the type rail 32 but is inclined downwardly with respect to the horizontal from the forward end to the rearward end.

Adapted for adjustable rigid attachment to the rearward end of the thrust rod 77 is a thrust collar 79, just forward of which and disposed about the thrust rod 77 is a compression spring 80. This spring 80 has its rearward end in abutment with the thrust collar 79 and its forward end in abutment with the thrust block 81 through which the thrust rod 77 is mounted for slidable movement with respect thereto. This thrust block 81 is pivotally mounted on the lower end of the counter-operating lever 82 which has its upper end rigidly attached to the counter-operating shaft 83. During the latter part of each rearward stroke of the carrier assembly, the guide pin 72 rides upon the forward, upward surface of the thrust rod 77 in order that the notch 73 of the lever 68 will be engaged with the roller 78 whereby to swing the arm or lever 75 forward and thus pull the thrust rod 77 forward whereby, through thrust collar 79, spring 80 and thrust block 81, the lever 82 is swung through an arc sufficient to rotate the counter-operating shaft 83 sufficiently to advance the tumblers 84 of the counter one count. The effective arc, through which the lever 82 is swung, may be adjusted by adjusting the thrust collar 79 along the thrust rod 77. Further adjustment of the counter is provided for by the adjustable mounting of the ends of the counter-operating shaft 83 in the longitudinal slots 85 in the right and left type rails 32, which slots 85 are similar to the slot 36 described above. The tumblers 84 of the counter are mounted in a frame comprising two thick substantially square side plates 86, between which is secured a U-shaped frame member 87. The dimensions of the side plates 86 are such that, when the supporting bushings 88 or the counter-operating shaft 83 are mounted in the slots 85, the lower straight edges of the side plates 86 are in engagement with the upper surface of the plate member 2. The counter and mode of operation thereof are otherwise conventional. It is thus clear that for each rearward reciprocatory stroke of the carrier in the first or lower printing unit B, the counter will be advanced one unit and, because the carriages in the respective units

reciprocate simultaneously, the number of forms printed by the machine may be easily calculated from the number of reciprocatory strokes or cycles of operation of the respective carrier assemblies in the machine during operation thereof.

CLUTCH OPERATING MECHANISM

(Figs. 3, 6, 7, 9, 22, 23, 24 and 32)

As pointed out above, the solenoid **26** is normally de-energized. With reference particularly to Figures 3, 6, 7, 22, 23 and 24, it will be seen that, when the solenoid **26** is deenergized, the lever **90** which is pivotally connected thereto and mounted for swinging movement on the right-hand side plate **1** is free to swing about its pivot **91**. This lever has a notch **90***a* on its rear edge which is adapted to be manually engaged with a transverse flange **92***a* of the plate **92** which has its lower end turned out into the flange **92***b*. This plate **92** is provided with elongated slots **92***c* which are adapted respectively to engage screws **93** and **94** to be guided thereby. The lower screw **93** is mounted in a boss **95** on the side plate **1** and pivotally supports a lever **96**, at the upper end of which is mounted the screw **94**. The lever **96** is thus adapted to swing about the screws **93** as a pivot. The lever **96** has a notch **96***a* providing in its forward edge an offset apertured transverse flange **96***b* at the upper rear portion thereof. The plate **92** is thus mounted by means of elongated slots **92***c* and the screws **93** and **94** for parallel sliding movement on the lever **96**. The plate **92** is retained in the uppermost position, provided for by the engagement of the elongated slots **92***c* and the screws **93** and **94**, by means of a tension spring **97** which has one end thereof attached to the flange **96***b* of the lever **96** and the other end thereof attached to the flange **92***a* of the plate **92**. Also mounted upon the side plate **1** is a boss **98** having secured therein a screw **99** which pivotally supports the lever **100**. This lever has an upper substantially horizontal portion which terminates at the rear in a projection **100***a*, which is adapted to engage the notch **96***a* in the lever **96**. The lever **96** and lever **100** are constantly urged toward this engagement by the spring **111** which is connected at one end to the lever **100** and at the other end to the lever **96**. This straight portion terminates at the forward end in a manually engageable flange **100***b*. The lever **100** has an arm **100***c* extending downward from the straight portion thereof, which supports a screw **101** to which is pivotally connected the rearward end of a link **102**. Forward of its rear end, the lever **102** is provided at its inner end with a transverse pin **103** which has one end of a tension spring **104** attached thereto. The other end of the tension spring **104** is secured to a stationary outwardly directed transverse pin mounted on the side plate **1**.

The spring is adapted to resiliently urge the link **102** in a forward direction. The forward end of the link **102** is pivotally connected to the upper end of the lever **105** by means of pin **106**. The lower end of the lever **105** is rigidly secured to a pintle member **107**. The pintle **107** is freely rotatably mounted in a pair of brackets, as will be hereinafter described. At the end of the pintle **107**, opposite from the lever **105**, is rigidly secured by means of pin **109** (Fig. 9), the clutch roller arm **108** which carries at its upper end the freely rotatable clutch roller **110** which is adapted, when the clutch roller arm **108** is swung into its foremost position, to perform a clutching operation to open the power train to the printing units in a manner which will be hereinafter fully described. This forward movement of the clutch roller **110** occurs when the link **102** is in its foremost position and the other parts are in the position shown in Figure 3 of the drawings.

The position of the clutch roller **110**, when removed from engagement with the clutch members, is shown in Figure 7 and, in order to bring the parts into this position from that shown in Figure 3, the operator presses downwardly on the flange **100** *b* of the lever **100**. The spring **111** having one end attached to pin **112** on the rear face of lever **96** and the other end attached to a pin **113** on the lever **100** then draws the lever **92** in a clockwise direction, as seen in Figure 3, until the projection **100***a* on the lever **100** is engaged in the notch **96***a* in the lever **96**. The spring **97** is then retaining the plate **92** in its uppermost position and the operator then, against the tension of the spring **97**, presses down on the flange **92***b* of the plate **92** and, still holding the plate **92** downwardly in this manner, by engagement with the transverse flange on the lever **90** swings the lever **90** in a counterclockwise or forward manner until the flange **92***a* of the plate **92** is engaged in the notch **90***a* of the lever **90**. The solenoid is then inoperative. The link **102** is then in its foremost position and the switch lever **29***a* of the switch **29** is then substantially upright or in a position to close the switch. A switch actuating plate **114** is secured by means of screws **115** to the link **102**, as shown in Figure 3. This switch operating plate carries a pair of spaced switch operating rollers **116** which are adapted alternately to contact and move the switch lever **29***a* to open and close the switch **29**. With the parts in the position, above described, and the solenoid de-energized, the plate **92** is held downwardly against the tension of spring **97** sufficiently far to avoid contact with the plate actuating hook **182***d* (Fig. 24) shown in contact therewith in Figure 3. The switch lever **29***a* is in substantially upright position and the operating circuit is closed. The machine is then adapted to operate continuously.

Upon the closing of the aligner circuit by the exhaustion of paper, as described above, the solenoid **26** is energized whereby to swing the lever **90** rearwardly or in clockwise direction, as seen in Figure 3. This permits the plate **92** to move upwardly with respect to the lever **96** to such a degree that the upper forward edge of the plate **92** will be engaged by the plate actuating hook **182**d (Fig. 24) on the right pitman **182** of the lower printing unit during the next traverse of the carrier assembly after the energization of the solenoid **26**. The inter-engagement of the plate actuating hook with the plate **92** is shown in Figure 3. When the plate actuating hook engages the plate **92** and continues its rearward traverse, the plate **92** swings the lever **96** to the rear or in counter-clockwise direction, as shown in Figure 3, whereby to disengage the projection **100***a* of the lever **100** from the notch **96***a* in the lever **96**. The spring **104** then becomes operative to move the link **102** to its foremost position while at the same time swinging the switch lever **29***a* into the position shown in Figure 3. Through the forward movement of the link **102**, the lever **105** and clutch roller arm **108** are swung forwardly or in clockwise direction, as seen in Figure 3, whereby to engage the clutch roller **110** with the clutch elements to break the power train to the printing units, as will be hereinafter more clearly described in the discussion of the power train

mechanism. It will thus appear that, upon breakage or exhaustion of any one of the several webs with which the machine is loaded, the clutching mechanism will open the power train upon the next traverse of the carrier assemblies, while at the same time shutting off the power by moving the switch lever 29*a* from the closed position forward to the open position, as shown in Figure 3.

Power Wiring

(Figs. 6 and 32)

As shown diagrammatically in Figure 32, the left-hand conductor plate 13 is connected by means of wire 13*a* with one terminal of the solenoid 26. The other terminal of the solenoid 26 is connected by means of wire 13*b* to the terminal L and also terminal N of the electrical plug block Z. The righthand conductor plate 15 is connected by means of wire 28 to the terminal R of tumbler switch 29. The opposite terminal of the tumbler switch 29 is connected by means of wire 28*a* with the terminal M of the plug block Z. A tumbler Q of the switch 29 is adapted, as shown, to open the circuit between the switch terminals P and R when the switch lever 29*a* is in the forward or open position, as shown in Figure 3, and is adapted when the switch lever 29*a* is in its rearmost or upright position to close the circuit between the terminals P and R. A plug *p* leading from a suitable source of power has the terminals *l* and *m* thereof adapted to make contact with corresponding terminals L and M of the plug block Z. An electrical plug *h* has two of the motor wires attached to each of the respective terminals *n* and *o* which are adapted to contact corresponding terminals N and O of the plug block Z. When the power plug *p* and motor plug *h* are properly inserted in the plug block Z, power from the plug *p* travels from the terminal *l* to terminal L and thence to terminal M, thence to terminal *n* through two of the motor wires to and through the motor, through the other two motor wires to the terminal *o*, thence to terminal O and through wire 28*b* to terminal R and then, when the switch is closed through the terminal Q to terminal P, thence through wire 28*a* to terminal M and thence through terminal *m* back to the source of power.

The circuit from the power plug *p* also extends from terminal *l* to terminal L through wire 13*b* to solenoid 26 thence through wire 13*a* to conductor plate 13. The circuit also extends from the terminal *m* to terminal M to switch terminal P and, when the switch is closed, through switch terminal Q to terminal R and thence through 28 to conductor plate 15. As described above, if the circuit is closed by the contact of any one of the contactor members 22 with the respective rolls 17, 18 or 19, the circuit will be continuous and the solenoid will be actuated.

As described above, actuation of the solenoid moves the link 102 forward to open the switch 29 by removing the tumbler Q from contact with the terminals P and R and simultaneously cuts off the power to the motor. Simultaneously with operation of the switch lever 29*a* by the link 102, the clutch roller 110 will be applied to break the power train to the respective printing units, as pointed out above.

Power Train

(Figs. 1, 2, 3, 5 and 9)

As shown particularly in Figure 3, the shaft of the motor H has secured thereon a pulley 117 which is drivingly connected by means of belt 118 with the pulley 119. With reference particularly to Figure 9, it will be seen that the pulley 119 is rigidly secured, by means of screw 121, to shaft 120 which is suspended for free rotation in the bracket 122 mounted on the lower side of plate member 2 and the bracket members 123 and 123*a* which are similar and in abutment and which are formed on extensions of the side plate 1 and one of the members 1*a* respectively. The endwise movement of the shaft 120 in its supporting brackets is prevented by means of collars 124 and 125 rigidly attached to the shaft between the brackets. Also rigidly attached to the shaft 120 between the collars 124 and 125 is a gear 126. This gear meshes with a gear 127 which is mounted for free rotation on the pintle 107 which carries the lever 105 and roller arm 108, as described above. Integrally secured to the gear 127 at the left side thereof is a gear 128 which is adapted to mesh with a pinion 129. The pinion 129 is supported for free rotation on the headed pintle bolt 130 which is secured through a lower portion of a boss 131 formed in the left side plate 1. In the upper portion of the left boss 131 (Figure 9) is secured a bushing 131*a* and a ball bearing member, generally designated 131*b*, for supporting the shaft 135. The bushing 131*a* also provides for the pivotal mounting of the left side plate 151 of the first printing unit with respect to the side plate 1 of the base unit. The right boss 131 (Figure 9) is similar to the left boss 131, save that the lower portion of the boss 131 is omitted because there is no necessity for the mounting of any such member as the headed pintle bolt 130 therein.

The pinion 129 meshes with a pinion 132 which is supported on a sleeve portion of pinion 133. The pinions 132 and 133 are separated by a friction washer 134 interposed between the adjacent side faces thereof, whereby when the pinion 132 is forced to the left, the pinion 133 will rotate freely therewith. The pinion 133 is supported for free rotation on the transverse shaft member 135 which is journaled at each end by suitable anti-friction means, each comprising a bushing and a roller bearing, in bosses 131 formed in the side plates 1. Cap nuts 136 secure the shaft member 135 against axial movement and also serve to retain the roller bearings in the bosses 131. The pinion 132 has a flanged portion 137 and a plurality of holes or apertures 138 at the righthand side thereof. A clutch sleeve 139 is mounted for free rotation on the shaft 135 and has a plurality of pins 140 at the left end thereof, which are adapted to engage in the holes or apertures 138 in the pinion 132. The lefthand or outer end of the clutch sleeve 139 is reduced and provided with a flanged portion 141 adjacent the pins 140.

The flanged portion 141 is similar to the flanged portion 137 on the pinion 132 and is oppositely disposed. The sleeve 139 has an annular recessed portion which is adapted to contain a compression spring 142 and a bushing 143. The bushing 143 is slidably disposed on the shaft 135. At the righthand end, the clutch sleeve 139 is flanged and provided with a female cone clutch surface 144. To the right of the clutch sleeve 139 and rigidly secured to the shaft 135 by means of set screw 146 is the stationary clutch member 145, which is provided with a cone clutch surface which is complementary to the surface 144 of the clutch sleeve 139. A friction washer 147 of suitable material is interposed between the

complementary cone clutch surfaces of the clutch sleeve 139 and the stationary clutch member 145.

In Figure 9, the parts are shown in driving position whereby to translate rotation of the pulley 119 to rotation of the pinion 133. It is to be noted that the spring 142 simultaneously urges the complementary cone clutch surfaces and friction washer 147 together at one end of the clutch, while at the other end the bushing 143, which has its left end in abutment with the right end of the pinion 132, urges the pinion 132, the friction washer 134 and the pinion 133 together whereby the drive is completed from pulley 119 to pinion 133. When the clutch roller arm 108 is swung forwardly (Figure 9), it engages the flanged end portions of the pinion 132 and clutch sleeve 139 and wedgingly, against the compressive force of the spring 142, draws the pinion 132 and clutch sleeve 139 tightly together a slight amount. This releases the friction between pinion 132 which is then rotating and the pinion 133 which is free. Likewise the complementary cone clutch surfaces of the clutch sleeve 139 and the stationary clutch member 145 are separated a slight amount whereby to release the friction therebetween. When the clutch roller 110, which is mounted in such a way as to prevent axial movement thereof, is so engaged with the pinion 132 and clutch sleeve 139, these members rotate free of the stationary clutch member 145 and free pinion 133 whereby to open the power train from the motor to the free pinion 133. As above explained, this engagement of the clutch engaging roller 110 with the pinion 132 and clutch sleeve 139 occurs simultaneously with the opening of the electrical switch whereby the drive train is opened simultaneously with the shut-down of the motor. As also explained above, the occurrence of these operations takes place during the cycle of operation immediately following the energization of the solenoid which is caused by torn or imperfect paper or exhaustion thereof. The compressive force of the spring 142 is preferably such that, although sufficient to provide positive drive of the parts connected with the free pinion 133, are unduly obstructed as, for instance, when a tool is left in the machine or when a part thereof is obstructed by any other foreign object. This provides an extremely effective and fool-proof safety feature which is directly incorporated in the drive mechanism of the machine.

In mesh with the free pinion 133 is a pinion 148 which is rigidly attached by means of a set screw 149 to shaft 150. This shaft is journaled in ball bearing units 152 disposed in suitable apertures in the side plates 151 of the first printing unit. Also rigidly secured on the shaft 150, adjacent the right side plate 151, is a second identical pinion 148 which is secured to the shaft 150 by means of set screw 149. To each outer end of the shaft 150 outside the side plates 151 is secured a chain sprocket 153 which is adapted to drive a chain 154. The righthand pinion 148 is adapted to mesh with and drive a connector gear 155 which is accommodated by a slot in the roof plate 161 of the first printing unit and which connector gear 155 is supported for free rotation on a pintle member 156 which extends transversely across the above-mentioned slot and which pintle member is rigidly attached to the roof plate 161 at each side of the slot by means of bolts 157 and 158. The connector gear 155 meshes with and drives the pinion 148 which is rigidly secured to the shaft 150 of the second printing unit which is identical with the shaft 150 of the first printing unit. The pinion 148 of the second printing unit meshes with and drives the connector gear 155 of the second printing unit and is mounted in the same manner as is the connector gear of the first printing unit. The connector gear 155 of the second printing unit meshes with and drives the pinion 148 which is rigidly secured to the shaft 150 of the third printing unit, which shaft 150 is identical with the shaft 150 of the second and first printing units and which is connected in the same manner to identical mechanism.

As shown in Figure 9, the connector gear 155 is omitted in the third printing unit because no further printing units are superposed on the third printing unit. All that is necessary, however, to increase the sheet or web capacity of the machine is to mount a connector gear 155 in the slot in the roof plate 161 of the third unit in the same manner as in the other units to continue the drive to other headed units. The fourth printing unit could then be pivotally mounted on the third printing unit in the same manner (hereinafter described) as the third printing unit is mounted on the second printing unit and as the second printing unit is mounted on the first printing unit.

Printing Units

(Figs. 1 to 5, 7, 8, 9, 13 and 35)

The construction of the respective printing units, designated B, is generally identical, save for certain details which will be hereinafter described. The frame of each of these units comprises a pair of side plates 151 which are provided with inwardly directed flanges at their upper ends by means of which they are bolted to the roof plate 161. At the forward ends of the tracks are guide plates 162 which extend upward beyond the tracks and which are secured rigidly to the outer surface of each side plate 151. Rearwardly of the guide plates 162, supported in like manner on the outer surface of each plate 151, is a chain guide plate 163 which extends upwardly of each track in the same manner as does the guide plate 162.

Also mounted on the outer surface of each of the side plates 151 is a chain support bar 164 which has elongated slots 166 therein, through which extend screws 165 which are threaded into the side plates 151. Journaled at the rear end of each chain support bar 164 is a chain sprocket 167 which is adapted to support and align the rear portion of the chain 154. When it is desired to tighten or loosen the chain 154, it is merely necessary to loosen the screws 165 and adjust the chain support bar 164 longitudinally of the side plate 151 and then tighten the screws 165 to secure the chain support bar 164 in adjusted position.

Extending outwardly from each forward end of the respective side plates 151 is a screw 168, upon which is pivotally mounted a latch member 169 having a handle member 170. The latch is urged in counterclockwise direction about the screw 168 by means of spring 171 having one end thereof secured to a pin 172 on the guide plate 162 and the other end thereof attached to a pin 173 on the latch member 169. The lower end of the latch member 169 is provided with a notch 169*a* which is adapted to engage a collar portion on screw 174 which is secured to the side plate 151. The latch member 169 on the lower or first printing unit engages a like screw 174*a* on the side plates 1 of the base unit and the cooperation of this screw with that latch member 169 is the

sole purpose of the screw 174*a*. The screws 174 perform a further function which will be hereinafter clearly described. The rear portion of the side plate 151 is provided with a suitable aperture 151*a* (Figure 9) to receive the bushing 131*a* which is mounted in the boss 131 of each side plate 1. By this means, the first printing section is pivotally mounted on the base unit A and locked thereon by means of the above described latching means.

The roof plate 161 of the first section is provided with type rails 32, type support member 33 and ink fountain unit 31, as well as resilient clamp 44, adjusting screw 62 and supporting block 65 in the same manner as the plate member 2 is equipped with these parts. The roof plates 161 of the second and other superposed printing units are likewise provided with these members. Rigidly attached to the side edges of the roof member 161 by means of screws 176 is a pair of upper side plates 175 which are provided with bosses 175*a* at their rear ends, which bosses are similar to the bosses 131 of the side plates 1 of the base unit A and are suitably apertured to receive cylindrical pivot pins 177 which are secured therein by means of suitable set screws 178 (Figure 5). The inward ends of the cylindrical pivot pins 177 are received in suitable apertures in the side plates 151 of the printing unit adjacent and thereabove.

Integrally secured to the inner sides of the upper side plates 175 and resting on the upper face of the roof plate 161 is a pair of support rails 179 which are adapted to engage and support the lower edges of the respective side plates 151 of the pivoted printing unit supported adjacent and thereabove. On the under surface of each roof plate 161 and at the left edge thereof is mounted a longitudinally disposed cam member 180 with inwardly directed straight cam surface of slight inclination which is adapted to engage a roller to reciprocate a member in the carrier assembly in a manner which will be hereinafter clearly described. The cam member 180 which is shown in Figure 2 also serves as a trackway for antifriction rollers on the carrier assembly. A member 181 similar to the cam member 180 is mounted in like manner on the under surface of the roof plate 161 at the righthand edge thereof, from which member 181 the cam surface may be preferably omitted. See Figure 3.

Carrier Assemblies

(Figs. 10 to 13, 25, 26, 27, 35 and 42)

The carrier assemblies are each of substantially identical construction, save for slight differences in equipment of the carrier assembly of the lower unit for the purpose of operating the counter and for operating the master print control mechanism. Each of the units have a frame comprised of a pair of plate-like side members 185 which are secured in rigid spaced relation by means of the L-section plate member 186 rigidly attached at the rear upper corners of each side member and the arcuate paper guide plate 187 arranged centrally between the two side members and rigidly attached at each end thereto and the front axle member 188 which is rigidly locked at each end in the respective side members by means of set screws 189. Each lower corner of each of the side members 185 is provided with a slot 185*d*. This provides slots at each of the four lower corners of the frame structure and in the rear right slot of each carrier is pivotally secured an ink roller lever shifting roller 67 which is adapted to contact and swing the lever 57 in counterclockwise direction in the extreme portion of the rearward reciprocation of the carrier. In the left forward slot 185*d* is pivotally secured in the carrier of the lower printing unit only the above-described counter operating lever 68. The carriers of the other units are provided with such a lever only if the respective units are provided with separate counters. In the forward righthand slot of the lower carrier only is rotatably mounted a roller 251 similar to the roller 67 which is adapted to cooperate with certain mechanism to be hereinafter described to operate the counter means disposed in the lower printing unit. If paper printing counter mechanisms are provided in the separate printing units, these rollers will be provided in the respective carriers of these units.

This structure comprises the framework of the carrier assembly. The front axle member 188 is positioned adjacent the forward upper corner of the side members 185. A second or rear axle member 190 is rotatably journaled in the side members 185 and is also axially slidable in its journals. The ends of this rear axle member 190 are provided with flattened portions. The pitman members 182 are secured axially with respect to the rear axle member 190 by means of screws 184 which engage threads disposed in the extreme ends of the rear axle member 190. By this means, pitmen 182 are rigidly secured at opposite ends of the rear axle member 190 and are held axially and radially in parallel position with respect to one another. The opposite ends of the pitmen 182 are each secured in pivotal manner by means of special chain links or pintles 182*a* to the respective carrier reciprocating chains 154, described above. Figures 1, 2, 3, 10, 22, 23 and 24 show that the chains 154, while traveling continuously, operate the pitman 182 having the hooked ends 182*d* which engage with the member 92 for actuating it, as indicated particularly in Figure 24. The pitman 182 and hook 182*d*, therefore, have a reciprocating motion because they are pivoted to the continuously moving chain 154 which moves throughout its circuit. By this means travel of the pairs of chains 154 at opposite sides of the machine units, which travel takes place in clockwise direction as seen in Figures 10, 11, 12 and 13, about the respective sprockets 153 and 167, causes forward reciprocative movement of the carrier frame when the member 182*a* is traveling in the top reach of the chain and rearward reciprocative movement of the carrier frame when the member 182*a* is traveling in the lower reach of the chain 154. By means of the chain 154, the members 182*a* are given a modified, simple, harmonic motion, in which the speed from zero in the position shown in Figure 10 is slowly increased to the ultimate in the position shown in Figure 11 and is again gradually decreased to zero at the position shown in Figure 12. On the rearward stroke of the carrier frame, the speed of travel of the member 182*a* is gradually increased from the position shown in Figure 12 to its ultimate and gradually decreased speed until the member 182*a*, after having traveled through the lower reach of the chain again reaches the position shown in Figure 10. By the provision of this gradual acceleration and deceleration at the ends of the traverse of the member 182*a*, undue shock to the carrier frame and supported mechanism is entirely prevented.

Rotatable on the rear axle member 190 and

disposed just outside the side members 185 of the carrier frame is a pair of ball bearing rollers 191 which are adapted to roll upon the track provided on the cutaway portion of the side plates 151 and adapted to be prevented from excessive axial movement thereon by means of guide plates 162 and chain guide plates 163 (Figure 3). These ball bearing rollers 191 are also adapted to be retained in downward position on the lower rails by means of the track member 181 secured on the underside of the roof plate 161 and the lower surface of the cam 180 secured at the left on the underside of the roof plate 161.

Similar ball bearing rollers 193 are journaled in like manner on the front or rigid axle member 188. These rollers are adapted to cooperate in the same manner as the ball bearing rollers 191 with the respective tracks and guide plates. The carrier frame is thus supported on ball bearing rollers in the trackway provided by the lower tracks formed in the cutaway portion of the side plates 151 of the printing units, the guide plates 162 and chain guide plates 163 and the tracks being formed by the undersides of the track member 181 and the cam member 180 respectively. The pitman secured at the righthand end of the rear axle member 191 are similar to those at the lefthand side, save for the provision of a widened portion 182b, to which is pivotally secured a clamp operating roller 192 which operates in a manner which will be hereinafter clearly described.

Adjustably secured on the top surface of the member 186 by means of a pair of slots which cooperate with screws 195 is a web support plate 194 which is of bent-up form and which is adapted to engage the folded or serrated portions of the web led thereover, as shown in Figures 10 to 13 inclusive. Journaled in the rear portion of the frame adjacent and forward of the rear axle member 190 is the bar 196 which is secured against axial movement by means of the rigidly secured sleeve 197 in abutment with the outside surface of the right side member 185 and by the rigidly secured lever 198 in abutment with the outer surface of the lefthand side member 185. The bar 196 extends a substantial distance past the righthand side member 185 and has rigidly secured at the outermost end portion thereof the lever 199. When the lever 199 is tilted in a manner which will be hereinafter described, the bar 196 is rotated in its journals whereby to swing the lever 198 for a purpose which will hereinafter clearly appear. The sleeve 197 is rigidly secured to the bar 196 by means of an elongated screw member 197a. The portion of the bar 196 disposed between the side members 185 is of substantially rectangular cross section, one side thereof having an arcuate surface with a centrally disposed slot therein, which arcuate portion terminates adjacent, but is spaced from, the bearing surfaces in the side members 185. When the lever 199 and lever 198 are swung into their foremost position, the slot is disposed rearwardly at a small angle from the vertical, as shown in Figure 13.

Also journaled at each end in the side members 185 forward of the bar 196 and rearwardly of and below the front axle member 188 is the shaft 200 which has two levers 201 rigidly secured thereto and disposed in spaced relation to one another between the side members 185. Also rigidly secured to the shaft 200 on the left end thereof, which projects beyond the left side member 185, is the lever 202 which is in line with the lever 198 on bar 196 which also lies outside the left side member 185. The lever 198 and lever 202 are connected by means of the pivoted link 203. The lever 198 is equipped with the transversely extending outwardly directed rigid pin 204 which also provides a pivot for the link 203.

Rigidly secured to the free ends of the levers 201 on the inside are pins 201a, to which are attached by means of slots therein a pair of roller supporting links 205 which have their outer or free ends connected by a rotatable clasping roller 206. The roller supporting links 205 are also secured together by means of a brace rod 207 connected thereto at its ends between the roller 206 and the slots which engage the respective pins 201a. The brace rod 207 is provided at its mid-portion with an adjustable set screw 208 which is adapted, under certain conditions, to rest upon the shaft 200 for the purpose of adjusting the clasping roller 206 in a definite position during certain of the operative positions. Rigidly secured to the rear, vertical surface of the member 186, adjacent each end thereof, is a pair of spring clamps 209 in the form of leaf springs which have inwardly disposed embossed teeth adjacent their lower ends. At the rear portion of each of the side members 185 and extending upward from the bottom of each side member 185 is a cutaway portion 185a, in which is adapted to be disposed an ink transfer assembly comprising a frame 210 having rotatably mounted therein a pair of identical, ink transfer rollers 211, mounted one in front of the other (see Figure 42). These ink transfer rollers have their central portions provided with suitable resilient clothing such as rubber, synthetic rubber or the like and have collars 212 rigidly secured thereto at either end.

The pintles of each of the ink transfer rollers are rotatably supported in sleeve members 213. These sleeve members have an inwardly disposed enlarged shoulder portion with flat sides adapted to be non-rotatably supported in upwardly directed slots 210a in the vertical side portions of the frame 210. The frame 210 has two of these slots 210a formed into each vertical side portion thereof and spaced apart a suitable distance. The outer ends of the sleeve members 213 are of cylindrical exterior and are adapted to fit into suitably spaced apertures in the attaching plate 214, which attaching plate is disposed thereover and drawn inwardly toward the vertical side portions of the frame 210 by means of the bolt 215 which has its outer or head portion disposed in a sleeve 216. By tightening the bolt 215, the attaching plate 214 may be drawn inwardly and the sleeve members 213 adjusted accordingly so as to properly adjust the amount of axial movements of the ink transfer rollers, as may be desired.

The top surface of the frame 210 is provided with a slot extending from side to side thereof, which is adapted to receive therein a rigid ink spreader roller 217 which has a pair of bushings 218 which are adapted to be received in suitable downwardly directed slots 210a in the top of the side portions of the frame 210. The grooved bushings 218 are adapted to be snugly secured therein by means of flat spring clamp members 219 which are suitably located on and secured to the top surface of the frame 210 by means of screws 220 and which have projections 219a on their lower sides which are adapted to engage the grooves in the grooved bushings 218. The lefthand end of the pintle of the ink spreader roller

217 is provided with a rigidly attached grooved roller 221 which engages a vertically disposed downwardly directed flange 222a of a horizontally disposed lever 222 which is pivoted by means of a screw 223 to the top surface of the left side member 185 (Figs. 25, 26, 27 and 28). The forward end of the lever 222 is provided with a rotatable roller 224 and a flat leaf spring 225 is suitably secured to the inner vertical surface of the left side member 185. The flat spring member 225 is adapted to urge the forward end of the lever 222 outwardly of the carrier frame and against the cam surface of the cam plate 180 which is secured to the left of the underside of the roof plate 161.

During reciprocation of the carrier frame in the above described trackway, the front end of the lever is progressively swung inwardly against the tension of spring 225 during the forward movement of the carrier (Fig. 27), whereby the ink spreader roller 217 is drawn axially toward the left in its bushings in the frame 210 and it will thus be seen that upon continued reciprocation of the carrier in the trackway the ink spreader roller 217 which is in contact with the ink transfer rollers 211 will have rolling reciprocatory motion whereby to uniformly spread ink over the resilient peripheral surfaces of the ink transfer rollers 211. The vertical side portions of the frame 210 have forwardly directed ears 210b which are adapted to be engaged with suitable supporting means on the side members 185. An arcuate downwardly disposed flange 210c is provided at the rear of the frame 210 which is adapted to be engaged by an inwardly directed projection 209a on each spring clamp 209, whereby to secure the frame 210 in the above-described carrier frame.

A pair of spring urged pins 226 project downwardly from the upper part of the aperture 185a in each side member 185 and engage the upper sides of the sleeve members 213 whereby the compressive force of the urging springs of these pins presses the ink transfer rollers 211 downwardly. It may be seen, particularly in Figure 13, the rear ink transfer roller 211 passes backwardly beyond the ink roller 51 in the ink fountain assembly. It again passes this roller 51 in traveling forward and, as before stated, the ink roller 51 is rotated through a predetermined arc on the backward reciprocating movement of the carrier. Thus the rear ink transfer roller 211 is provided with a predetermined amount of ink each time it travels over the ink roller 51. The ink is transferred by the rear ink transfer roller 211 to the ink spreader roller 217 and also during reciprocation of the carrier to the upper flat surface of the member 47 forward of the roller 51 during reciprocation of the carrier. In this way, ink is transferred from the rear ink transfer roller 211 to the forward or front ink transfer roller 211 and, during the reciprocation of the carrier, as is shown particularly in Figures 10 to 13 inclusive, this ink is transferred by the ink transfer rollers 211 to the type 42. The inking operation occurs during both the forward and the rearward reciprocative movements of the carrier because the ink transfer rollers come in contact with the type 42 during both reciprocations. It will be clear from the above description that the amount of ink so transferred from the ink fountain to the type or printing plate 42 may be controlled by adjustment of the lever 57 through the adjusting screw 62.

Journaled for free rotation in the front portion of the side members 185 and below the front axle member 188 is a web supporting shaft 227 having an axial slot 227a disposed therein. Supported for axial adjustment on the web supporting shaft 227 is a pair of edge support rollers 228 which have friction members 229 disposed in their bores for cooperation with the slot 227a. A plurality (three are shown) of non-smear rollers 230 is disposed between the edge support rollers 228 and adjustably mounted in the same manner by means of friction members 230a which engage with the slot 227a in the web supporting shaft 227. These non-smear rollers are of spool form having radially tapered end flanges provided with very fine serrations or saw teeth, due to which construction a freshly printed surface on which the ink is still wet may be supported without smearing of the wet ink by contact with the teeth or serrated portions of the non-smear rollers.

Spaced forward of the apertures 185a in each of the side members 185 is an aperture 185b extending from the lower edge of each side member 185 and which has an arcuate upper surface. An arcuate roller guide slot is formed into each side member 185 forward of the aperture 185b which slot extends only partway through the side member 185 from the outer side thereof. The arc of this slot is concentric with the center of the pivot pin 235 which is journaled in the side member 185 above and slightly forward of the aperture 185b. To the rear of the aperture 185b and adjacent the lower part of the side member 185 is secured a pivot screw 236, upon which is swingably mounted the impression roller support arm 237. This impression roller support arm 237 has a pin 238 secured at the forward end thereof and a circular aperture 237a therein, which is adapted, when the support arm is in its uppermost position, to be concentric with the circular upper portion of the aperture 185b in the side member 185. A circular flanged ball bearing member 239 is disposed in the aperture 237a with the flanged portion thereof, engaging the outer side of the impression roller support arm 237. The impression roller 240 has a resilient center portion 240a, a pair of rigid collars 240b, arbors 240c with reduced end portions which are adapted to be supported in the flanged ball bearing members 239 at each end of the roll and which are secured therein by means of screws 241 which are threaded into the ends of the reduced portions, whereby to draw the flanged bearing members 239 inwardly into close engagement with the shoulder formed between the portions 240c and the reduced end portions.

In the top forward edge of the impression roller support arm 237 is an arcuate notch 237b adapted at certain times to be engaged by a sleeve portion of a roller 242 which has a flanged portion 242c which is received in the slot 185c (Fig. 30). It will thus be seen that by swinging the impression roller supporting arms 237 about their pivot screw 236, the impression roller 240 is swung alternately upwardly into a position above the ink transfer rollers 211, as shown in Figures 10, 11 and 13, and downwardly into the position shown in Figure 12, in which latter position it is enabled to engage the top face of the type plate 42 on the rearward stroke of the carrier in operation.

The means for performing the shifting of this impression roller support arm 237 comprises a shifting lever 243 which has an inwardly disposed offset flange 243a at its top and which is provided

with an elongated aperture 243b by means of which it is adapted to be supported on the pivot pin 235 and retained in axial position thereon by the shoulder formed between the outer enlarged head portion 235a of the pivot pin and the outer side face of the flange 243a. At its mid-portion, the shifting lever 243 is provided with a second flange 243c to which is rigidly secured the headed pin 244 which rotatably supports the roller 242. The main portion of the lever is at right angles to the flanges 243a and 243c and the lower end thereof is bent up into a stepped portion 243d having a small circular aperture therein and adjacent thereto is provided an extension 243f which is parallel to and offset from the main portion of the shifting lever 243. The headed portion 235a of the pivot pin 235 has a transverse bore therein, which is in substantial alignment with the aperture of the stepped portion 243d of the shifting lever 243. A screw member 245 has a reduced head portion and an integral flanged portion 245b adjacent thereto and thereabove. The reduced head portion is adapted to be engaged in the aperture and the flanged portion 245b is adapted to rest upon the stepped portion 243d of the shifting lever 243. The upper threaded end of the screw member 245 is adapted to extend through the bore in the head portion 235a of the pivot pin 235.

Screw-threadedly mounted on the screw member 245 is a spring tensioning block 246 which is adapted for sliding movement with respect to the main portion of the shifting lever 243 and which is adapted to be prevented from rotation relative thereto by engagement of one side of the block with a surface of the main portion of the shifting lever. Disposed about the screw member 245 between the spring tensioning block 246 and the head 235a of the pivot pin 235 is an extremely strong compression spring 247. A nut member 245b is locked on the upper threaded end of the screw member 245 and the compression spring 247 is thus held in compression between the tension block 246 and the lower surface of the head 235a of the pivot pin. The compression of the spring may be adjusted by adjustment of the compression block axially of the screw member 245 by rotating the reduced headed portion of the screw member 245 with a screw driver. To the back surface of the main portion of the shifting lever 243 is integrally secured an upstanding pin 248, to which is secured one end of a spring 249 which has its other end secured to the pin 238 at the end of the impression roller support arm 237. This spring retains the sleeve surface 242b of the roller 242 in constant contact with the arcuate notch 237b and the cam surface on the upper edge of the impression roller support arm 237 which leads from the arcuate notch 237b. As before stated, the arcuate slot 185c is disposed concentrically with respect to the axis of the pivot pin 235.

When the parts are in the position shown in Figure 10, the tension of the spring 249 connecting the pins 238 and 248 holds the cam surface on the upper edge of the impression roller support arm 237 adjacent the arcuate notch 237b up into close contact with the sleeve portion 242b of the roller 242 which is rotatably secured on the shifting lever 243. In this position the compression of the spring acts to cause contact between the top of the arcuate portion of the slot 243b and the pin 235. This is the position of the parts during the forward stroke of the carrier. When the carrier is adjacent the end of its forward stroke, the lower end of the shifting lever 243 is engaged by a pivoted print control lever 250. Further forward motion of the carrier will cause the shifting lever 243 to be swung rearwardly in clockwise direction about the pin 235. This will be resisted by the tension of the spring 249. The swinging movement of the shifting lever 243 will continue until at the end of the stroke, the parts are in position shown in Figure 12. In this position of the parts, the roller 242 is disposed in the notch 237b of the impression roller support arm 237. The compressive force of the spring 247 acts upon the spring tensioning block 246 to transmit this force through the lower end of screw member 245 and flanged part 245b thereof to urge the shifting lever 243 downwardly until this movement is limited by contact of the top surface of the slot 243b with the pin 235.

Due to the contact of the roller 242 with the impression roller support arm 237, the compressive force of the spring 247 is transmitted to the impression roller 240 supported by the support arms 237. The adjustment of the spring is preferably such that, when the impression roller engages the paper with the printing plate 42, spring 247 is compressed and the pin 235 disposed in the slot 243b below the top surface thereof. This provides a resilient support for the impression roller 240. When the carrier on its rearward stroke again approaches the position of Figure 10, the lower part of the shifting lever 243 engages a roller 251 which is stationarily supported on a side plate 151 in the path of the shifting lever 243. During the rearward stroke of the carrier, the shifting lever 243 and the cooperating parts remain in the position shown in Figure 12 and then adjacent the end of the rearward stroke, the shifting lever is engaged by the roller 251, whereby upon continued movement in the rearward stroke of the carrier the shifting lever 243 is swung up to the position shown in Figure 10. It will thus be seen that, when the carrier begins its forward stroke, the parts are in the position shown in Figure 10 and the impression roller 240 shifted to its uppermost position. This positioning of the parts continues until adjacent the end of the forward stroke of the carrier. The print control lever, when properly positioned, engages the end of the shifting lever 243 and swings it in counterclockwise direction about the pivot pin 235 into the position of parts illustrated in Figure 12, which is reached at the extreme end of the forward movement of the carrier. The impression roller is then swung downwardly into the printing position where it remains during the rearward stroke of the carrier; when, during this rearward stroke, the impression roller 240 engages the printing plate 42, the force of contact tends to swing the impression roller 240 upwardly against the compression of the spring 247. Thus, during the travel of the impression roller 240 over the printing plate 42, the impression roller 240 is resiliently urged downwardly into contact with the printing plate 42 by the force of compression of the spring 247.

When the end of the rearward stroke is approached, the roller 251 which is pivotally mounted in a stationary position again shifts the shifting lever in counterclockwise direction, until, at the end of the rearward stroke, the parts are again in the position illustrated in Figure 10. As will be understood, the cycles of operation continue during the operation of the machine. The print control lever 250 is shown in Figures 10 to 13 in its operative position, but by means of mechanism which will be hereinafter described

the print control lever 250 may be swung downwardly out of the path of the shifting lever 243 whereby, during the continued operation of the machine, the shifting lever and cooperating parts will remain in the position shown in Figures 10 and 11, wherein the impression roller 240 is drawn up out of printing position. In this position of the parts, the web or webs will be fed through the machine without the performance of the printing operation thereon.

The position of the web with respect to the carrier is illustrated in Figures 10 to 13 inclusive and it will be seen that, when the webs are properly aligned, the serrated, weakened or folded part is engaged by the upwardly disposed forward edge of the web support plate 194. The web thence extends downwardly over the paper guide plate 187 and under the clasping roller 206, under the impression roller 240 and over the web supporting shaft 227, where the edges are supported by the edge support rollers 228 and the central portion thereof is supported by the nonsmear rollers 230. The ends of the web extending from the forward and rear sides of the carrier are supported and held by mechanism mounted in the unit frames which will be hereinafter clearly described.

Web Supporting Means

(Figs. 4, 6, 9 to 13 and 31)

The web is supported by the web support roller 260 journaled for free rotation between the side plates 151 at the rear of the frame, to which roller it is held securely and in stationary manner during a portion of the reciprocatory movement of the carrier during the operative cycle. This is accomplished by means of the clamps 261 having contact surfaces equipped with resilient material 262. These members are adapted to be adjusted axially of and rigidly secured to the rotatable clamp support shaft 263 which is journaled in the side plates forward of and adjacent the web supporting roller 260. At the right end of the clamp support shaft 263, outside the frame of the machine, is a lever 264 which is rigidly secured to the shaft 263. Secured to the outside of the righthand side plate 151 is a bracket 265 which has screw threaded therein and disposed in the path of the lever 264 the stop screw 266 which is provided at its rear with a screw head and which is equipped with a lock nut 267. This stop screw may be adjusted to limit the counterclockwise swinging movement of the lever 264, whereby to limit the approach of the clamps 261 to the web support roller 260. The clamps 261 are normally urged toward the web support roller 260 by means comprising a pin 268 about which is supported a compression spring 269, the spring and pin being accommodated by suitable apertures provided in the top surfaces of the clamp members 261. It will thus be clear that the clamps 261 are urged downwardly against the web supporting roller 260 by the springs 269 and the position being positively controlled by means of the stop screw 266. When the lever 264 is swung counterclockwise to its extreme position, the web is securely clamped on the web supporting roller 260 and rotation of the roller 260 is likewise prevented by this means.

The forward or delivery end of the web is supported by a pair of drive rollers 270 which are non-rotatably mounted on the shaft 150 for axial adjustment thereon. The manner of so mounting these rollers 270 on the shaft 150 comprises the friction springs 270*a* which are adapted to cooperate with the axial groove 150*a* in the shaft 150 (Fig. 9). The cylindrical peripheries of these drive rollers 270 are relatively narrow. Journaled in the frame above and rearwardly of the shaft 150 is the rotatable shaft 271 which has rigidly secured at the righthand end thereof, outside the frame, the lever 272 which is connected to the lever 264 by means of the link 273 which is pivotally connected at either end to the respective levers by means of screws 273*a*. Rigidly connected to the shaft 271 at one end thereof and widely spaced within the frame on the shaft is a pair of levers 275 which carry a cross bar 276 which is spaced therebetween and secured at either end to one of the levers 275. A tension spring 275*a* is attached at one end to the outer end of the righthand lever 275 and has its other end attached to the roof plate 161 thereabove, whereby to urge the arms and attached parts to be swung into counterclockwise direction (Figure 5). Mounted on this cross bar 276 and adapted for adjustment axially thereof is a pair of web support clamps 277 which have rearwardly projecting spring ends 277*a* provided with suitable resilient clothing 278 similar to the clothing 262 on the clamps 261. The rocking of the lever 264 will be transmitted through the link 273 to the lever 272 and thence through shaft 271 and levers 275 into swinging movement of the portions 277*a* of the web supporting clamps 277. A bracket 276*a* is mounted at each end of the cross bar 276 in certain of the units and a guide plate 276*b* is supported between the ends thereof for the purpose of guiding the webs on delivery from the machine.

As will most clearly appear from a comparison of Figures 10 and 11, when the members 261 are pressed downwardly (Figure 10) to hold the web securely upon the web support roller 260 and prevent rotation of the roller 260, the web is supported at its forward end by the portions 277*a* which hold it above and out of engagement with the drive rollers 270. When the web is clasped by the web clasping mechanism of the carrier during the feeding stroke (Figure 11), the clamp members 261 are withdrawn from the web, and the web suport roller 260 and the portions 277*a* of the web supporting clamps 277 are swung downwardly whereby to allow the web to have access to the drive rollers 270. Means is provided for resiliently pressing the web against the portions 277*a* of the members 277 in the position shown in Figure 10 and against the web drive rollers 270 in the position shown in Figure 11. This means comprises a pair of arms 279 which are pivotally mounted on the shaft 271 adjacent the inwardly disposed sides of the respective levers 275. These arms have their free ends connected by a rotatable web compression roller 280. A flat leaf spring member 281 is connected at either end to one of the arms 279 between the roller 280 and the shaft 271.

Rigidly secured to the mid-portion of the flat spring member 281 is the block 282 which is adapted to be engaged by an adjusting screw 283 which is screw-threaded through the roof plate 161. By adjustment of the screw 283, the tension of the spring member 281 may be adjusted as desired to alter the compressive force of the web compression roller 280. By pushing the link 273 rearwardly until the lever 264 is in abutment with the stop screw 266, the parts take the position shown in Figure 10 wherein the portions of the web adjacent the ends of the units are clamped tightly against the web sup-

porting roller 260 at the rear of the machine and supported at the forward part of the machine upon the web support clamps 277 out of engagement with the web drive rollers 270 and securely held between the web compression roller 280 and the web support clamps 277. The web is released at both of these portions and brought into driving position between the web compression roller 280 and the web drive rollers 270 by pushing the link 273 forwardly into the position shown in Figure 11. The means for performing this movement comprises the stationary bar 284 secured at each end by means of screws 285 to the right side member 151 above the link 273. A block 286 is mounted on this stationary bar 284 for adjustment longitudinally thereof and is adapted to be securely clamped in adjusted position thereon by means of the clamping screw mechanism 287, which also provides a pivot for the cam lever 288.

Also pivotally mounted on the rear portion of the block 286 by means of screw 289 is the pawl 290 which is connected to the cam lever 288 by means of spring 291. An adjustable block 293 is mounted on the link 273 by means of clamping screw mechanism 292 in the same manner in which the block 286 is mounted by the clamp screw mechanism on the stationary bar 284. The clamp operating roller 192 is adapted on the forward stroke of the carrier to engage the cam lever 288 and swing it in counterclockwise direction about its pivot, as shown in Figure 11, whereby to push the link 273 toward the front of the machine and to lower the web supporting clamps so that the web may engage the web drive rollers 270. On the rearward stroke of the carrier, the clamp operating roller 192 is adapted to pass the cam lever 288. At its forward end, adjacent the lever 272, the link 273 is provided with an integral block 294, which is adapted to cooperate with a clamp locking cam 295 in a manner which will be hereinafter clearly described. The clamp locking cam 295 is pivoted at 296 to the side member 151 and has a notch 295a at its forward end, with which the block 294 is adapted to cooperate. Below the pivot 296 on the clamp locking cam 295 is a pin 297, to which an end of a spring 298 is attached. The opposite end of the spring 298 is attached to a pin 299 on the link 273. By means of the spring 298, the clamp locking cam 295 is normally urged in clockwise direction about its pivot 296. Thus, when the link 273 is pushed forward, the block 294 on the link 273 will be engaged in the notch 295a in the clamp locking cam 295, as shown in Figure 11.

The front axle member 188 of the carrier is provided with an adjustable screw 188a which is adapted during the latter portion of the forward stroke of the carrier to engage the lower edge 295b of the clamp locking cam 295, which lower edge is in the form of an inclined cam surface. This engagement of the screw 188a with the surface 295b is clearly shown in Figure 12. As this screw 188a is moved forward, after having first engaged the surface 295b, the clamp locking cam 295 is swung upwardly in counterclockwise direction about its pivot 296 whereby to release the block 294 from the notch 295a. The link 273 is then freed from the clamp locking cam 295 and moves rearwardly, the block 293 on the link 273 moving into close abutment with the block 286 on the stationary bar 284.

As will clearly appear from the above description, the adjustment of the block 286 on the stationary bar 284 and the block 293 on the link 273 will determine the position in the forward stroke of the carrier when the web will be clasped by the carrier and carried forward until the releasing operation takes place at a predetermined point adjacent the extreme forward position of the carrier. Thus, by adjustment of the blocks 286 and 293 on their respective supports, the distance may be adjusted through which the carrier (with the web clasped thereto) moves the web, before the web is released from the carrier and clamped again in stationary position in the machine, free of the feeding effect of the carrier. It is to be noted that the blocks 286 and 293 of the respective units may be adjusted independently, as desired, whereby the respective webs may be advanced different distances in the respective units, while the machine is operating simultaneously.

The pitmans 182 have boss portions at their upper ends by means of which they are attached to the rear axle member 190. To this boss of the pitman disposed at the left side of the machine are secured pin retainer members 300 which are integrally secured to the boss portions of the pitmans by means of screws 301 (Figs. 9 and 26). These pin retainer members are in the form of arcuately bent spring strips having an upwardly extending end flange, in which the pin 204 on the lever 198 is adapted to fit when the clasping roller 206 and connected parts are in the position illustrated in Figure 10. When the parts are in the position shown in Figure 13, the pin 204 is disposed forward of the upwardly disposed forward flange on the pin retainer member 300 and is in engagement therewith.

Securely fastened to the left side of the frame adjacent the forward portion thereof is a pin hook member 302 which projects downwardly and rearwardly and has a hook portion formed at the rear end thereof (Fig. 13). This member is preferably resilient and formed of a flat strip of material. The pin hook member 302 is so disposed that, when the web clasping mechanism of the carrier is in the position shown in Figure 11, in which position the pin 204 is supported on the pin retainer member 300 back of the upturned forward flange thereof, the pin 204 will, during the forward stroke of the carrier, engage and pass under the hook portion of the pin hook member 302 adjacent the end of the forward stroke. After the forward stroke is completed and the carrier begins its rearward stroke, the hook member 302 will engage the top portion of the pin 204, and due to the fact that the pin hook member is designed to provide more retaining force than the pin retainer member 300, the pin 204 will be retained by the pin hook 302 sufficiently long to draw the pin 204 forward of the upwardly projecting end flange of the pin retainer member 300. Further rearward reciprocation of the carrier on the rearward stroke will carry the pin 204 from under the pin hook member 302. This retention of the pin 204 by the pin hook member 302 causes the lever 198 to be swung from its rearmost position in which the clasping roller 206 is in the position shown in Figure 11 to its forwardmost position, in which the clasping roller 206 is in the position shown in Figure 12. This causes the web to be clasped and unclasped by the clasping mechanism of the carrier at predetermined times.

As I have described the means by which the clasping roller is removed from clasping position in the first part of the rearward stroke of the

carrier, I will now describe the means by which the clasping roller is again brought into clasping position. After the rearward stroke of the carrier has been completed, the pawl 290 engages the lever 199 on the bar 196 and tilts this lever 199 from its substantially vertical position, as shown in Figure 10, to its rearmost position, as shown in Figure 11, which figure shows the position of the various parts just after this operation has taken place. The web is then clasped in the carrier and the parts are positioned for a forward, web moving or feeding stroke.

GAUGING MEANS

(Figs. 1, 3 and 34)

This means comprises the gauging member 303 (Figure 3) which is of L-section having a horizontally disposed elongated arm and a vertical arm disposed at one end which is provided with a notch 303*a*. This notch 303*a* is adapted to engage with the next forwardmost screw 165 at the right side of any unit to which applied. When so disposed, the horizontal elongated arm of the member 303 projects above the top reach of the chain 154 of the unit and above the type plate 42 thereof. The perforated, serrated or otherwise marked portion of the webs may be definitely located with respect to the rear edge of the elongated arm of the member 303, during loading of the unit, by manually advancing the web in the unit to predetermined, desired position. The position of the member 303, when applied to a unit of the machine, is shown in dotted lines in Figure 3 and is also illustrated in plan in Figure 34. This gauging member 303 is adapted, when not in use, to be supported at the underside of the base E by a bracket 304, as shown in Figure 3.

MASTER PRINT CONTROL

(Figs. 14 to 21 and 35)

This mechanism is provided in the lower printing unit only, simple, efficient connecting means being provided between it and the above-described print control levers 250 in the second and other superposed printing units. The master print control mechanism comprises the frame 305 of U-shaped horizontal section which is rigidly secured at the forward end of the right side plate 151 in spaced relation to the roof plate 161 and rearwardly of the pinion 132, gear 133, clutch sleeve 139 and other clutching mechanism. The right-hand flange of the frame 305 is rigidly secured to the right side plate 151 and has integrally formed in the top edge thereof a flange 305*a* which is bent over into a horizontal portion provided with a vertically disposed bore which is adapted to slidably guide a vertically disposed connector pin 306 which performs a function which will be hereinafter most clearly described.

Rotatably journaled in both side plates 151 of the frame of the lower printing unit B is the cross shaft 307 which has rigidly attached at the left end thereof the print control lever 250. This shaft 307 is also rotatably journaled in the frame 305 and has rigidly secured adjacent the right end thereof and disposed between the side flanges of the U-shaped frame 305 the master print control lever 308. The master print control lever 308 is of substantial L-form having the longer and substantially horizontal arm thereof shaped similarly to and arranged in parallelism with the print control lever 250 at the left end of the shaft 306. The shorter arm 308*b* of the master print control lever is disposed substantially perpendicularly of the above-described longer arm 308*a* and is provided at its lower rear end with a cutaway portion and integrally formed pin 308*c* which is adapted to retain and position a compression spring 309 which has the rear end thereof in abutment with the rear transverse flange of the U-shaped frame 305 and its forward end in abutment with the short arm 308*b* of the lever 308. On the left or inward side surface of the arm 308*b* of the lever 308 is pivotally mounted a cam follower roller 310. Rigidly secured to the right end of the cross shaft 307, outside the right side plate 151, is the lever 311. Disposed on the cross shaft 307 and swingably mounted thereon to the left of the lever 308 is the pawl 312. Journaled in the side flanges of the frame 305 and extending outwardly of the side plate 151 is the shaft 313 which is disposed rearwardly of the cross shaft 307 with respect to the machine and slightly below the horizontal plane of the cross shaft 307.

Rigidly attached to the outer end of the shaft 313 and disposed outside the side plate 151 is the latch lever 314. Rotatably attached to the extreme right end of the shaft 313 outside of the latch lever 314 is the latching control member 315 in the form of a cylindrical sleeve having an inwardly directed latch pin 316 secured to its inner side. The latch lever 314 has a trip handle 314*a* in the form of an outwardly directed pin attached to its outer side. Pivotally mounted on the shaft 313 and spaced inwardly from the left flange of the U-shaped frame 305 by means of a sleeve formed integrally therewith is an actuator member 317 in the form of a plate having two arms disposed radially of its pivot and at an acute angle to one another. A pin 318 is rigidly secured to the upper of the levers of the member 317 and is adapted to cooperate with the top edge of the left flange of the U-shaped frame 305 to limit the forward and rearward rocking movement of the member 317 on the shaft 313. A headed pin 319 is mounted adjacent the end of the forward lever arm of the member 317 and pivotally supports a pawl 320 disposed in abutment with the right side of the actuator 317. The end of the headed pin 319 extends to the left of the actuator 317 and provides a perch for one end of a spring 321 which is supported on the integral sleeve of the actuator 317 at the left of the plate portion thereof. The opposite end of this spring 321 is supported on a pin 322 which extends vertically from the right or inner side face of the left flange of the frame 305. The spring 321 is thus adapted to swing the actuator 317 so that the end of the top lever arm swings toward the rear of the machine until such movement is prevented from continuing by abutment of the pin 318 with the top edge of the forward portion of the left flange of the U-shaped frame 305.

Pivotally mounted on the shaft 313 to the right of the actuator 317 is a member 323 which comprises a ratchet 323*a* and cam 323*b* formed integrally therewith and separated axially at small distance. The ratchet is in line with the pawl 320, while the cam member 323*b* is in alignment with the roller 310 which is rotatably mounted on the lever 308. The free ends of the pawls 312 and 320 are connected by the tension spring 324 which extends therebetween and operates to retain the teeth at the ends of the respective pawls in contact with the teeth of the ratchet member 323*a*. Pivotally attached at the outside of the right side plate 151 rearwardly of the above described mechanism, with respect to the machine, is the manual latch 325 and whch has the handle

327 at its free end and the notch 325*a* in its rear edge, which is of shape complementary to the shape of the free end of the latch lever 314. For a purpose which will hereinafter appear, the latch lever 314 may be swung into upward, substantially horizontal position and latched in this position by swinging the latch handle 327 toward the front of the machine. This position of parts is shown in Figures 16 and 17, while the other position, wherein the lever 314 is disengaged from the latch 325, is shown in Figures 18, 19 and 20.

As explained above, no printing will occur when the impression roller 240 of the carriage is swung upwardly into position shown in Figure 19, for instance. In order that printing occur on the reverse stroke of the carrier, it is necessay that the shifting lever 243 be swung in counterclockwise direction about the pivot pin 235 in order to swing the impression roller 240 downwardly into printing position; in order that this occur, it is necessary that the end of the master print control lever 308 be struck by the shifting lever 243 on the forward stroke, on one side of the carrier of the lower printing unit and that the print control lever 250 which is parallel to the lever 308 be likewise struck by the shifting lever 243 at the left side of the carrier in the forward stroke. Due to the rigid interconnection in parallelism of the print control lever 250 and the master print control lever 308 by the cross shaft 307, it will be necessary only to describe the cooperation of the shifting lever 243 at the right side of the carrier with the master print control lever 308 because the cooperation of the shifting lever 243 at the opposite side of the carrier with the print control lever 250 will be identical and will occur simultaneously, as will clearly appear.

By the above structure, three conditions of operation may be achieved: first, the shifting lever 243 may be prevented from contacting the master print control lever 308, second, the shifting lever 243 may contact the master control lever 308 on every reciprocation of the carrier, and third, the shifting lever 243 may contact the master print control lever 308 and be shifted by it on every second reciprocation. When the latching control member 315 is rotated in clockwise direction from the position of Figures 17 to that of Figure 16, the lever 311 has its forward edge engaged by the latch pin 316, whereby the lever 311 and the cross shaft 307, along with the master print control lever 308 and print control lever 250 are all swung in counterclockwise direction into the position shown in Figure 16 wherein the levers 308 and 250 are swung below the operative path of the shifting lever 243. When the parts are in this position, no printing whatsoever will occur and the same will hold true where the latch lever 314 is free of the latch 325, because when the latch pin 316 is in engagement with the forward edge of the lever 311, the roller 310 on the lever 308 is latched out of the path of the cam member 323*b*. When the latching control member is in the position shown in Figure 17 with the latch pin 316 removed from contact with lever 311, the latch lever 314 is held in upward, substantially horizontal position by the latch 325.

The master print control lever 308 which is integrally connected to the latch lever 314 by the shaft 313 is likewise held in upward substantially horizontal position and upon each traverse of the carrier the shifting lever 243 will be engaged and swung by the master print control lever 308. Printing will then occur upon each reciprocation of the carrier. When the parts are in the position shown in Figure 18, the carrier moving forward will cause engagement of the roller 251 with the upper arm of the actuator 317, as shown in Figure 19. The position of parts upon the initial engagement of the roller 251 with this arm of the actuator 317 is shown in Figure 19. Upon further movement of the carrier, the arm of the actuator 317 is swung forwardly of the machine to the position shown in Figure 20. The shifting lever 243 has come in contact with no part whatsoever and the position thereof is therefore unchanged. On the rearward stroke of the carrier, no printing will occur because the impression roller 240 remains swung in its upward position. As soon as the rearward stroke of the carrier begins, the actuator 317 is swung toward the rear of the machine by the spring 321. The pawls 312 and 320 will cause the ratchet member 323*a* to be rotated in the direction in which the actuator 317 is swung, namely, in counterclockwise direction as shown in Figure 19 and in clockwise direction as shown in Figure 20.

At the beginning of the above-mentioned rearward swinging movement of the actuator 317, the roller 310 on the master print control lever 308 is engaged with a high part of the cam member 323*b*. At the end of this rearward movement, the cam member 323*b* will be rotated sufficiently to present a low part or surface to the roller 310. The master print control lever 308 will then be in the position shown in Figure 21. When the carrier makes its second forward stroke, the shifting lever 243 is swung backwardly or in clockwise direction in order to cause printing on the reverse stroke and simultaneously the roller 251 engages the upper arm of the actuator 317 to swing it toward the front of the machine. When the carrier moves back on its rearward stroke, the actuator 317 again rotates the cam member 323*b* so that from the position of parts shown in Figure 21, wherein a low part of the cam member 323*b* is presented to the roller 310, the cam member 323*b* is moved back to the position of Figure 19, having been rotated by the rearward swinging movement of the actuator 317 just sufficiently to present a high part of the cam member 323*b* to the roller 310. On the next forward reciprocatory movement of the carrier, the roller 251 will engage the actuator 317, but as the shifting lever 243 will not have its position changed, there will be no printing, although the cam member 323*b* will be rotated sufficiently to present a low portion thereof to the roller 310, whereby on the next succeeding forward reciprocation of the carrier, the shifting lever 243 will be engaged with the master print control lever 308. The cycle of operation is thus continuous. This comprises the master print control mechanism whereby the printing is controlled in the lower printing unit.

Printing Control for Second and Superposed Printing Units

(Figs. 9 to 21)

Each of the printing units, above the first printing unit, is provided with a pair of print control levers 250 which are integrally supported by a cross shaft 330, which is similar to the cross shaft 307, and which is rotatably journaled at each end in a side plate 151. To the right side plate of each unit is attached a bracket 331 providing a journal for the right end of the cross

shaft 330 and provided with an upper inturned flange 331*a* provided with a guide aperture for a connector pin 306 and with a lower inturned flange 331*b* which is adapted to limit the counterclockwise rotation of the cross shaft 330 by limiting the downward swing of the print control lever 250 at the right of the unit. Each of the print control levers 250 is provided with a boss or cam 250*a* at the rear of and adjacent the pivot point of the lever. A similar boss or cam is provided on the top edge of the master print control lever 308. The print control connector pin 306 which connects the master print control lever 308 with the righthand print control lever 250 of the second printing unit extends through the bore or aperture in the flange 305*a* of the frame 305, has its lower end in abutment with the boss or cam 308*d* and also extends through a suitable guide bore or aperture in the roof plate 161 and has its upper end in contact with the lower boss or cam 250*a* of the righthand print control lever 250 in the second printing unit. The connector pin 306 which connects the righthand print control lever 250 with the righthand print control lever 250 of the third printing unit has its lower end in contact with the upper boss or cam 250*a* of the righthand print control lever 250 in the second printing unit and extends upwardly through the guide bore or aperture in the flange 331*a* of the bracket 331, through a suitable aperture in the roof plate 161 of the second printing unit and upwardly to engage at its upper end the lower boss or cam 250*a* of the righthand print control lever 250 of the third printing unit.

If further units are superposed one upon the other, the same means will be used for interconnection of the print control levers 250 with one another and with the master print control lever 308 of the first printing unit. It will thus be seen that the respective print control levers 250 of each of the printing units B will take the same position with respect to the carriers in the respective units, as is taken by the master print control lever 308. The print control connector pins 306 provide the only operative connection between the lower printing unit and the superposed printing units, other than the drive connection provided in the gear train described above.

Web Separator

(Figs. 1, 2, 3, 5, 7, 8, 31 and 35)

The web separator comprises a pair of bracket members 333 attached in spaced relation at opposite sides of the rear edge of the table E, between which brackets are removably mounted two separating members 334 in vertical spaced relation with respect to one another. In threading the webs into the respective units of the machine, as described above, the webs, particularly if fanfolded, are placed between the legs F of the machine, and the topmost of the webs is engaged directly with the rear edge of the aligner support plate 4 and then drawn about the roller 17 of the aligner. The second web is drawn out about the lower separator member 334 and then in between the two separator members 334 and thence about the roller 18 of the aligner. The lower of the webs is drawn out beyond both of the separator members 334 and then drawn inwardly over the top separator member 334 and then around the roller 19 of the aligner. From the aligner, as shown particularly in Figure 13, the first or topmost web passes under the front guide roll 10 of the aligner. The second web passes thence under the front guide roll 11 and the third under the front guide roll 12 (Figure 6), and thence to the respective printing units, as pointed out above.

Web Delivery Guide

(Figures 1, 2, 3 and 5)

The web delivery guide means comprises a pair of pivot brackets 335 rigidly secured in transverse spaced relation to the table E adjacent the forward or delivery end of the machine. A pivot bar 336 is journaled in the brackets 335. Transverse movement of the pivot bar 336 in the brackets 335 is prevented by the collars 337 which are rigidly secured on the pivot bar 336 at opposite sides of one of the brackets 335. Rigidly secured to the extreme ends of the pivot bar 336 outside the brackets 335 are supports 338 which are parallel to one another and each of which is provided with arcuate notches 338*a* disposed in spaced relation at their top ends. These notches are adapted for engagement with the pivot bar 177*a* which is substituted, in the top printing unit, for the pivot pins 177 which would ordinarily be secured in the aperture therein if further printing units were pivoted thereabove. When it is desired to open the carrier, the pivot bar 177*a* is engaged with the topmost arcuate notch 338*a* after the top unit has been unlatched from and swung upward from the next lower printing unit. The second printing unit may be unlatched from and swung upwardly from the printing unit therebelow and again latched in raised position to the top printing unit which is secured by means of the pivot bar 177*a* to the supports 338.

For the purpose of securing access to the next lower printing unit, it will be desirable to then swing the two raised printing units further upwardly and engage the second notch 338*a* and then unlatch the next printing unit B from the base frame A and swing it upward into engagement with the raised units and latch it therewith. This affords utmost access to the lower printing unit B. The web delivery guide therefore performs a dual function, inasmuch as it also provides a support for the printing units when in raised position. Upon swinging the printing units in the above described manner, the engagement of the pivot bar 177*a* with the notches 338*a* may be made to take place automatically because of the tension spring 339 which is attached at one end to one of the supports 338 and at the other end to the table E. The swinging movement of the supports 338 toward the machine is limited by a stop member in the form of a pivoted lever 340 which has suitable notches therein to be engaged with the rear edge of one of the supports 338, when desired.

Adjacent the top part of each support 338 is rigidly attached an inwardly directed bracket 341, the bottom portions of which are connected by means of the brace plate 342 which is rigidly attached at each end to one of the brackets 341. This means provides for rigidity and retains the supports 338 always in parallelism. Rotatably supported in vertical alignment are two guide roller shafts 343 and 344 which are spaced from one another and which have their ends rotatably journaled in the rearwardly extending inward flange of the brackets 341. These shafts carry edge guide rollers 345 which are mounted for rotation with and adjustment axially of the shafts 343 and 344. Below the shaft 344 and slightly forward thereof is the pivot support shaft 346 which is likewise journaled at each end in a bracket 341. Rigidly secured to this pivot support shaft 346, adjacent the inward rearwardly

disposed flange of each bracket 341, is a rigidly attached arm 347. The arms 347 at their top ends provide journals for the rotatably mounted shaft 348 which has mounted thereon a pair of rollers 349 which are similar to the rollers 345 and which are axially adjustable on the shaft 348 and rotatable therewith. On each bracket 341 is secured by means of a screw 351 a clamping spring 350, each of which has an inwardly disposed rearwardly directed flange which is adapted to engage the forward edge of an arm 347, whereby to swing the rollers 349 toward and between the rollers 345 at each end of the delivery guide means.

The shafts 343 and 344 are connected by suitable means at one end thereof (not shown) to rotate together, in the same direction and at the same speed, and the shaft 343 is provided at one end (the left, as shown in Figure 5) with a pulley adapted to be drivingly connected by means of spring belt 352 with a pulley 150*d*, which is secured to the shaft 150 of the topmost printing unit to rotate with said shaft. The shaft 150 and pulley 150*d* rotate in clockwise direction, during operation of the machine, as seen from the left, as for instance, Figures 10 to 13 inclusive. By means of the above-described connections, the guide rollers 345 also rotate in the same direction, while the rollers 349 are spring pressed thereagainst but are freely rotatable due to the free rotation of the shaft 348 which supports these rollers 349.

When the machine is loaded, the members 350 are swung out of engagement with the arms 347 and the rollers 349 swung forwardly out of engagement with the rollers 345. The web extending from the lowest printing unit is drawn through the aperture between the rollers 345 and between the shafts 348 and 344. The rollers 349 are then swung upwardly and locked in position by the members 350, whereby the web from the lowest printing unit is supported by the paired rollers 349 of the shaft 348 and 345 of the shaft 344. The web from the second lowest printing unit is drawn over the guide rollers 345 of the shaft 343 and merely rests thereon, being freely supported thereby. During operation of the machine, the web from the lowest printing unit is securely clamped between the rotating rollers 345 of the shaft 344 and the freely rotatable rollers 349 of the shaft 348. The web from the third printing unit merely extends over the web of the second printing unit and is prevented thereby from contact with the rollers 345 or 349.

Stacking Means

(Figs. 1, 2, 39, 40 and 41)

When superposed fan-folded webs of paper are fed to the machine and printed therein, it is desirable that means be provided for returning the webs to their superposed stacked form after they have issued from the machine. While various means might be employed, I have illustrated one such means which is operated by the machine simultaneously during operation thereof. The stacker proper comprises the base plate 354 having a pair of longitudinally disposed laterally spaced adjusting slots 354*a* therein. Rigidly attached to the rear of the base plate 354 is the rear guide standard 355. The forward edge of this standard 355 is flat and disposed vertically with respect to the top of the base plate 354. This standard 355 is provided with side flanges 355*a* extending rearwardly from the front of the standard, which are connected at their bottom edges by the rearwardly extending flange 355*b* which is horizontally disposed and which extends rearwardly from the bottom edge of the front of the standard. A front guide standard 356 having a flat vertical inwardly or rearwardly disposed face and, being flanged in the same manner as the member 355, is adjustably connected to the base plate 354 by means of screws 357 extending from the bottom of the base plate 354 upwardly through the slots 354*a* and through suitably spaced circular apertures in the bottom flange of the forward guide standards 356. The screws 357 cooperate with wing nuts 358 to clamp the front guide standard 356 in desired spaced relation on the base plate 354 with respect to the rear guide standard 355. A suitable brace rod 359 is pivotally attached at one end to the rear guide standard 355 and has its forward end extending through a suitably apertured boss 360 on the front guide standard 356 to which it may be adjustably secured in rigid manner by means of the adjusting screw 361 which has a head provided with wings for ease of adjustment. The brace rod 359 may be graduated for ease of adjustment of the front guide standard 356 with respect to the rear guide standard 355 in order to facilitate adjustment of the stacker to accommodate webs having fan-folds of various lengths.

Rigidly secured to the rear of the rear guide standard 355 is a pair of horizontally aligned brackets 362 in which is journaled the shaft 363. The shaft 363 carries at its right end, outside the righthand flange 355*a*, an arm 364 which is rigidly attached thereto and provided with a slot 364*a* extending lengthwise thereof from the front edge thereof and terminating in an arcuate surface. A similar arm 364 is rigidly attached to the shaft 363 at the left, adjacent, and outside the lefthand flange 355*a*. Forwardly extending brackets 366, similar to the brackets 362, are secured in like manner on the front guide standard 356 and in horizontal alignment with the brackets 362. The brackets 366 have journaled therein a shaft 367 which is similar to the shaft 363 and which carries a second pair of arms 364 provided with slots 364*a* which are oppositely disposed and secured to the shaft 367 at each end of the shaft outside the side flanges of the front guide standard 356. The shaft 363 has rigidly secured thereto at the left of the lefthand arm 364 a lever 368, while a similar lever 369 is rigidly attached at the left end of the shaft 367 and disposed in alignment with the lever 368. The lever 369 extends downwardly or in substantially opposite direction from the lever 368. The ends of the levers 368 and 369 are connected by means of an adjustable link 370 whereby upward swinging movement of the arms 364 on the shaft 363 will occur simultaneously with upward swinging movement of the arms 364 on the shaft 367.

The transversely disposed shaft 371 having thereon rotatable rollers 372 is disposed transversely of the stacker with the rollers 372 each engaging a slot 364*a* of the respective arms 364 of the shaft 363. A similar shaft 373 is likewise disposed with the rotatable rollers 374 thereof in engagement with the slots 364*a* of the arms 364 of the shaft 367. At each end of the shaft 371 is rigidly attached a substantially vertical rod 375 which extends downwardly therefrom and which is guided for substantially vertical reciprocatory movement by a pair of suitably apertured brackets 376 rigidly attached to each of the side flanges of the rear guide standard 355 and in superposed aligned position. A rod 377, similar to the

rods 375, is rigidly attached to each end of the shaft 373 and guided by apertured brackets 376, similar to the brackets 376, for vertical reciprocatory movement.

Between each of the rods 375, at the bottom portion thereof, is disposed a packer member 380 of flat form bent up into U-sectional shape which has the legs thereof extending upwardly parallel to and adjacent the rods 375. The upper end of each of the legs of the member 380 is provided with an outwardly disposed boss 380a which is suitably apertured to receive a rod 375. Each boss 380a is also provided with a set screw 381 by means of which the friction between the aperture in the boss 380a and the rod 375 may be adjusted. The portion of the member 380 which connects the lower ends of the legs thereof is disposed substantially parallel to the base plate 354 and between the two guide standards. A nut 375a is threaded on the lower end of each rod 375. A packer member 380 similar to the packer member 380 attached to rods 375 and having thereon bosses 380a, similar to the bosses 380a on the other rods 375, provided with apertures for receiving the rods 377 and screws 381 similar to the above-mentioned screws 381 is provided for equipping the reciprocatory rods 377 in similar manner to the rods 375. The lower end of each rod 377 is provided with a nut 377a screw-threaded thereon in a manner similar to the nuts 375a screw-threaded on the rods 375.

To the left of the lever 368 on the shaft 363 is rigidly secured an actuating lever 382 having a headed pin 383 at the forward end thereof. A detachable web guide is provided for attachment to the rear guide standard 355 which comprises a longitudinally extending member 384 provided with a rear clamp portion 384a adapted to cooperate with a screw 385 for attachment to the upper end of the rear guide standard 355. The member 384 has rigidly attached at the front end thereof a transverse bar 386, to which is slidably secured a pair of web side guides 387 which are adapted, by slidably engaging the sides of the webs, to retain the webs in transverse alignment with respect to the stacker.

The rear guide standard 355 is provided with a pair of rearwardly disposed brackets 388 which are adapted to engage a part of the machine frame, a shown in Figures 1 and 2. A counterbalance spring 389 is provided which is attached at one end to the shaft 367 and at the other end to a bracket 356. As will clearly appear, when the lever 382 is swung upwardly or in clockwise direction, the rods 375 and 377 will be raised, thus raising the packer members 380. This is made to occur at suitable intervals so that when the rods 375 and 377 descend, the packer members 380 will descend upon the respective ends of the folded webs adjacent the folds therein. As the amount of web stacked or packed increases, the bosses 380a will move axially upwardly of the respective rods 375 and 377 due to the fact that their attachment to the rods is merely frictional. The friction may be properly adjusted by means of the screws 381. The means for periodically swinging the lever 382 upwardly or in clockwise direction comprises the connector link 390 which is attached at its lower end to the lever 382 by means of a keyhole slot 390a for the purpose of easy detachment and attachment thereof. The opposite end of the connector link 390 is pivotally attached at the forward end of the bell crank lever 391 which is pivotally attached at one side of the base of the machine and which has the other arm thereof pivotally attached to a link 392. The link 392 has the opposite or rearward end thereof pivotally attached to a swinging plate member 393 which is pivotally attached at the lower part thereof at one side of the machine frame and which is provided with a roller 394 which is adapted to be engaged by the lower lefthand pitman 182 of the machine on the rearward stroke of the carrier whereby to swing the swinging plate member 393 in clockwise direction or to the rear and through the link 392, bell crank 391 and connector link 390 to cause the packing members to be drawn upwardly. When the carrier moves forwardly in the machine, the packer members 380 are released and allowed to fall upon the end folded portions of the webs in the stacker.

Modified Carrier Construction

(Figs. 28, 29 and 30)

As an alternative form of means whereby the reciprocating carrier may grasp the web to feed it through the machine, I have provided, as illustrated in Figures 28, 29 and 30, means comprising pins 400 disposed radially of the bar 196 of the carrier and spaced axially therealong. These pins 400 cooperate with a groove 401 which extends axially of the bar 402 and in the bottom face thereof. The bar 402 is supported by a pair of arms 405 which are adapted to be connected to the pins 201a on the free ends of the levers 201 in the same manner in which the supporting links 205 (now removed) were connected. An extension 404 of the bar 402 extends transversely outwardly from the outer sides of each of the arms 405. The web support plate 194 has been removed along with the links 205 and supported parts. Secured to the top edge of each side member 185 is a guide member 406 having therein a straight guide slot 407 which is adapted to receive one of the extensions 404 of the bar 402 when the lever 199 of the bar 196 is tilted from the upright position. When the lever 199 is in upright position, the pins are tilted from the vertical in a direction forwardly of the carrier. The web is then free of the carrier. When the lever 199 is tilted or swung toward the rear of the carrier, the pins 400 are substantially vertically disposed.

At the same time that the pins are moving from their forwardly inclined position to their vertical position, the shaft 200 is rocked rearwardly and the arms 405 are swung rearwardly whereby the extensions 404 of the bar 402 engage the slots 407 in the cam members 406 and ride therein whereby, the bar 402 is brought into close engagement with the bar 196 whereby the web is impaled on the pins 400 and held in that position during the feeding portion of the forward reciprocation of the carrier. The means for releasing this mechanism, as well as the other unmentioned mechanism of the carrier, is the same as that described in detail hereinabove.

Loading

(Figs. 6, 11, 13, 31 and 35)

In loading the machine, the aligner is slid out to its extreme position. The paper webs are threaded through the separating means 333, 334 and then through the aligner, as shown, for instance, in Figure 31. All printing units B are swung into upward or open position (see Figure 35), exposing the lower part of the lower print-

ing unit B. The first web is threaded through the lower printing unit, the bottom portion of which is exposed.

This is accomplished by releasing the web clamping mechanism by pushing the link 273 forward until the block 294 engages the keeper notch 295a and the parts are locked in the position of Figure 11. The web is then inserted and threaded between web supporting roller 260 and clamps 261 over web support plate 194 and between guide plate 187 and clasping roller 206, under the impression roller 240 and over the web supporting shaft 227 where the edges are supported by the edge support roller 228 and the portion therebetween is supported by the non-smear rollers 230; the web is then threaded between the web drive rollers 270 and the web compression roller 280, the web supporting clamps 277a being lowered below the upper peripheries of the web drive rollers 270, as shown in Figure 11, and thus out of web supporting position.

The first or lower printing unit B is then brought down into closed position and locked on the base unit A, the other units B being swung upwardly to expose the lower part of the second lowest or the lowest of the units B.

The second web is threaded through the second lowest printing unit B in the same manner as the first web was threaded through the first printing unit B, the path of this web through the second printing unit and the procedure followed in so threading it therethrough being the same as that followed in threading the first web through the first printing unit B.

The second printing unit B is then brought down into closed position and locked on the first printing unit B, the remaining unit or units being swung upward into open position to expose the lower surface of the lowest open or raised unit B.

The threading is continued until all the webs are threaded through the respective printing units B. The clamping mechanism is now in released position and the webs threaded through the respective units.

Aligning and Clamping the Webs

(Figs. 6, 13, 31 and 34)

When superposed webs, and particularly preprocessed fan-folded superposed webs, are used in the machine, it is necessary to so adjust the webs in the respective printing units that they issue from the machine in superposed registering relation. This requires that the perforations, serrations or folds be adjusted, in the respective printing units, to the same position and locked in that position. When the paper used has not been preprocessed, indicia such as marks, slits or the like may be applied to the superposed webs before they are threaded into the aligner and into the respective printing units.

In aligning the respective webs in proper position for issuance from the machine in the same relative superposed position in which they are supplied to the machine, a number of procedures may be followed, but a preferable and most convenient method has been evolved and practiced by me, which is practiced as follows: with the machine so positioned that the carriers are in their rearward position and the clamping mechanism released, the gauging member 303 is positioned on one of the printing units with its long arm extending inwardly of the machine and the notch 303a in engagement with the next forwardmost screw 165 at the right side of the unit, see Figure 34. The web is then manually pulled through the particular unit until the perforations, folds, serrations, or other indicia are in a predetermined position with respect to the gauging member 303. The clamping mechanism of that unit is then brought against the web by manually swinging the clamp locking cam 295 in a counterclockwise direction, whereby to release the block 294 from the keeper notch 295a and allow the link 273 to swing to the rear.

The gauging member 303 is then removed and placed in position on another printing unit, with which the above operations are carried out. After the web is aligned and clamped in this unit, the operation is continued with the remaining unit or units.

The webs are then properly aligned with respect to one another and clamped in the synchronized units of the machine.

The length of throw or feed of the web in each unit by the carrier therein is now adjusted by properly positioning the block 286 of each unit on the stationary bar 284 thereof, which stationary bar may be graduated in inches or other units and provided with indicia to facilitate the adjustment of the block 286 thereon.

The block 293 is then clamped in proper position on the link 273.

It is, of course, assumed that the clamping mechanism has been previously properly adjusted and that the inking mechanism has also been properly adjusted, however, in order to make this latter adjustment, it is merely necessary to adjust the screws 62 of the respective units during operation of the machine. Such adjustment, during operation, may be desired because the operator may see the effect of his adjustment upon the printed paper issuing from the machine.

Starting the Machine

(Figs. 3, 22, 23 and 24)

With the parts in the position of Figs. 3 and 24, the operator applies pressure to the flange 100b to swing the lever 100 from the position of Figs. 3 and 24 in clockwise direction until the projection 100a of this lever engages the notch 96a in the lever 96, which lever 96 is drawn in clockwise direction toward the lever 100 by the interconnecting spring 111 which is connected at one end to lever 100 and at the other end to lever 96. (Figure 22). Downward pressure is then applied to the flange 92b of the plate to hold the plate in down position with respect to lever 96 against the tension of spring 91. While the plate is thus held down, the operator swings the lever 90 in a counterclockwise direction, so that the notch 90a engages the transverse flange 92a of the plate 92 to hold it in down position, whereby it will not be engaged by the plate actuating hook 182d of the right pitman 182 of the lower printing unit B. The plugs *p* and *h* being properly secured in plug block Z, power may be supplied by actuation of a suitable switch (not shown) connected with the power wires. The above adjustment of the levers 90, 96 and 100 has caused the link 102 to be swung forward to close the switch 29; the webs threaded through the aligner in the aligning chamber of the base unit A open the circuit between wires 28 and 13a, whereby the solenoid is de-energized. The switch lever 29a is in upright or rearward position and the motor circuit is made continuous by the closed switch 29. The motor operates to cause rotation, through the gear train, of the shafts 150 and chain sprockets 153. The chains

154 then travel forward on the upper reach and then rearwardly on the lower reach. When the pintle members 182*a* travel in these reaches, they cause, through pitmen 182, the reciprocation of the carriers in the respective units.

SEQUENCE OF CARRIER OPERATIONS

(*Figs. 10 to 13*)

At the beginning of the operation of the machine by the prime mover, the parts are in the position shown in Figure 10, the web being clamped at the rear of the machine between web support roller 260 and the clamps 261 and at the front of the machine between support clamps 277 and web compression roller 280 out of contact with the web drive rollers 270; the clasping roller 206 is in its forward or released position; the lever 199 is in upright position. The counter actuating lever 68 is, by engaging the roller 78, retaining the thrust rod 77 of the counter in its foremost position against the tension of the spring 80. The lever 57 is in rearward position. As the pintle 182*a* moves into the top reach of the chain 154, the carrier moves forward in its trackway free of the unclamped web. The counter actuating lever 68 releases the counter mechanism and the roller 67 releases the lever 57. When, during this movement, the lever 199 engages the pawl 290, the lever 199 is swung backwardly and the bar 196 rocked backwardly; the pin 204 is placed in its rearmost position with respect to the pin retainer member 300. The clasping roller 206 moves into rearmost or clasping position to clamp the web in the carrier. Simultaneously the roller 192 has engaged and swung the cam lever 288 forwardly or in counterclockwise direction to engage the block 293, whereby to push the link 273 forward and release the web clamping means and free the web in the frame. The parts are now in the position shown in Figure 11.

Adjacent the extreme end of the forward travel, the shifting levers 243 are engaged and swung backwardly by the print control levers 250 or master print control lever 308 to swing the impression rollers 204 down into printing position, the screw 188*a* then strikes the lower cammed edge 295*b* of the clamp locking cam 295, raises it and releases the block 294 from the keeper notch 295*a* of the clamp locking cam 295. The pin 204, in its rearward position on the pin retainer member 300, has passed under the pin hook 302 which does not affect the position of parts 204 and 300 on the forward stroke which ends with the parts in the position shown in Figure 12. During this forward stroke, the lever 57 has remained in released position, as has the control operating mechanism. The above description has been made for operation where the print control levers 250 and master print control lever 308 remain in operative position to cause the machine to shift the impression lever 204 on every forward stroke. The modification of the operation under other conditions of adjustment of the print control mechanism will clearly appear from the above description of that mechanism.

From the position of parts of Figure 12, with the carrier in the extreme forward position, the web clamped, the beginning of rearward travel of the carrier in the trackway causes the pin hook 302 to draw the pin 204 forward of the end of the member 300 which retains it in this position; this releases the clasping roller 206 to free the carrier from the web. The travel continues with the impression roller 240 progressively pressing the web against the printing plate 42. The lever 199 passes the pawl 290 and the ink transfer rolls 211, having engaged the printing plate 42 on the forward travel of the carrier, likewise travel along the printing plate on the rear stroke of the carrier, followed by the impression roller 240 which is progressively bringing the web into contact with the face of the printing plate. Adjacent the extreme rearward travel of the carrier, the counter operating lever 68 engages the roller 78 and the roller 67 engages the lever 57 to rotate the ink roller 51 a predetermined amount and the rearward ink transfer roller 211 passes over the ink roller 51. The parts thence are returned to position shown in Figure 10, a complete operative cycle of the carrier having occurred.

If, for any reason, parts become jammed, or if a tool has been left in such position as to cause jamming, breakage and other damage is prevented by the opening of the overload clutch mechanism in the above described drive train as soon as the resistance to the drive becomes great enough to cause the clutch mechanism to open against the pressure of the spring 142.

From the machine, the webs issue to the stacker where they are restacked, if originally fan-folded, into original relation.

It is, of course, to be understood that where the sheets or webs are not fan-folded, the length of feed or throw of the respective units may be independently adjusted. In the event that the throw is made unequal, a single stacker may not be used, it being preferred to utilize a plurality of stackers properly synchronized and arranged preferably in tandem to receive and stack the respective webs. Likewise, the machine may be provided with other folding or arranging means, varying widely with the character and desired disposition of the webs.

It is also to be understood that a plurality of fan-folded webs having forms of different lengths may be simultaneously printed in the machine due to the provision of independent adjustment of the respective carrier throws; when this is done, it will, of course, be desirable to use separate fan-folded stacks and a plurality of suitably synchronized stackers in tandem.

The machine is further capable of use to combine a plurality of separate fan-folded stacks of paper into a single fan-folded stack comprised of interfolded superposed fan folded sheets, as is illustrated diagrammatically in Figure 36 of the drawings. Figures 1 and 2 illustrate the use of a single pack comprising superposed interfolded fan-folded webs or sheets, while Figure 36 diagrammatically illustrates the first-mentioned arrangement.

The machines are further capable of use in tandem for the purpose of printing forms on opposite sides of the respective sheets, as is diagrammatically illustrated in Figure 37 of the drawings. It is, of course, to be understood that the webs may be fed to the lower of the printing machines, illustrated in Figure 37 in the manner disclosed in Figures 1 and 2, or in the manner disclosed in Figure 36, and that a suitable arrangement of stackers with the upper of the printing machines, illustrated in Figure 37, is comprehended. Furthermore, the forms printed on one side of one or more of the webs or sheets may be of a different color from those printed on the other side of that sheet or on either of the sides

of the other sheets, as may be desired. The changing of the color of each of the forms is accomplished by changing the color of ink in the respective ink fountains in one or both of the machines. It is further to be understood that, with the arrangement of machines disclosed in Figure 37, the forms may be spaced as desired by suitable manipulation of the master print control of one and/or both of the machines. As shown in Figure 37, the machines are synchronized and driven from one of the motors, but it is to be understood, of course, that other driving arrangements may be used.

It is also contemplated that forms in different colors, or of different subject-matter, may be simultaneously printed on one side of one of or each of the respective webs, sheets or strips by an arrangement of two of the machines in tandem, as shown in Figure 38. The loop of paper between the machines is preferably of such length as to permit of drying of the printed matter printed by the first machine before the webs enter the second machine.

In doing vari-colored work, one of the machines may be supplied with ink of one color in either one or more of the respective units, while the other machine may be supplied with ink of contrasting color or colors in either one of or all of the respective printing units.

By suitable manipulation of the master print controls of the respective machines, the contrasting forms may be made to occur alternately or in any suitable sequence. Furthermore, by using forms in one of the machines having certain blank portions and forms in the other machine adapted to print only the blank portion in the form printed by the first mentioned machine, it is possible to vary, within a rather wide range, the finished form by suitably changing the second mentioned form or forms. It is likewise to be understood that a combination of the arrangements disclosed in Figure 37 and in Figure 38 is comprehended.

Likewise, when desired, printing on opposite sides of the sheets or webs may be accomplished by running the webs through and printing one side thereof, restacking the webs and then, in a second run, printing the sheets on the opposite sides, either in a single machine or in the tandem arrangement described above with regard to Figure 38.

While I have illustrated a machine comprising one base unit A and three hingedly connected and superposed printing units B, it is to be understood that, in order to accomplish the objects of my invention, and to achieve the advantages of the practice and principles thereof, it is possible, and in many cases desirable, that the machine comprise a single base unit A and a single printing unit B. It is further contemplated by me that the number of the superposed units B may be increased to correspondingly increase the capacity of the machine when, and if, desired. The aligner has been illustrated as equipped with aligning rollers for three webs but as constructed to accommodate a sufficient number of rollers to accommodate six webs, but as will clearly appear, this, as well as the other illustration and description, is intended to be and is to be considered as merely illustrative and in no wise limiting.

It will be understood that the above described structure is merely illustrative and that I desire to comprehend within my invention such modifications as come within the scope of the claims and the invention.

Having thus fully described my invention, what I claim as new and desire to secure by Letters Patent is:

1. In a printing machine, a base unit including an aligning chamber with an aligner slidably mounted therein and a printing plate support mounted thereon.

2. In a sheet printing machine, a base unit including sheet aligning means, a printing plate support and a prime mover, and a printing unit hingedly connected to said base unit to provide free access to the mechanism of said units, a driving mechanism between said prime mover and printing unit, said prime mover being operatively connected to said printing unit through said pivotal connection whereby said driving mechanism is undisturbed by swinging the printing unit upwardly on the base unit for free access to both units.

3. In a printing machine including a plurality of superposed hingedly connected printing units, a unit frame having a pair of chambers separated by a roof plate, the lower of said chambers being adapted to support a carrier and the upper of said chambers having means adapted to support a printing plate for cooperation with the carrier of the next adjacent superposed unit.

4. In a printing machine including a plurality of superposed hingedly connected printing units, a unit frame having a pair of superposed chambers separated by a roof plate, the lower of said chambers being adapted to support a carrier including ink transfer means and the upper of said chambers having means adapted to support a printing plate and ink supply means for cooperation with the ink transfer means of the carrier of the next adjacent superposed unit.

5. In a printing machine including a plurality of superposed hingedly connected printing units, a unit frame having a pair of chambers separated by a roof plate, one of said chambers being adapted to support a reciprocatory carrier including ink transfer means and having therein means adapted to support a printing plate and ink supply means, said ink transfer means being adapted, during reciprocation of said carrier, to transfer ink from said ink supply means to said printing plate.

6. In a printing machine for paper strips, a base unit having a printing plate therein, a printing unit attached to said base unit, said printing unit having therein means to move a paper strip to be printed into proper position comprising a reciprocatory carriage adapted during reciprocation in one direction to move a paper strip relative to said printing plate to form a slack in said paper strip, and means associated with said carriage during reciprocation in the opposite direction to bring the strip in contact with the printing plate to print the paper strip.

7. In a printing machine for paper webs, a base unit having a printing plate therein, a printing unit superposed on said base unit and means to move a paper web into printing position comprising a reciprocatory carriage adapted during reciprocation in one direction to move a web with respect to said printing plate and means thereon adapted during reciprocation in the opposite direction to progressively bring said web into contact with said printing plate.

8. In a printing machine for printing forms in series on a web having a printing plate and means for clamping a web in spaced relation thereabove, means to ink said printing plate, a reciprocating carrier adapted when reciprocating

in one direction to cooperate with a clasping mechanism to clasp said web for movement thereof, means to release said clamping means to advance said web a form length while inking said printing plate, means to operate said clamping means at the end of said reciprocation, and means upon return reciprocation to engage said web with said printing plate.

9. In a printing machine for printing forms in series on a web having a printing plate and means for clamping a web in spaced relation thereabove, means to ink said printing plate, a reciprocating carrier having a clasping means thereon, said carrier being adapted when reciprocating in one direction to clasp said web for movement thereof, means to release said clamping means to advance said web a form length while inking said printing plate, means to operate said clamping means at the end of said reciprocation, and means upon return reciprocation to progressively engage said web with said printing plate to print a form thereon.

10. In a machine for printing forms in series on a web, a printing plate, and means for supporting a web in spaced relation to said printing plate, mechanism for detachably grasping said web, clamping means for intermittently clamping said web in fixed position, and a reciprocating carrier adapted to release said clamping means to move said web with respect to said printing plate, means to operate said clamping means, and means to engage said web with said printing plate.

11. In a machine for printing forms in series on a web, a printing plate, ink supply means, means for supporting a web in spaced relation to said printing plate, mechanism for detachably grasping said web, clamping means for intermittently clamping said web in fixed position and a reciprocating carrier adapted to release said clamping means and move said web with respect to said printing plate, means to simultaneously ink said printing plate and means to operate said clamping means to secure said web in fixed position and engage said web with said printing plate.

12. In a printing machine for printing forms in series on a web, an ink supply means, a printing plate, and a carrier adapted to reciprocate in opposite directions above said printing plate, means for intermittently engaging said web, said carrier being adapted to cooperate with said engaging means to move a web longitudinally of said plate while reciprocating in one direction, means to simultaneously transfer ink from said ink supply means to said printing plate and means adapted when reciprocating in the opposite direction to press said web against said inked printing plate progressively in a direction opposite to the direction of movement of the web.

13. In a printing machine having a plurality of printing units, each of said units including a type plate, ink supply means and means adapted to support a web to be printed and means to intermittently clamp said web in fixed position; a carrier adapted to reciprocate in opposite directions, means on said carrier for clasping a portion of the web to feed said web, means to ink said type plate and means to engage said web with said type plate.

14. In a printing machine having a plurality of printing units, each of said units including a type plate, ink supply means and means adapted to support a web to be printed and to intermittently clamp said web in fixed position; a carrier adapted to reciprocate in opposite directions to release said clamping means, means on said carrier for clasping a portion of the web to feed said web, means to simultaneously ink said type plate when traveling in one direction, means to operate said clamping means, and means to engage said web with said type plate while traveling in the opposite direction to print said web.

15. In a machine for simultaneously printing a plurality of webs, a plurality of printing units each having means adapted to simultaneously feed said webs and means for simultaneously printing said webs, and means for independently adjusting the length of feed in the respective units.

16. In a machine for simultaneously printing forms on a plurality of webs, a plurality of printing units each having a type plate, means for intermittently engaging said webs, a plurality of carrier units adapted to cooperate with said engaging means to simultaneously feed said webs with respect to said plates and means to ink said plates, means associated with each carrier to press its paper web on the inked plate for simultaneously printing said webs, and means for independently adjusting the inking means in each of said printing units, and a common driving means adapted to synchronously actuate said carriers in each unit to cause the feeding of the paper webs, the inking of the plates and the printing of the webs to occur simultaneously.

17. In a machine for simultaneously printing forms on a plurality of webs, a plurality of printing units each having a type plate, means comprising web clasping members adapted to simultaneously feed said webs in printing position with respect to said plate, means to ink said plate, means for simultaneously printing said webs, and means for independently adjusting the length of feed in the respective units and means for independently adjusting the plate inking means therein, and means for actuating said printing units simultaneously to cause a uniform movement of the paper webs and a simultaneous inking of the plates and printing of the webs one with respect to the other.

18. In a printing machine having a plurality of printing units, a printing plate and a carrier for each unit, means in each unit for engaging a web to be printed, said carriers being adapted to alternately cooperate with said web engaging means to feed said web a predetermined distance, a member associated therewith to move said web in contact with said printing plate, and means for independently adjusting the length of feed in each of said units.

19. In a printing machine having a plurality of printing units provided with a printing plate, means comprising a carrier in each unit adapted to cooperate with a web clasping means for alternately feeding a web a predetermined distance, and means associated therewith for engaging said web and moving it against said printing plate, independently adjustable plate inking means in each unit, and means for independently adjusting the length of feed in each of said units.

20. In a printing machine having means to support a web adjacent a type plate, a reciprocating carrier having means actuated by said carrier adapted to engage said web and carry the web during a portion of the reciprocation of said carrier, and means associated with said carrier to bring said web progressively into contact with said printing type plate.

21. In a printing machine having means to support a web adjacent a fixed type plate, a re-

ciprocating carrier having means responsive to the movement of said carrier adapted to engage said web and carry the web during a portion of the reciprocation of said carrier, and means associated with said carrier to bring said web progressively into contact with said printing type plate during a certain portion of said reciprocation.

22. In a printing machine having means to support a web adjacent a fixed printing plate, a reciprocating carrier adapted to reciprocate, means actuated by said carrier for periodically grasping and feeding said web a predetermined distance, and means to form a slack portion in said sheet and means to press said slackened sheet against said printing plate for a printing.

23. In a printing machine having means to support a web adjacent a printing plate, a reciprocating carrier adapted to periodically grasp and feed said web a predetermined distance, said carrier having interpenetrating means adapted to penetrate said web at the beginning of the feeding stroke and adapted to be disengaged from said web at the end of said feeding stroke, and means to form a slack portion in said sheet and means to press said slackened sheet against said printing plate for a printing.

24. In a printing machine having means to support a web adjacent a printing plate, a reciprocating carrier adapted to periodically grasp and feed said web a predetermined distance, said carrier having interpenetrating pins adapted to penetrate said web at the beginning of the feeding stroke and adapted to be disengaged from said web at the end of said stroke, means associated with said carrier to ink said plate while traveling in one direction with said carrier, and means to cause said paper web to engage said inked plate.

25. Means to combine separately stacked fanfolded webs while providing them with printed forms in series comprising means to feed said webs in spaced superposed relation, means to separate said webs, means to simultaneously feed each of said webs the same distance into printing position, means to simultaneously stop and maintain in printing position each of said webs, means to simultaneously print forms on each web after the feeding movement of the webs has ceased and while said webs are at rest, means to again guide said printed webs into close relation, and means to stack said printed webs into a single stack comprising interfolded superposed webs.

26. Means to provide a stack of superposed interfolded webs with printed forms in series comprising means to feed said webs in spaced relation, means to separate said webs, means to simultaneously feed each of said webs the same distance into printing position, means to simultaneously stop and maintain in printing position each of said webs, means to print forms on said webs during feeding, and means for restacking said printed webs into a single stack of interfolded superposed webs.

27. In a machine for printing forms in series on a plurality of webs, means for simultaneously feeding said webs, means for simultaneously printing forms on said webs, means for varying the intervals between the forms on the webs, and means for guiding and aligning said webs while passing through said machine.

28. In a machine for printing forms in series on a plurality of webs, means for simultaneously feeding said webs, means for independently varying the feeding length of each web, means for simultaneously printing forms on said webs, and adjustable means for varying the intervals between forms on each web in increments equal to the length of feed thereof.

29. In a machine for printing forms in series on a plurality of webs, means for simultaneously feeding said webs, adjustable means for independently varying the feeding length of each web, means for simultaneously printing forms on said webs, and means for varying the intervals between forms on each web in increments equal to the length of form thereon.

30. In a printing machine, a plurality of printing units each having web feeding means therein, means for operating said feeding means in unison, and means for selectively making the feeding means in one of said units inoperative independently of the operation of the feeding means in the other units of the machine.

31. In a printing machine including a plurality of units each having web feeding means therein, means for aligning webs in each of said units in superposed relation comprising a gauging member adapted to cooperate with each of said units to locate the respective webs therein during loading of the units of the machine.

32. In a printing machine, a plurality of superposed units, each of said units including means simultaneously operable to feed a web through the unit and means simultaneously operable to print the web in said unit.

33. In a printing machine, a plurality of superposed units, each of said units including means simultaneously operable to feed a web through the unit and means simultaneously operable to print the web in said unit and each of said units having means whereby the length of feed of the respective units may be independently adjusted.

34. In a printing machine, a plurality of superposed printing units, a prime mover and a gear train including overload means adapted to connect said prime mover with each of said units in driving relation.

35. In a printing machine having a flat type form, means for supporting a web above said type form, means for moving said web longitudinally of said form a predetermined distance with a slack formed in said sheet, and means engaging with said slack in the web for pressing the web against said type form progressively in a direction opposite the direction of feed, and means for holding the web at spaced intervals against movement during the operation of the pressing means operating between said holding means.

36. In a printing machine, means for supplying a plurality of paper webs in superimposed aligned spaced relationship, means for intermittently feeding said plurality of webs synchronously by increments of the same distance, means for simultaneously printing forms in series on said webs, and automatically operating means comprising a reciprocating member for simultaneously clamping said webs in stationary manner during the printing of forms thereon.

37. In a printing machine, means for supplying a plurality of paper webs in superimposed aligned spaced relationship, means to support said plurality of webs synchronously by increments of equal distances, means to feed said webs, means to clamp said webs in supported position, and means associated with said feeding means for automatically releasing said clamping means during operation of said feeding means.

38. In a printing machine, means for supplying a plurality of paper webs in superimposed

aligned spaced relationship, means to support said plurality of webs synchronously by increments of equal distances in superimposed relation, means to feed said webs, means to clamp said webs in supporting position, and means associated with said web feeding means for automatically releasing said clamping means during operation of said feeding means.

39. In a printing machine, means for supplying a plurality of paper webs in superimposed aligned spaced relationship, means to support said plurality of webs synchronously by increments of equal distances in superimposed relation, means to feed said webs, and means associated with said feeding means to automatically clamp said webs after the feeding thereof.

40. In a printing machine, means for supplying a plurality of paper webs in superimposed aligned spaced relationship, means to support said plurality of webs, clamping means adapted to clamp said sheets in supported position, means to feed said webs, means to simultaneously print forms thereon, and means adapted to automatically operate simultaneously said clamping means, during operation, to release simultaneously said webs upon operation of said feeding means and to clamp simultaneously said webs during operation of said printing means.

41. In a printing machine, means for supplying a plurality of paper webs in superimposed aligned spaced relationship, means to support said plurality of webs in superposed relation, clamping means adapted to clamp said sheets in supported position, means to feed said webs, means to simultaneously print forms thereon, and means adapted to automatically operate simultaneously said clamping means, during operation, to release said webs upon operation of said feeding means, and to clamp said webs in stationary manner during operation of said printing means.

42. In a printing machine, means to support a plurality of webs adjacent and out of contact with a plurality of printing plates, impression means comprising a cylinder, means for aligning said webs, means to feed said webs synchronously equal distances simultaneously, means to clamp said webs to form a loop between said impression cylinder and said aligning means, a single mechanism for each web cooperating with said web to feed said web, inking means for said printing plates, and means for engaging said webs with said ink printing plates.

43. In a printing machine, a base unit, a plurality of superimposed printing units pivotally mounted thereon and pivotally connected to one another so that they may be swung about the base unit to afford access to the parts of the respective units, each of said units comprising means for printing simultaneously its own web sheet.

44. In a printing machine, a base unit, a plurality of superimposed printing units pivotally mounted thereon and pivotally connected to one another, each of said units being adapted to print simultaneously its own paper sheet, and means comprising a drive train so situated and located in the respective units as to be undisturbed by the swinging of one or more of the respective printing units upwardly with respect to the supporting structure whereby to gain full view and access to the parts of the unit.

45. In a printing machine, a supporting base comprising a base unit, a plurality of superimposed printing units, means of supplying a continuous sheet of paper to each unit from a common aligned supply, means for feeding said independent sheets from the aligned supply through said respective printing units in synchronism, and means for delivering said independently printed sheets into a common aligned storage condition.

46. In a printing machine, a supporting base comprising a base unit, a plurality of superimposed printing units, means for supplying a continuous sheet of paper to each unit from a common aligned supply, means for feeding said independent sheets from the aligned supply through said respective printing units in synchronism, means for delivering said independently printed sheets into a common aligned storage condition, and means for independently inspecting and adjusting any one of said units without disturbing the remainder.

47. In a printing machine, means for supplying a plurality of superimposed continuous sheets in aligned condition, means for separating said sheets, a plurality of superimposed printing units hingedly connected to one another for independent operation and inspection of each unit, each unit being adapted to pass therethrough one of said sheets and to print thereon, a common synchronized driving means for causing the feeding and printing of similar sections of said sheets simultaneously, and means for feeding said sheets into assembled superimposed relationship whereby identical printed areas will be superimposed one upon the other.

48. In a printing machine, means to supply a plurality of superimposed continuous strips in collated condition, means to feed strips in superimposed separated condition, a common driving means for feeding said strips and printing said strips, means for printing each of said strips comprising means to advance the strips, ink a printing plate and cause said strips to be printed from said plate, and means to feed said strips step by step after each successive printing operation, and means to deliver said strips again into superimposed collated condition with each printing superimposed above the other in each group of printings.

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