E. E. STRAWN.

PROCESS AND MACHINE FOR PRINTING COMPLETE FORM LETTERS.

APPLICATION FILED JULY 29, 1920.

1,411,592.

Patented Apr. 4, 1922.

10 SHEETS—SHEET 1.

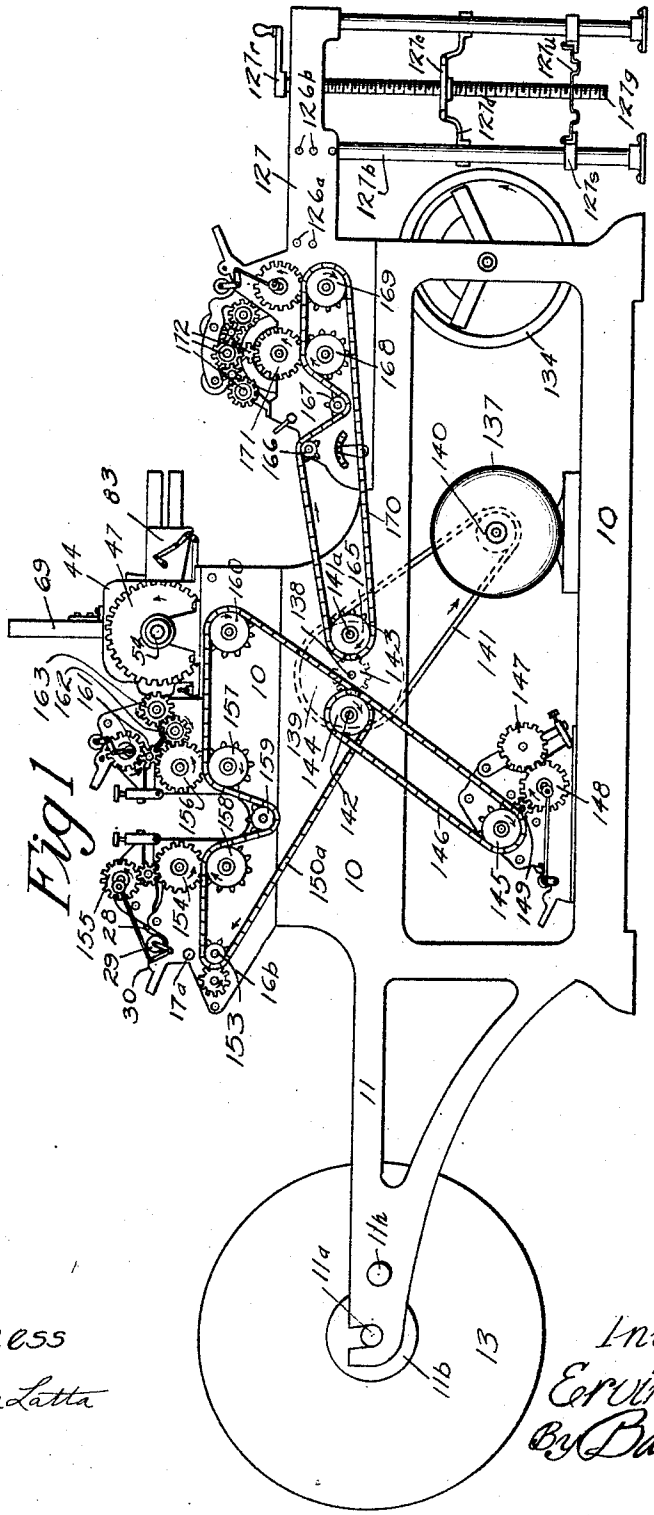


Fig 1

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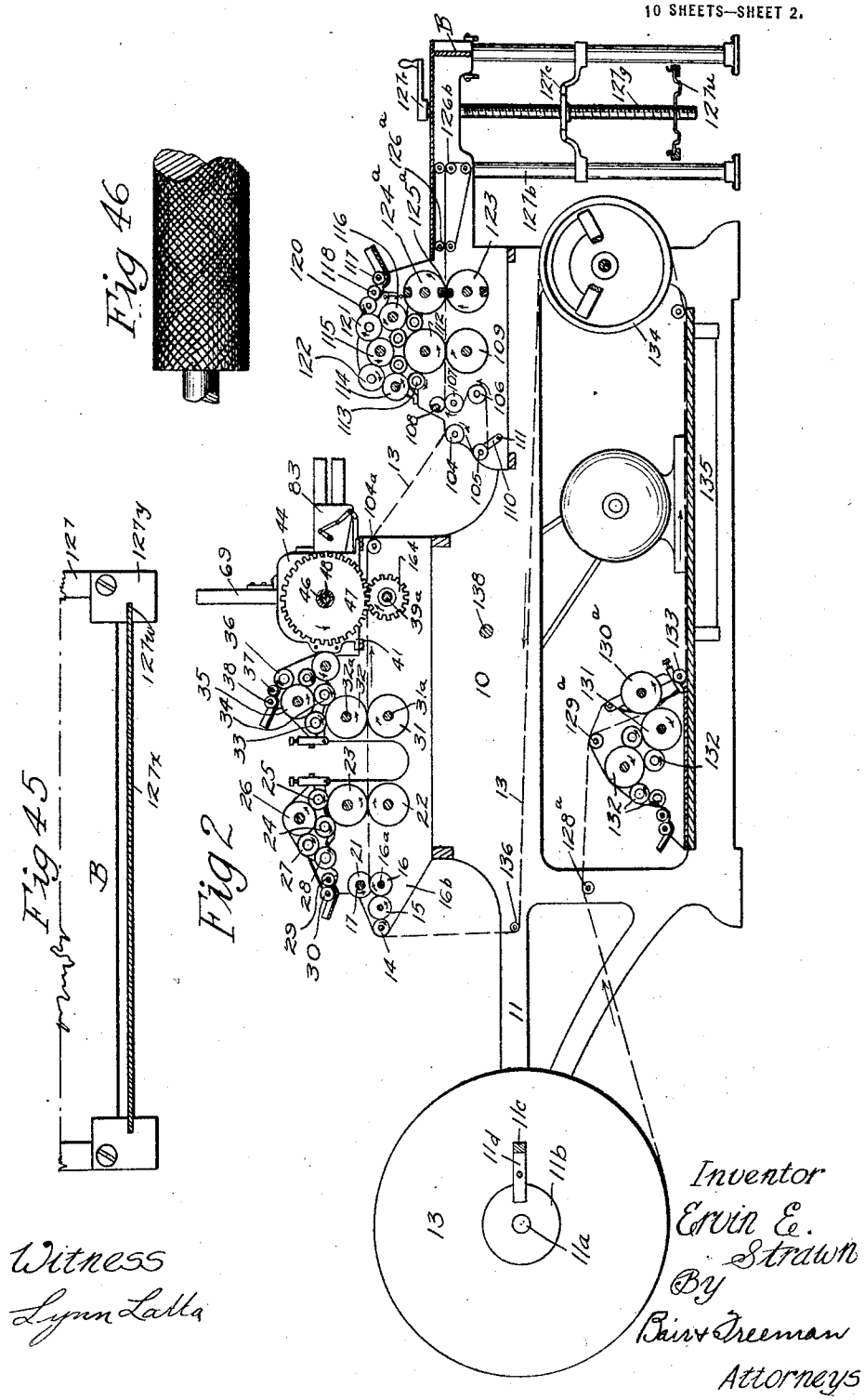


Fig 46

Fig 45

Fig 2

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Fig 3

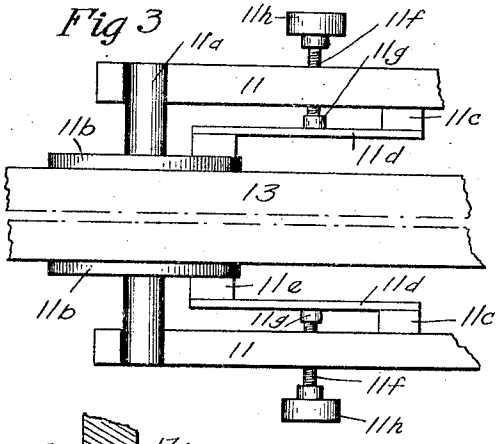


Fig 5

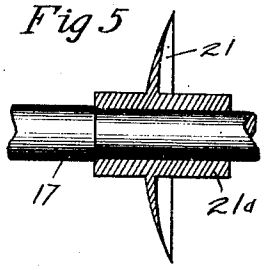


Fig 6

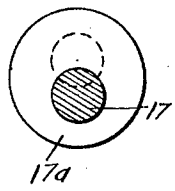


Fig 4

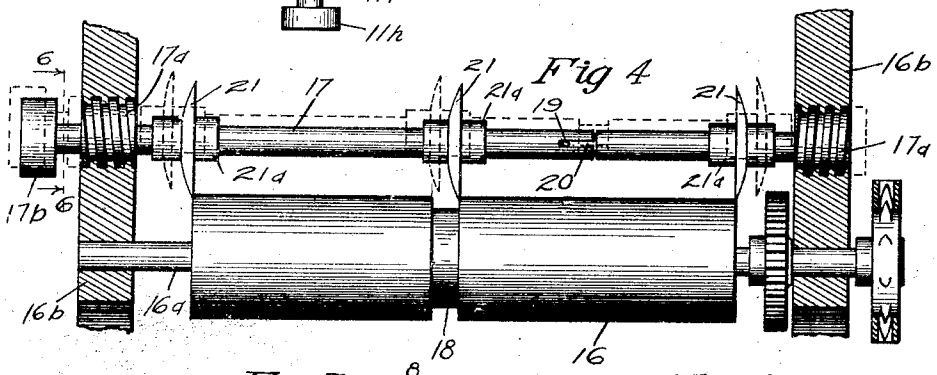


Fig 7

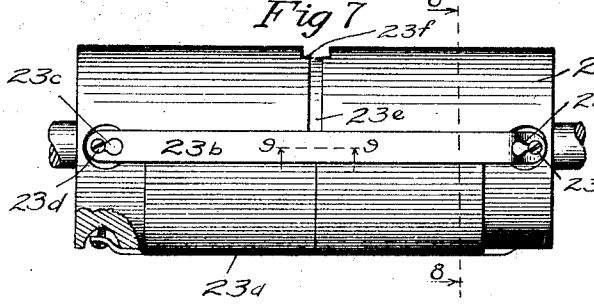


Fig 8

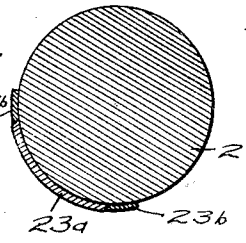


Fig 9

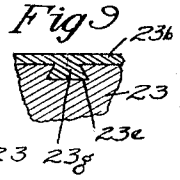


Fig 10

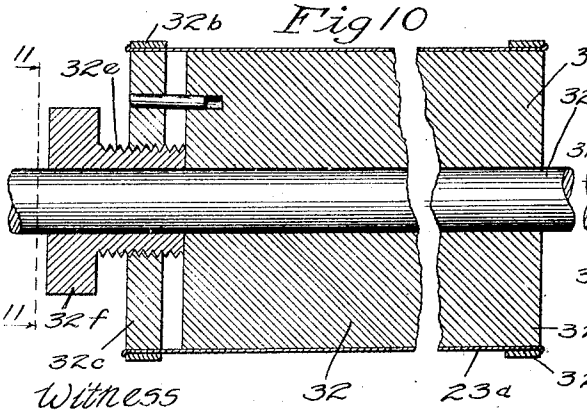


Fig 10a

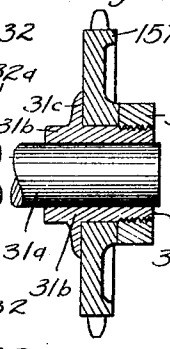
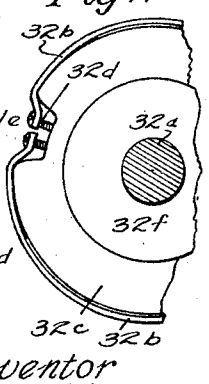


Fig 11



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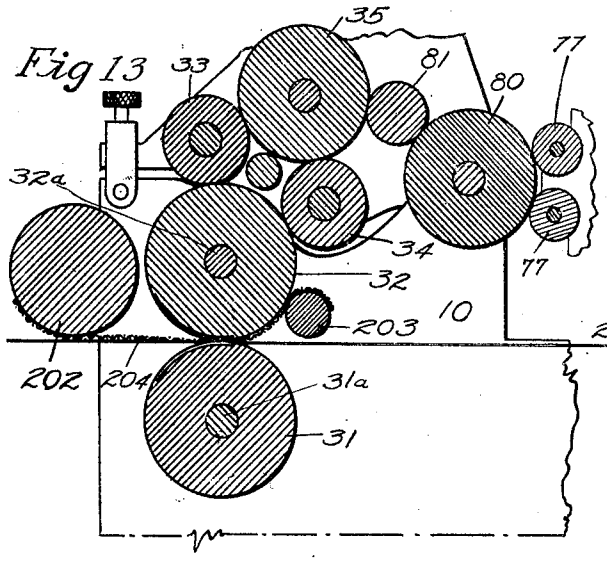
PROCESS AND MACHINE FOR PRINTING COMPLETE FORM LETTERS.

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10 SHEETS—SHEET 4.

Fig 13



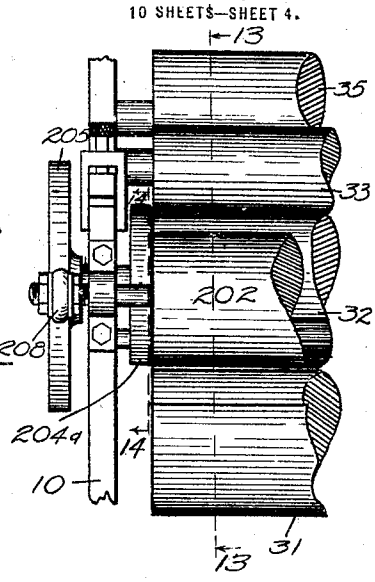


Fig 12

Fig 14

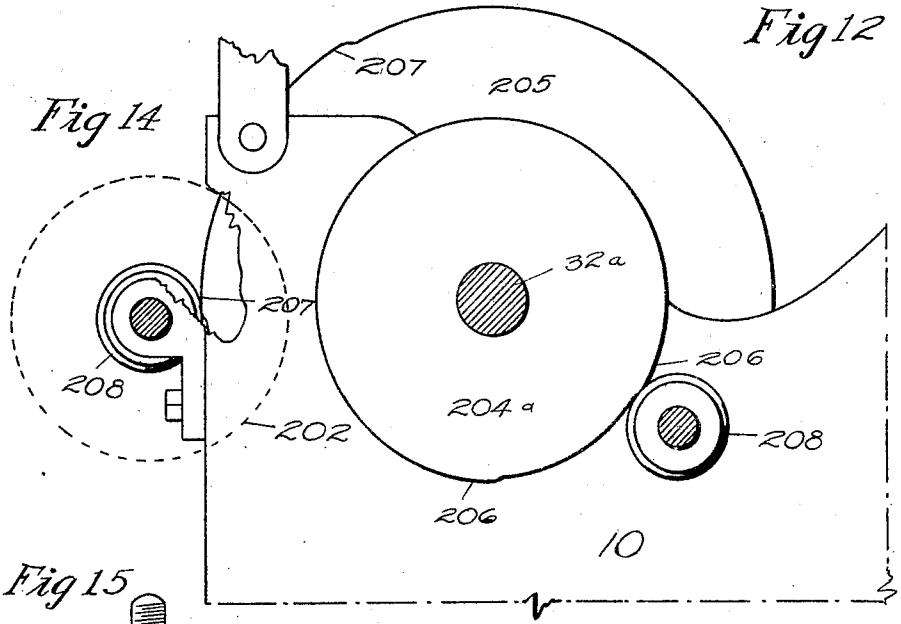
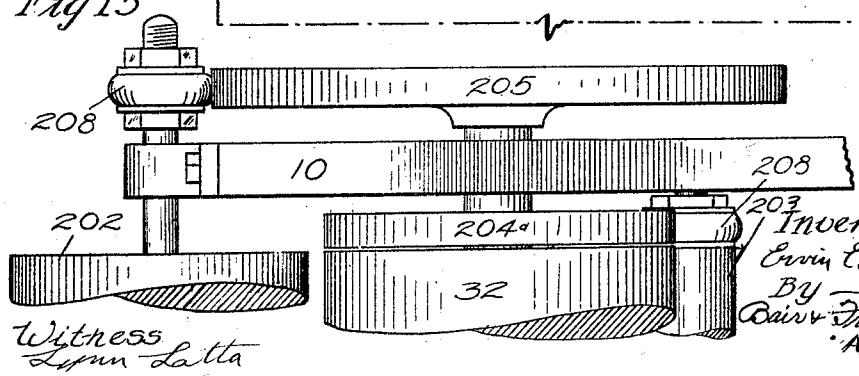


Fig 15



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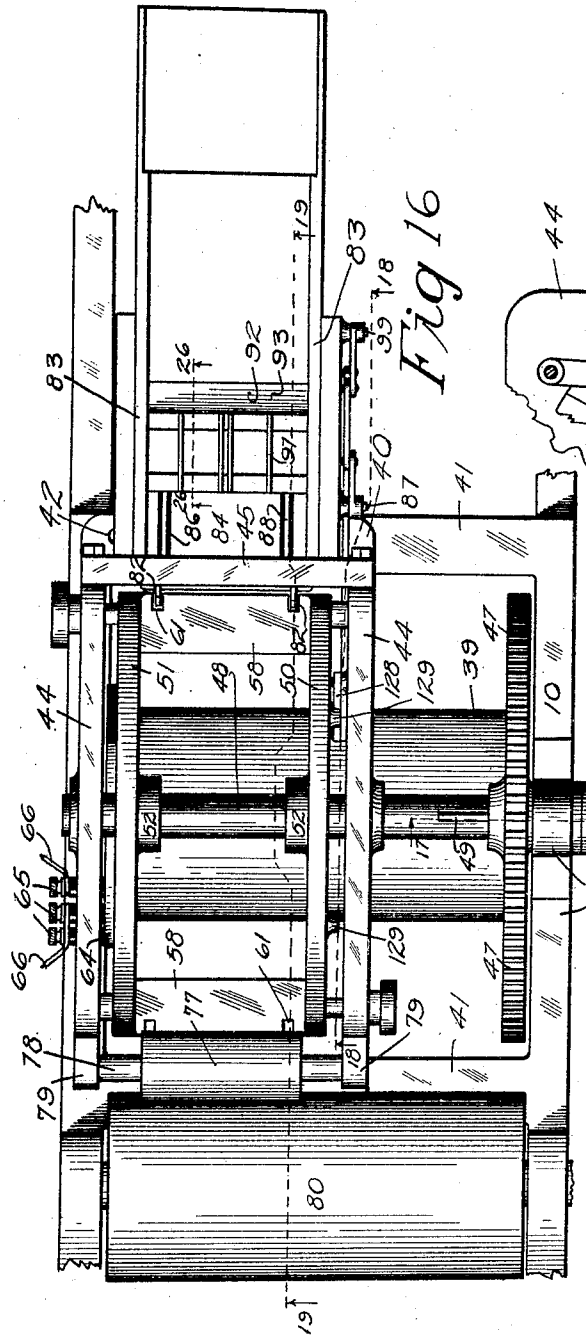


Fig 16

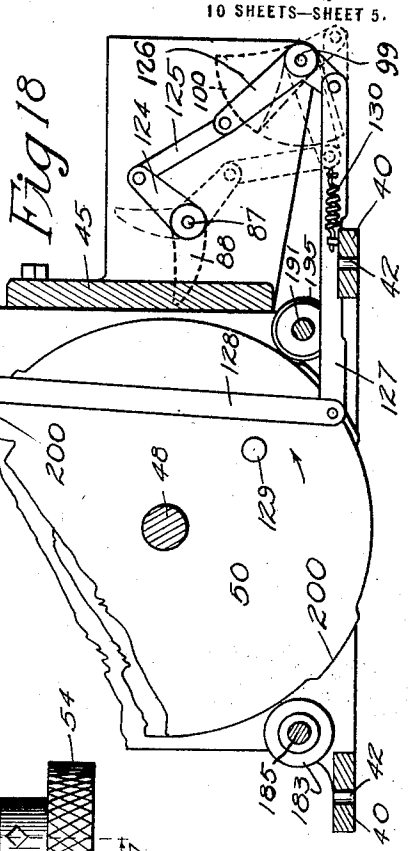


Fig 18

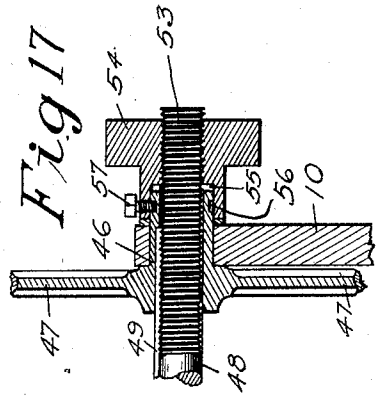


Fig 17

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10 SHEETS—SHEET 6.

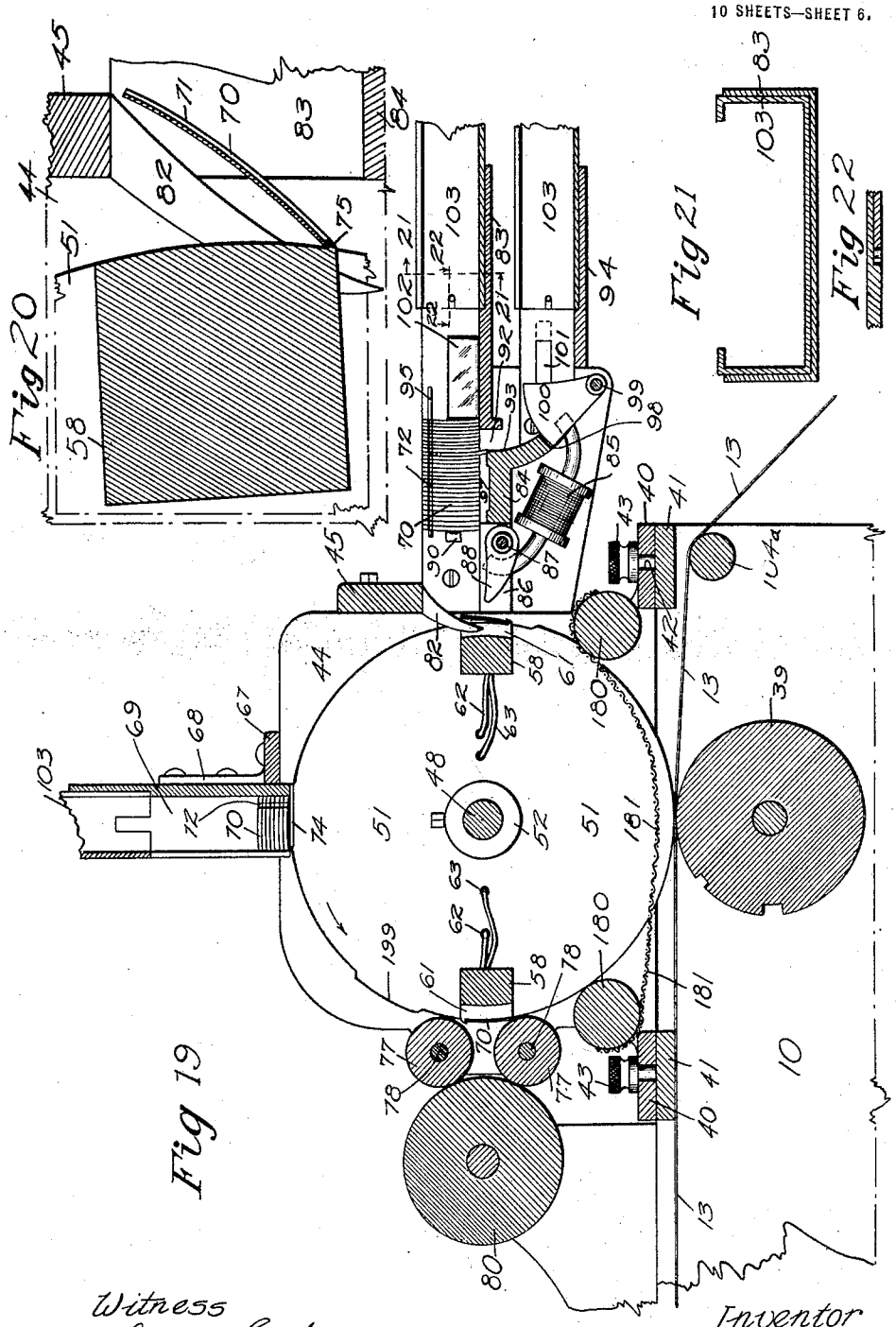


Fig 19

Fig 20

Fig 21

Fig 22

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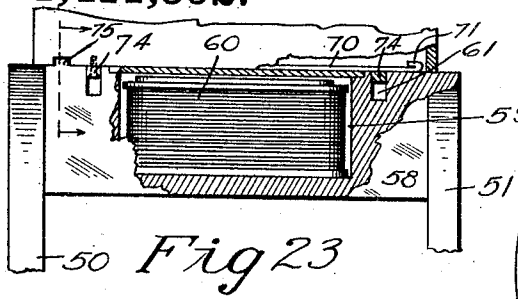


Fig 23

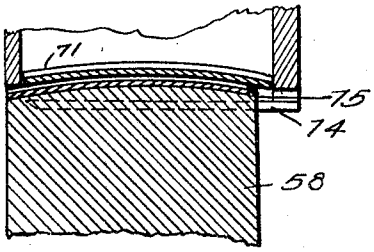


Fig 24

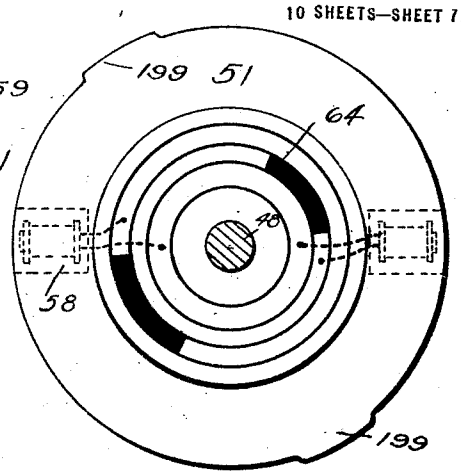


Fig 25

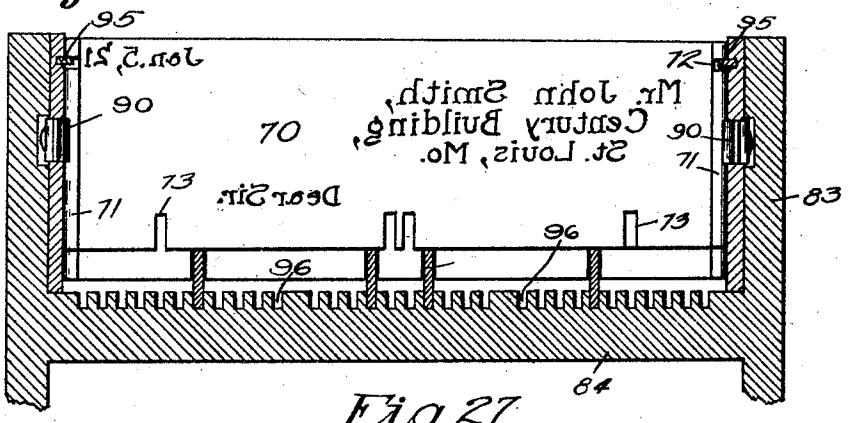
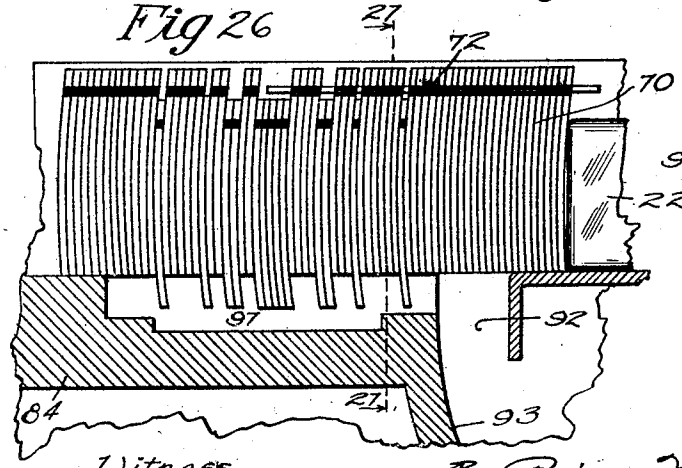


Fig 27

Fig 26



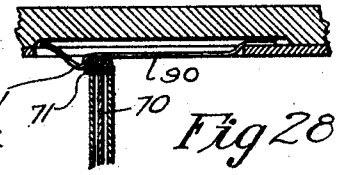


Fig 28

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PROCESS AND MACHINE FOR PRINTING COMPLETE FORM LETTERS.

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10 SHEETS—SHEET 8.

Fig 29

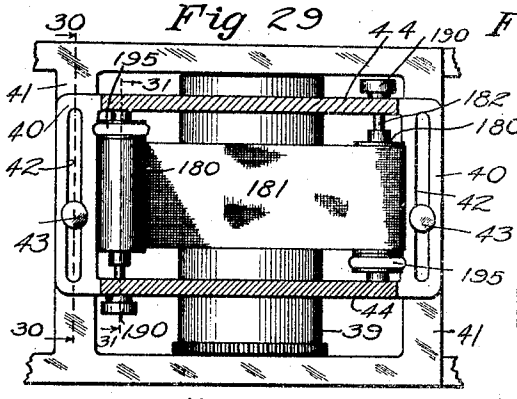


Fig 30

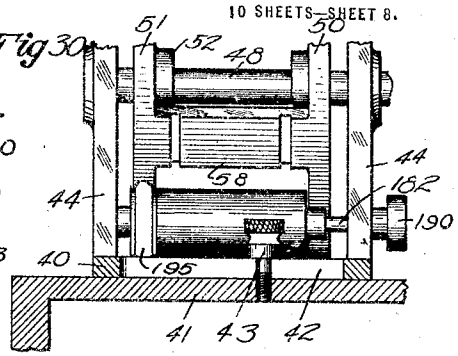


Fig 31

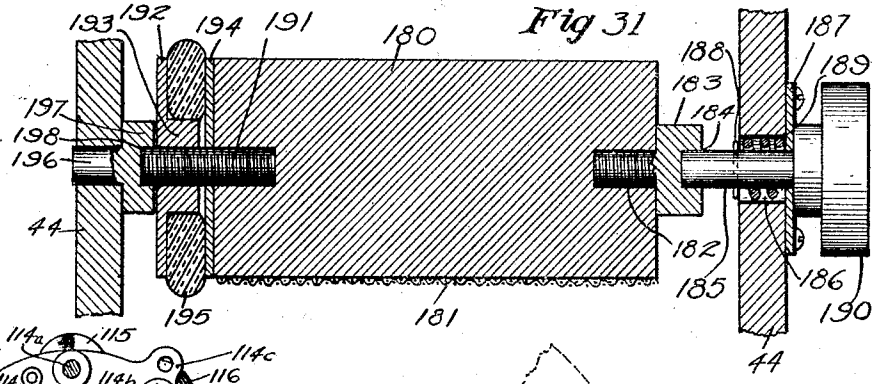


Fig 32

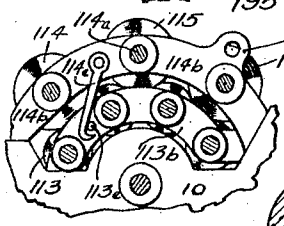


Fig 33

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10 SHEETS—SHEET 9.

Fig 34

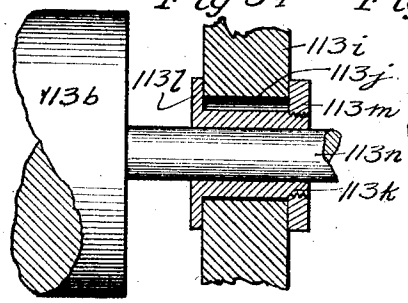


Fig 36

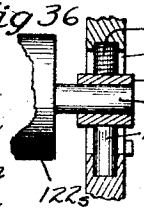


Fig 35

Fig 40

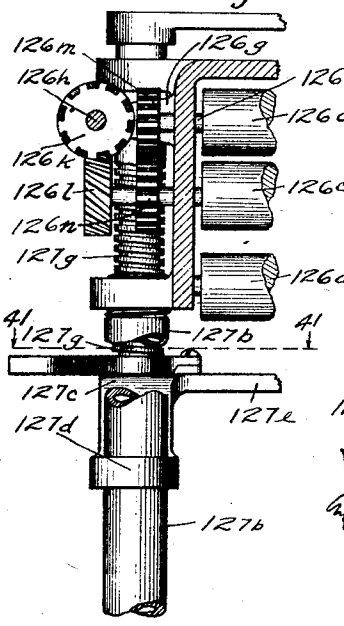


Fig 37

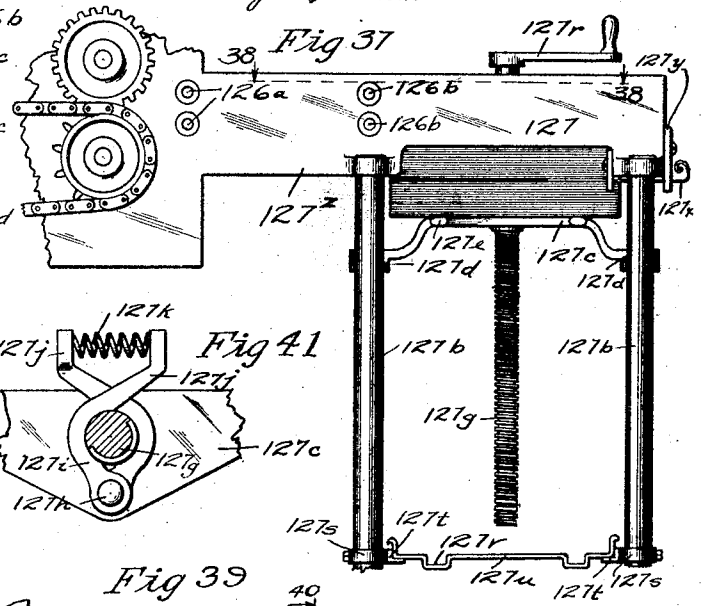
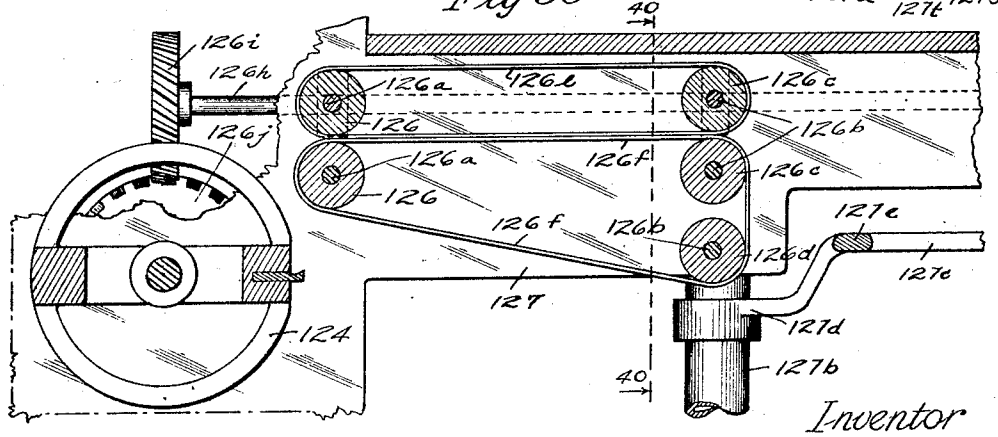


Fig 41

Fig 39



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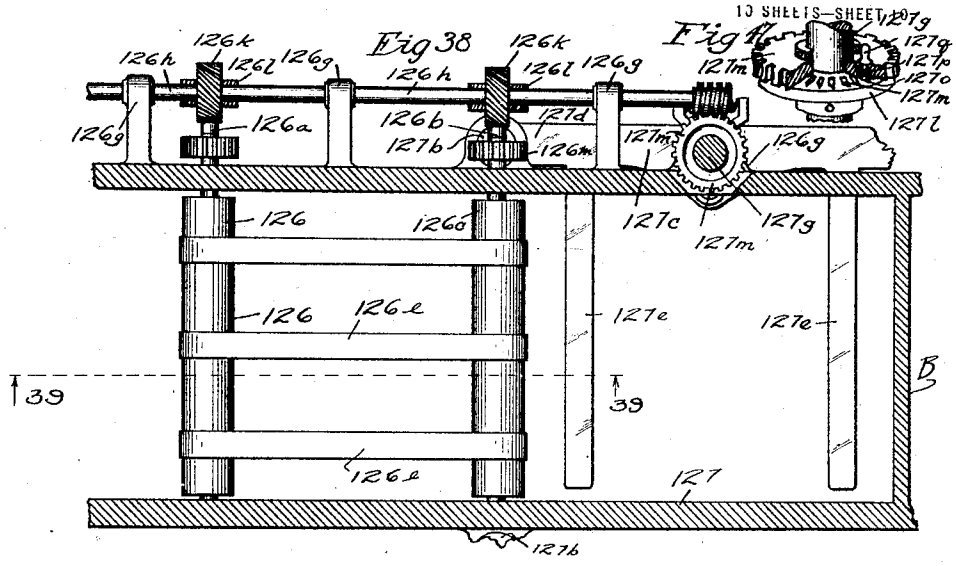
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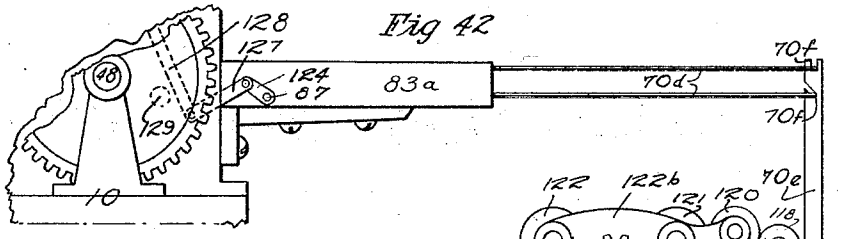
PROCESS AND MACHINE FOR PRINTING COMPLETE FORM LETTERS.

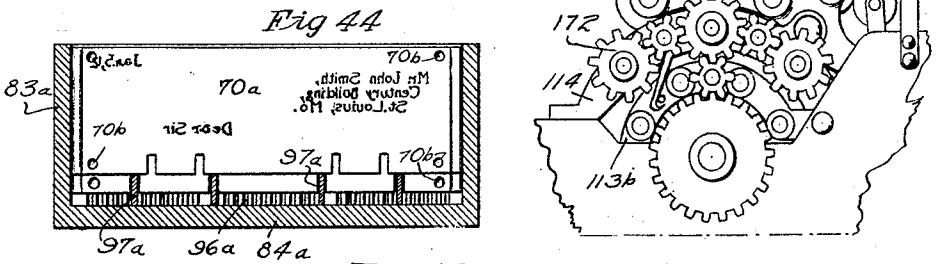
APPLICATION FILED JULY 29, 1920.

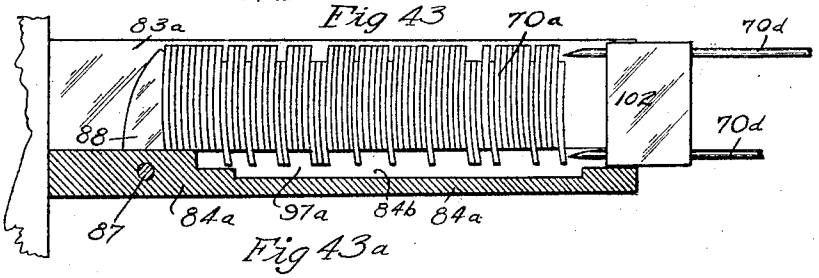
1,411,592. **Patented Apr. 4, 1922.**

10 SHEETS—SHEET 12











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Inventor
Erwin E. Strawn

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UNITED STATES PATENT OFFICE.

ERVIN E. STRAWN, OF DES MOINES, IOWA, ASSIGNOR TO THE OMNIGRAPH COMPANY, OF DES MOINES, IOWA, A CORPORATION.

PROCESS AND MACHINE FOR PRINTING COMPLETE FORM LETTERS.

1,411,592. Specification of Letters Patent. **Patented Apr. 4, 1922.**

Application filed July 29, 1920. Serial No. 399,668.

To all whom it may concern:

Be it known that I, ERVIN E. STRAWN, a citizen of the United States, and a resident of Des Moines, in the county of Polk and State of Iowa, have invented a certain new and useful Process and Machine for Printing Complete Form Letters, of which the following is a specification.

The object of my invention is to provide a process for printing complete form letters including the letter-head, body of the letter, address, salutation and signature, and for printing various parts of the letter or letter-head in different colors in a series of steps constituting one general operation and to provide a machine whereby the various processes mentioned herein may be carried out.

More particularly it is my object to provide a single unit machine which will print on a moving strip of paper, a letter-head, an address, a salutation, a body of a letter, and a signature or any one of these parts of a letter, and will print different parts in different colors if desired, or will print different parts in the same color if desired, and which will print the body of the letter and the address and salutation in the same colored ink from the same ink fountain.

Still a further object is to provide in such a process a step, and in a machine suitable mechanism, whereby the signature may be printed and somewhat blurred to give the effect of blotting.

Still a further object is to provide in such a process a step, whereby the so-called "ribbon" effect may be secured in a form letter where desired.

Still a further object is to provide such a process in which all the steps above outlined may be performed upon moving paper during the movement thereof, so that intermittent movement or sudden starting or stopping may be wholly avoided.

An additional object is to provide such a process including the printing of the reverse side of the paper as well as the upper side thereof, and the drying of the paper during the progress of the process between printing operations on the opposite sides.

Still a further object is to provide such a process including the steps of printing on moving paper, with a series of separate address plates, from which address and salutations or the like are printed during the movement of the plates.

Still a further object is to provide a process of the kind mentioned including the carrying of address plates successively from one magazine to printing position, and from printing position to another magazine, and depositing them therein by suitable means, such as an electro-magnet.

Still a further object is to provide a process of the kind mentioned, including the printing successively from separate address plates by carrying the plates from a magazine to printing position, then away from printing position, and then removing the plates successively from the carrying means and depositing them in a receiving magazine.

A further object is to provide such a process, including the selecting and classifying of the plates after printing, and depositing them in different magazines.

With these and other objects in view, it may be said that my invention consists in the steps hereinbefore referred to, and hereinafter more fully set forth, which may be performed on a machine which will now be described, and which is illustrated in the accompanying drawings, in which:

Figure 1 shows a side elevation of a machine upon which the various steps of my process may be carried out.

Figure 2 shows a vertical, longitudinal, sectional view through the same, the view being taken near one side of the machine with the side frame removed.

Figure 3 shows a plan view of the paper holding device.

Figure 4 shows a detail view partly in section of the paper trimming mechanism.

Figure 5 shows a detail, sectional view of one of the trimming knives.

Figure 6 shows a detail, sectional view taken on the line 6—6 of Figure 4.

Figure 7 shows a detail view of a printing roller of the first printing unit, illustrating the means for fastening the printing plates.

Figure 8 shows a sectional view of said roller, taken on the line 8—8 of Fig. 7.

Figure 9 shows a detail, sectional view taken on the line 9—9 of Figure 7.

Figure 10 shows a longitudinal, sectional view of a printing roller, such as is used in

the second printing unit, illustrating the means for holding the printing plate, and the means for adjusting the roller for securing proper register.

Figure 10[a] shows a detail, sectional view of one of the impression roller shafts, illustrating the manner of mounting the drive sprocket thereon.

Figure 11 shows a detail, sectional view taken on the line 11—11 of Figure 10.

Figure 12 shows a rear elevation of one end of the inking rollers of the second printing unit.

Figure 13 is a vertical, sectional view taken on the line 13—13 of Figure 12, the latter two figures referring to the inking rollers used for printing the body of a form letter, and also for inking of the plates for printing the address and salutation.

Figure 14 is a vertical, sectional view through the spindle of the main printing roller, showing the cams in end elevation.

Figure 15 is a top or plan view of one end of said roller which is the one employed in printing the body of the letter.

Figure 16 shows a top or plan view of a part of the machine used in printing from the address plates.

Figure 17 shows a sectional view taken on the line 17—17 of Figure 16, illustrating the means for adjusting the address printing mechanism laterally.

Figure 18 shows a detail, sectional view taken on the line 18—18 of Figure 16.

Figure 19 shows a sectional view of the address printing mechanism taken on the line 19—19 of Figure 16.

Figure 20 is a vertical, sectional view through one of the magnets and parts adjacent thereto, illustrating the stripping of the address plates from the magazine.

Figure 21 shows a transverse, vertical, sectional view of the address plate receiving magazines taken on the line 21—21 of Figure 19.

Figure 22 shows a sectional view taken on the line 22—22 of Figure 19.

Figure 23 shows a detail plan view of one of the magnets, parts being broken away and parts being shown in section.

Figure 24 is a vertical, sectional view through the lower end of the address plate supply magazine, and one of the magnets illustrating the construction of the machine, whereby the plates are removed from said magazine.

Figure 25 is a detail, sectional view illustrating the commutator in side elevation.

Figure 26 is a detail, sectional view taken on the line 26—26 of Figure 16.

Figure 27 is a transverse, detail, sectional view taken on the line 27—27 of Figure 26.

Figure 28 shows a sectional view taken on the line 28—28 of Figure 24.

Figure 29 shows a detail, sectional view illustrating the inking ribbon and operative mechanism therefor, used in connection with the address plate printing device, taken on the line 29—29 of Figure 30.

Figure 30 shows a detail, sectional view taken on the line 30—30 of Figure 29.

Figure 31 shows a detail, sectional view taken on the line 31—31 of Figure 29.

Figure 32 shows a sectional view through the printing and inking rollers of the fourth printing unit, three of the rollers being omitted for the better showing of other parts.

Figure 33 shows a sectional view of part of the same unit taken in a plane just outside the frame at one end of the rollers.

Figure 34 shows a sectional view of the bearing of an inking roller, such as of the fourth unit illustrating the means for adjusting the bearings.

Figure 35 shows a side elevation of part of the second unit, the shafts being shown in section, illustrating the means for separating the rollers.

Figure 36 shows a vertical detail, sectional view taken through the end of one of the inking roller shafts illustrating the means for mounting the same.

Figure 37 shows a side elevation of the sheet receiving and stacking device.

Figure 38 shows a detail, sectional view taken on the line 38—38 of Figure 37.

Figure 39 shows a detail, sectional view taken on the line 39—39 of Figure 38.

Figure 40 shows a detail, sectional view taken on the line 40—40 of Figure 39.

Figure 41 shows a detail, sectional view taken on the line 41—41 of Figure 40.

Figure 42 shows a detail, side elevation of a modified form of the selecting device.

Figure 43 shows a longitudinal, sectional view of the receiving magazine of the modified form referred to.

Figure 43[a] shows a plan view of the U shaped selector member.

Figure 44 shows a transverse, sectional view of the receiving magazine shown in Figure 43.

Figure 45 shows a detail, sectional view taken on the line 45—45 of Figure 37.

Figure 46 shows a detail view of part of one of the paper guide rollers; and

Figure 47 shows a perspective view of a clutch device.

I shall now describe the machine whereby the various steps of my process may be carried out, and will then explain somewhat in greater detail the steps of the process and the sequence thereof.

In the accompanying drawings, I have used the reference number 10 to indicate generally the main frame of my machine on which the other parts are mounted. On the

frame 10 are rearwardly projecting bracket arms 11, which support a shaft 11^a, on which may be mounted a roll of paper 13.

Mounted on the bracket arms 11 is a rotatable shaft 11^a on which is a drum 11^b for the roll of paper. Mounted on strips 11^c on the inner sides of the arms 11 are the forward ends of spring arms 11^d which extend rearwardly in the machine and carry at their rear ends shoes 11^e for engaging the drum 11^b. Mounted in the arms 11 are screw-threaded rods 11^f, having swivelled heads 11^g bearing against the springs 11^d and having at their outer ends heads 11^h. By adjusting the screw-threaded rods inwardly or outwardly in the arms 11, varying tension may be imposed on the drum 11^b. The device just described may be used as a brake, and also for adjusting the roll of paper laterally in the machine.

The paper 13 is threaded from the roll over a guide roller 14, under a guide roller 15, thence between the paper trimming and splitting rollers 16 and 17.

The lower trimmer roller is provided with a central, annular groove 18. The upper trimmer roller or shaft 17, which is made of two parts telescoped together and held against relative rotation by means of a pin 19 received in a slot 20, is provided with the cutting knives or discs 21, arranged to co-act respectively with the edges of the roller 16 at the ends thereof, and with one edge of the slot 18. The upper trimmer roller is preferably mounted so as to be readily raised or lowered at will.

The central knife 21 may be removed when it is not desired to cut the paper into two strips.

The shaft 16^a of the roller 16 is preferably mounted in frame members 16^b (Figure 4). The ends of the roller 17 are eccentrically fixed in externally screw-threaded bearings 17^a, which co-act with screw-threaded openings in the frame members 16^b. On one end of the roller 17 is a head 17^b for conveniently rotating that roller, and the bearings 17^a for moving the knives to and from cutting position. The screw-threads of the opposite bearings 17^a are respectively right and left handed, so that when the parts are in the position shown in Figure 4, and the head 17^b is rotated to a certain position, the roller 17 and parts thereon will be moved to their dotted-line positions illustrated in said figure.

The opposite ends of the roller 17 will move apart for carrying the outside knives in opposite directions away from the roller 16. Said opposite ends will each follow a spiral path moving bodily endwise and toward or from the roller 16.

The knives or discs 21 have short hubs 21^a, which are rotatably mounted on the roller 17.

From the trimmer rollers the paper goes to what I may call the first printing unit. This is a unit which is usually employed for printing signatures, but as hereinafter more fully explained, it may be used for a great variety of purposes.

The first printing unit, now under consideration, consists of the impression roller 22, and the printing roller 23, which is adapted to receive curved printing plates 23^a of any suitable kind.

The plates 23^a have beveled side edges arranged to co-act with correspondingly beveled edges of holding strips 23^b, which have at their ends keyhole slots 23^c to receive screw-bolts 23^d, which are screwed into the roller 23. The roller 23 may have a central circumferential slot 23^e, having an enlarged portion 23^f to receive an inverted wedge-shaped lug 23^g on the strip 23^b. (See Figures 7 and 9.)

The type plates 23^a on the printing roller 23 are inked from the composition inking rollers 24 and 25, which receive their ink from a roller 26. The roller 26 is inked from the distributor roller 27, which in turn receives ink from the vibrator distributing roller 28. The vibrator 28 is inked from an ordinary swinging roller 29, which in turn is inked from the fountain roller 30.

From the first printing unit the paper goes to the second printing unit which will now be described, and which may be used for printing the body of a letter or for printing various other subjects matter.

The second printing unit includes the impression roller 31, mounted on the shaft 31^a, which shaft is rotatably mounted on the frame of the machine.

On one end of the shaft 31^a is a sleeve 31^b having an annular flange 31^c and an externally screw-threaded end 31^d. On the sleeve 31^b is a sprocket 157 held against the flange 31^c by a nut 31^e on said sleeve, as shown in Figure 10^a.

Above the roller 31 is the co-acting printing roller 32 on the shaft 32^a, which is rotatably mounted on the main frame. The roller 32 may be made like the roller 23, with or without the groove 23^e and may have printing plates 23^a fastened thereto, as shown in Figures 7, 8 and 9, and as herein before described.

It may be mentioned that where the groove 23^e and lug 23^f are employed, two printing plates may be used, one being located on each side of the lug 23^f.

By using inks of different colors for the two plates, there may be produced matter printed in two colors from one roller. Where one wider printing plate 23^a is employed, I use strips 23^b without the lugs 23^f.

The roller 32 may be made as shown in Figures 10 and 11, with a gripping strip 32^b at one end to hold a printing plate 23^a. Ad-

jacent to the other end of the roller 32 is a disc 32^c of the same outside diameter as the roller, to which the other end of the plate 23^a may be secured by a strip 32^b. These strips 32^b are fastened at their ends to the roller 32 and the disc 32^c by screw-bolts 32^d.

The disc 32^c has a central screw-threaded opening of larger diameter than the shaft 32^a. Extended through such opening is an externally screw-threaded sleeve 32^e, one end of which abuts against the roller 32, as shown in Figure 10, and the other end of which has a head 32^f. It will be seen that by screwing the sleeve 32^e in the proper direction, the disc 32^c will be forced away from the roller 32, for stretching the printing plate 23. The roller 32 may be inked from the inking rollers 33 and 34, shown in Figure 2. A distributing roller 35 takes ink from a roller 36 and furnishes it to the rollers 33 and 34. The roller 36 is inked from the roller 37, which in turn is inked from the fountain roller 38.

From the second printing unit the paper is threaded to the third printing unit which is the one including the mechanism for printing on the paper from separate address plates or the like which are successively brought to printing position.

Third unit—address printing mechanism.

The third printing unit includes an impression roller 39 on a shaft 39^a, mounted on the main frame 10 of the machine. The rest of the printing unit is supported for lateral adjustment on an auxiliary frame detachably mounted on the main frame and having the cross members 40 resting on the members 41 of the main frame.

The transverse frame members 40 of the third printing unit are provided with transversely elongated slots 42, through which extend set-screws 43, mounted in the frame members 41 of the main frame. At the ends of the respective frame members 40 are the upright side frame members 44. Connecting the forward edges of the side frame members 44 is a transverse frame member 45. Rotatably mounted in the main frame 10, as shown for instance in Figure 17, is a sleeve like hub 46 of a gear 47.

The gear 47 is keyed to the shaft 48, by a spline 49, so that the shaft can slide, but the gear must rotate with the shaft.

One end of the shaft 48 is screw-threaded as at 53, and receives an adjusting nut 54, which has at its inner end an enlarged bore 55, receiving the outer end of the hub 46. The hub 46 is provided with an annular groove 56 into which projects the end of a screw 57 mounted in the nut 54, as shown in Figure 17.

The inner end of the screw 57 is smooth to permit the nut to turn freely with relation to the hub when the shaft is held against rotation and the nut is screwed inwardly or outwardly thereon. Ordinarily the nut will turn with the shaft on account of frictional engagement therewith.

This lateral movement of the third printing unit is for the purpose of printing at different places laterally on the paper for varying the margin for the address or other matter printed from the address printing plate, or for making the margin at the side of the paper adjacent to the address properly conform to the margin adjacent to the other printed matter on the sheet.

The shaft 48 extends through a pair of spaced discs 50 and 51, as shown for instance in Figure 16, which are arranged inside the side members 44. The shaft is rotatably but non-slidably mounted in the side members 44, and the hubs 52 of the discs 50 and 51 are fixed to the shaft 48.

Mounted between the discs 50 and 51 adjacent to the peripheries thereof, and diametrically opposite each other are blocks 58. The blocks 58, which for convenience sake in description, I shall hereafter refer to as the electro-magnets are hollow and have the recesses 59 in which are the electro-magnets proper 60. (Fig. 23). In the faces of the blocks 58 are grooves 61. The electro-magnets are connected by wires 62 and 63 with an ordinary commutator 64, shown in Figure 25. The commutator 64 is mounted on the disc 51.

Mounted in the third unit frame member 44, as shown in Figure 16, are the contacts 65 arranged to properly coact with the commutator and connected by wires 66 with any source of electrical energy.

The frame members 44 are connected at their upper portions by a cross member 67 on which is a bracket 68 to which is secured an upright feed magazine 69, for holding a supply of address plates 70.

In the operation of the machine, the magnets 58 carry the address plates 70, one at a time from the magazine 69, past an inking roller, then past the impression roller 39, then to a receiving magazine, all as described more fully a little later. The address plates 70 preferably have the form of a rectangle considerably longer than it is wide, and they are curved from side edge to side edge on the arc of a circle having its center at the center of one of the discs 51 and 52, and having its circumference at the circumference of one of those discs.

It may be mentioned that this circumference is twenty-two inches or twice the length of ordinary letter paper.

I have provided two of the electro-magnets with the relatively large discs 50 and 51 in order that the curvature of the address plates may not be too great. The ends of the plate 70 are folded over as at 71, illus-

trated for instance in Figure 28, and on the outside of the curve. This is done for the purpose of giving strength to the address plates which may be used for an address or other subject matter, and also for engaging and gripping and holding the paper firmly and smoothly on the impression roller during the printing operation.

It may be mentioned that the thickness of the folded over portion at the ends of the address plates should be the same as the rise of the type face from the surface of the plate.

The plates are longer than the roller from which they are inked and thus the folded over portions are never inked.

In the ends of the plate 70 are opposite notches 72, the purpose of which will be hereafter referred to.

In one edge of each plate there is preferably provided one or more notches 73. These notches may vary in location in different plates, and their purpose will be hereinafter referred to.

It may be mentioned that the various notches above described are of importance in selecting certain address plates from the entire number of address plates after the printing operation has been effected.

Extending across the bottom of the magazine 69 is a pair of spaced downwardly projecting strips 74, so located as to enter the notches or grooves 61 in the magnets as the magnets pass the bottom of the magazine 69. The rearward end of the magazine at the lower end is open to permit the exit of the address plates one at a time.

On each magnet block 58 is a pair of projecting fingers 75, just long enough to engage the bottom address plate 70, as the magnet passes under the lower end of the feed magazine, as illustrated particularly in Figure 24.

The commutator is so arranged that the instant the fingers 75 engage the lowermost address plate in the magazine 69, or shortly after that instant, the magnet under consideration is energized, whereupon the address plate which has been engaged by the fingers will be firmly held on the magnet until such magnet is de-energized. As the discs 50 and 51 continue their rotation in the direction indicated by the arrow in Figure 19, the address plates are inked from the rollers 77. The spindles 78 of the rollers 77 are mounted in the brackets 79 (Fig. 16). It is an important feature of my invention that the address plates should receive their ink from a fountain common to the address plates and to the printing plates on the roller 32. For accomplishing this purpose, I have provided the distributing roller 80 for supplying ink to the rollers 77. The roller 80 is inked from a roller 81 which receives its ink from the roller 35 already described, whereby both sets of type faces may be inked from a common source of supply.

From the inking rollers the magnet carries the address plates to position for printing on the paper 13 in coaction with the impression roller 39. From printing position the magnet carries the address plate to the stripper arms 82, which are preferably mounted on the cross member 45 and project to position where their points enter the grooves 61 of the magnet blocks for stripping the address plate therefrom, and dropping it into the permanent receiving magazine 83.

The commutator is so arranged that the magnet is de-energized at the instant the stripping process commences.

Below the bottom 84 of the permanent receiving magazine 83 is a magnet 85. The magnet 85 is so arranged as to cause the forward edge of the plate that has just been stripped from one of the moving magnets, to be gripped against the bottom 84 of the permanent receiving magazine.

On account of the curved form of the plate, it will be noted that the plate will be slightly tilted to position above the bottom of the magazine at its rearward edge, and the plate will be snugly held in position until the further action of the machine.

In the bottom 84 are spaced slots 86. Mounted on a shaft 87 and extending through the slots 86 is a pair of plate raising fingers 88, which are so timed and actuated by mechanism hereinafter more fully described as to raise the plate that has been stripped from the magazine, and push it upwardly and forwardly to the position shown in full lines in Figure 19, and which return to their lowered position, as shown in Figure 19, before the plate is stripped from the next magnet. In the sides of the magazine 83 are spring catch members 90. The plate raising fingers 88 carry the plates just past the projecting portions 91 of said springs a sufficient distance, so that when the fingers return to their lower position, the plate which has been raised can move rearwardly a short distance, so that the successive plates will not be held too tightly together. The plates will then be in the receiving magazine, and will not be held so tightly together, but that the selected plates may drop downwardly through the bottom of the receiving magazine in the manner hereinafter referred to.

It may be mentioned that the receiving magazine, the plate raising arms and the shaft on which these arms are mounted are brass so as not to be magnetized by the magnet 85.

It should be mentioned that points project upwardly from the magnet 85 through the bottom of the permanent receiving magazine to position for properly magnet-

izing the forward edge of the plate that has been stripped from the moving magnet and should also be mentioned that on account of the fact that the forward edge of the stripped plate is held by the magnet 85, there is insured a pivotal or hinge movement during the first part of the raising movement of the stripped plate.

Plate selecting mechanism.

Where it is desired to select a certain number or kind of plates, from the total number, after the printing operation has been carried out, such selection can be accomplished by mechanism which will now be described.

In the bottom of the permanent receiving magazine is a transverse slot 92, below which is a chute 93, which leads to a second receiving magazine 94. On the inside of the walls of the permanent receiving magazine 83, are opposite horizontal ribs 95. The ribs 95 extend across the slot 92.

In the bottom of the permanent receiving magazine 83 rearwardly of the opening 92 therein, are longitudinally arranged grooves 96, as illustrated for instance in Figure 27. These grooves are preferably arranged in four series, for instance from left to right, there being a series of twelve, a series of five, a second series of five and another series of twelve, as shown in said figure. Selectively received in the grooves 96 are strips 97. The notches 73 in the address plates 70 are located on different address plates to correspond or register with certain of the slots 96 in the bottom of the permanent receiving magazine, and to receive strips 97 received in such grooves. For instance, if the strips are placed in the two outside grooves 96, then the address plates which have notches 73 properly located, will, drop downwardly a short distance in the permanent receiving magazine, with the installed strips 97 received in such notches 73. The other address plates will slide on the installed strips 97 until the ribs 95 enter the notches 72 in the ends of the address plates.

In this connection, it may be mentioned that the ribs 95 terminate short of the rear ends of the strips 97, so that the plate which it is desired to select out, may drop downwardly on the installed strips 97^m before the ribs 95 enter the notches 72.

It will be seen that as the address plates advance, those which have dropped downwardly with the strips 97 received in their notches, will drop off the ends of the strips through the hole 92 into the chute 93.

It may be mentioned in this connection that for each selection I preferably employ two strips 97 in order that the plates which are not selected, and also that the plates which are selected may be properly supported during their advancing movement.

The strips 97 could be arranged in various ways, and I have shown in my drawings an arrangement whereby it is possible to make sixty selections: That is to say with each groove of each series of twelve grooves 96, one selection can be made. It is of course understood that two corresponding strips are inserted in corresponding grooves in each of the series of twelve grooves for making such selection.

Thus, for instance, if each address plate representing the January expiration of a magazine, has notches 73 corresponding to the left-hand groove 96 of each series of twelve, then the January expiration plates may be selected out by placing the strips 97 in the grooves mentioned, and it will be seen that a general letter may be sent to an entire list represented by all the address plates, and the January expiration plates may be selected out for the purpose of writing a special letter to the January expirations.

If it were desired to make a still more limited selection, it can be seen that the plates representing expirations in the first week in January might be further provided with notches 73 corresponding to the left-hand grooves 96 of the respective series of five grooves, and that when the strips 97 are installed in the last mentioned grooves, then only the expirations of the first week of January would be selected out from the total number of address plates.

Or from a general list there might be selected out the plates having the addresses of persons with special credit ratings, for sending special letters to such persons. In such case the plates having the special addresses may have notches corresponding to the right-hand grooves 96 etc.

In the chute 93 are spaced slots 98. Mounted on a transverse shaft 99 are plate raising fingers 100 adapted to travel through the slots 98, when the shaft 99 is rocked in the manner hereinafter described. The fingers 100 are substantially triangular in outline as shown in Figure 19, and their upper edges are curved, so that if a plate should drop into the chute when the fingers 100 are in their raised position as shown in Figure 19, then when the fingers move rearwardly and downwardly to their lowered position, the plates which have dropped into the chute will slide freely on the curved upper edges of the fingers 100.

When the fingers 100 are raised for raising a plate lying on the bottom of the chute, they carry the plate upwardly and forwardly past the projecting beveled portions of springs 101 similar to the springs 90, already described. These springs are mounted in the side walls of the receiving magazine 94.

The magnet 85 has portions which project

through the non-conducting bottom of the chute for holding one edge of the selected plate against the chute bottom until the raising of the plate by the fingers 100, and during the first part of such raising.

The selected plates are thus held at their lower edges until the fingers 100 raise them and are raised with a pivot or hinge movement, such as has already been described. It may be noted that in the receiving magazine there is preferably provided a follower block or the like 102 for the purpose of holding the address plates in upright position in the magazine.

In the outer end of each of the receiving magazines is a filing magazine 103. Received in the upper end of the feed magazine 69 is one end of a similar filing magazine 103. It will be noted that the address plates are fed into the receiving magazine with the same relative arrangement which they had in the feed magazine.

In Figures 42, 43 and 44, I have shown a modified form of plate selecting mechanism. In the form under consideration, the receiving magazine 83^a receives the address plates 70 in the same manner as has been described. The magazine 83^a has no hole in its bottom 84^a, but has in the upper surface thereof a recess or depression 84^b, which is long enough fore and aft for the purpose and extends across the magazine. The bottom 84^a has adjacent to the ends of the depression 84^b slots or grooves 96^a, which receive the ends of selector bars 97^a. The address plates 70^a are similar to the plates 70, except that they have holes 70^b near each corner as shown in Figure 44.

I use a pair of U-shaped members 70^c, having the parallel pointed arms 70^d adapted in the case of the upper member 70^c to enter the upper holes 70^b of the non-selected plates, and in the case of the lower member 70^c, the lower holes 70^b of the selected plates, which have dropped down on the selector bars 97^a.

It will be seen that with the form of selector device under consideration, the selected plates will be on one member 70^c and the non-selected plates on another member or placed from said members into a filing magazine 103.

On the frame of the machine is a bar 70^e having notches 70^f to receive and support the forward portion of the members 70^c.

In Figure 18, I have shown the operating mechanism for actuating the plate raising fingers 88 and 100. On the shaft 87 is an arm 124 extending for instance upwardly and forwardly and pivoted to a link 125. The link 125 is pivoted to a bell crank 126 on the shaft 99. The bell crank 126 is pivoted to a bar 127 extending rearwardly. The lower end of a lever 128 is pivoted to the rear end of the bar 127, and the upper end of the lever 128 is pivotally mounted on a frame member 44. On the disc 50 are diametrically opposite pins 129, which, in the rotation of disc alternately engage the lever 128 for actuating the bar 127 and moving it forwardly for operating the plate raising fingers.

Suitably attached to the bar 127 and to the laterally slidable frame which carries the address printing mechanism is a spring 130 which insures the prompt return of the lever 128 into the path of the pins 129 after each operation of said lever.

Fourth printing unit.

The paper is threaded from the impression roller 39 over rollers 104^a and 104, thence rearwardly and downwardly around a roller 105, thence forwardly around a roller 106, thence rearwardly and upwardly and around the roller 107, thence forwardly to the fourth printing unit.

Above the roller 107 is a heavy or weighted roller 108 which serves to grip the paper for drawing it forward.

It will be seen that the arrangement of the rollers just described makes it possible to secure what may be called a capstan action in drawing the paper through the machine.

It may be mentioned in this connection that the spindle of the roller 105 is mounted in arms 110 pivoted on a shaft 111 so that the roller 105 may be adjusted to different positions for thereby regulating or varying the length of paper between the impression rollers 39 and 109.

The fourth printing unit may be used, for instance, for printing a letter head. If it should be found for example in printing a form letter or the like that the body of the letter was a little too far from the letter head, as printed on the fourth printing unit, then an adjustment could be made by adjusting the roller 105.

The fourth printing unit has the impression roller 109 above which is a printing roller 112 adapted to receive curved printing plates. The printing plates on the roller 112 are designed to be inked from four inking rollers 113 shown in Figures 2 and 32. The inking rollers 113 are inked from rollers 114 and 115 and 116. From the fountain ink roller 117, the ink is carried by the inking roller 118 to the vibrator roller 120. Ink is distributed from the roller 120 to the roller 121, from the roller 121 to the rollers 115 and 116, and from the roller 115 to the roller 122, and from the roller 122 to the roller 114 (Fig. 2).

It will be noted that also several of the rollers distribute ink to a plurality of other rollers and that with the arrangement just described, I have effected a very thorough distribution of the ink, and it may also be

mentioned that the composition and steel rollers are always alternated.

Sheet cutter.

I have provided forwardly in the machine from the impression roller 109 and printing roller 112, a paper cutting device of the rotary type comprising a pair of cylinders 123 and 124ª provided with suitable cutting means 125ª. This cutting device is preferably similar to that described in my co-pending application, Serial Number 337,081, filed April 27, 1920. Just forwardly of the cutting cylinder is a pair of what I may call ejector rollers 126ᶻ, between which the paper passes after leaving the cutter. It is desirable that the severed sheet of paper, after having been cut from the main body, should be carried away from the following paper at a somewhat more rapid speed than that of the body of the paper. This is accomplished by speeding up the rollers 126ᶻ just described, in a manner which will be hereinafter more fully set forth. Another object of speeding up the rollers 126ᶻ is to cause them to pick up and insure the carrying of the forward edge of the following paper between them.

The sheets of paper are discharged from the ejector rollers 126ᶻ into a suitable receptacle 127ᶻ.

Mechanism for printing on reverse side of paper.

There is provided in connection with the mechanism hereinbefore described, an additional printing unit for printing on the reverse side of the paper. Where the additional printing unit is employed, the paper from the large roll is first threaded over the roller 128ª, thence over a guide roller 129ª, and thence between the impression roller 130ª and the printing roller 131, which are so arranged that the printing is done on the reverse side of the paper.

The type plates or the like on the printing roller 131 are inked from a set of inking rollers 132 substantially similar to those described in connection with the first printing unit.

From the printing and impression roller of the additional unit, now under consideration, the paper is threaded around a guide roller 133, thence forwardly in the machine, and around a relatively large dryer drum 134, which may be heated in any suitable way, preferably by electricity. There may be provided an additional dryer below the paper or adjacent thereto, as indicated at 135 between the additional printing unit and the dryer drum 134.

From the dryer drum the paper is drawn rearwardly in the machine and around the guide roller 136. When the additional printing unit is employed, the paper is threaded from the roller 136 around the roller 14 already described and from there through the machine in the manner heretofore set forth.

Driving mechanism.

My machine may be operated from any suitable source of power.

In the form of the machine illustrated in my drawings, I have shown a motor 137 mounted on the main frame 10, as shown in Figure 1. Rotatably mounted is a main drive shaft 138 on which is a pulley 139, shown in dotted lines in Figure 1, arranged in line with a pulley 140 on the motor shaft and driven therefrom by means of a belt 141.

On opposite sides of the power shaft 138 are counter-shafts 141ª and 142. On the power shaft 138 is a gear 143 which meshes with gears not shown on the shafts 141ª and 142.

On the shaft 142 is a sprocket 144 in line with a sprocket 145 on the shaft of the main inking roller of the additional printing unit used for printing on the reverse side of the paper.

A chain 146 travels on the last two described sprockets. On the shaft of the impression roller 130 is a gear 147 in mesh with a gear 148 on the shaft of the printing roller 131. The printing roller gear 148 is connected with the shaft of the main inking roller of the unit by means of suitable gearing devices 149.

On the shaft 142 is another sprocket 150 not shown, on which travels a chain 150ª.

On the shaft of the printing roller of the first printing unit is a gear 154 which meshes with a similar gear on the shaft of the impression roller 22, the latter gear not being shown.

The shaft of the printing roller 23 is connected with the adjacent inking rollers by gearing devices 155. On the shaft of the printing roller of the second printing unit is a gear 156 in mesh with a similar gear not shown, on the shaft of the impression roller 31. On the shaft of the impression roller 31 is a sprocket 157. On the shaft of the impression roller 22 is a sprocket 158. Between the sprockets 157 and 158 and below them is an idler sprocket 159. The chain 150ª extends from the sprocket 153 over the sprocket 158, thence around the idler 159, and thence around the sprocket 157. On the shaft of the impression roller 39 is a sprocket 160 around which the chain 150ª extends.

The gear 156 is connected with the adjacent inking roller for supplying ink to the printing roller 32, by means of a chain of gearing 161. Gearing devices 162 and 163 are provided for operating the inking rollers for the address plates, in unison with the inking rollers of the second printing unit.

The gear 47 meshes with a gear 164 on the shaft of the impression roller 39, whereby the discs which carry the magnets are operated in proper synchronism with the rest of the machine.

On the shaft 141ª is a sprocket 165 in line with a sprocket 166 on the shaft of the capstan roller 104. On the shaft of the capstan roller 106 is another sprocket 167. On the shaft of the impression roller 109 is a sprocket 168. On the shaft of the lower cutter cylinder 123 is a sprocket 169. A chain 170 travels over the sprockets 165, 166, 167, 168, and 169.

On the shaft of the printing roller 112, is a gear 171, in mesh with a similar gear on the shaft of the impression roller 109, the latter gear not being shown.

The ink distributing rollers for the printing roller 112 are operated by means of a chain of gears 172.

On the shaft of the lower cutter cylinder on the other side of the machine is a helical gear 126ʲ for operating the sheet handling mechanism, more specifically referred to in another part of this specification.

On the shaft 16ª of the lower trimmer roller 16 is a sprocket 153 over which passes the chain 150ª.

Device for securing registration.

The device shown in Figure 10ª, already described, permits adjustment of the printing rollers of the various units with relation to each other for securing proper register on each predetermined length of paper of the matter printed by the different units.

It will be seen that when the nut 31ᵉ is loosened the impression roller and the printing roller geared thereto may be rotated free from the operating mechanism, for adjusting the printing roller to secure proper register on the sheet, and when the nut is tightened the sprockets will properly operate the printing units.

In some instances it is desired that the form letter and the address and salutation be given the so-called "ribbon" effect. I have provided, therefore, for the second printing unit and for the address printing unit ribbon structures whereby this ribbon effect may be secured.

In Figure 19 and in Figures 29 and 30 and 31 I have shown a ribbon device comprising spaced rollers 180, to which are secured the ends of the inking ribbon 181. The inking rollers are detachably mounted on the frame members 44 in the following manner.

Each roller has mounted in one end a spindle 182 having just outside the end of the roller a head 183 with a recess 184 receiving the end of a spindle 185. The spindle 185 projects through a hole 186 in the adjacent frame member 44, which hole is of greater diameter than the spindle 185.

On the outer side of the frame member 44 is secured a plate 187 through which the spindle 185 projects. Extending through the spindle 185 is a pin 188 serving as a stop device for the spring 189 mounted in the hole 186 between said pin and the plate 170.

On the outer end of the spindle 185 is a head 190, which can be grasped for pulling the spindle 185 outwardly for removing it from the recess 184 for thereby permitting the removal of the roller 180.

Mounted in the other end of each roller 180 is a spindle 191 on which is a wheel comprising a disc 192 having a hub 193 extending laterally and mounted on the spindle 191.

On the spindle 191 adjacent to the projecting hub 193 is a disc 194. Between the discs there is mounted on the hub on annular wheel 195 made of suitable composition.

Mounted in the frame member 44 adjacent to the spindle 191 is a spindle 196 on which is an enlarged head 197 which is provided with a recess 198 to receive the outer end of the spindle 191.

On the disc 51 on the periphery thereof are diametrically opposite cams 199, and on the disc 50, arranged diametrically opposite each other and staggered with relation to the cams 199 are the cams 200. A wheel 195 on one of the rollers 180 is arranged at the opposite end of the roller from the wheel 195 on the other roller 180.

As the discs 50 and 51 rotate, one of these cams 199 or 200 will engage one of the wheels 195 for winding the ribbon in one direction, and after a quarter revolution of the discs the other cam will engage the other roller for winding the ribbon in the opposite direction.

It will be noted that the ribbon is moved twice backwardly and twice forwardly with each revolution of the discs. Only a short ribbon need be employed and a large number of impressions can be secured from one ribbon. It will be noticed in this connection that the ribbon is re-inked by the freshly inked address plates at each printing operation.

This ribbon inking device is detachable and a similar inking device may be provided for the second printing unit.

The difference between the latter ribbon inking device and the ribbon inking device already described will now be mentioned.

The ribbon inking device provided for the second inking roller is partially shown in Figures 13, 14 and 15. The rearward roller is indicated by the reference character 202, and the forward roller, which is the smaller, by the character 203. The inking ribbon 204 is connected with the roll-

ers 202 and 203. These rollers are mounted on the frame of the machine in the same manner as the rollers 180.

On the shaft 32^a of the roller 32 at one end thereof there are mounted a relatively small disc 204^a, and a relatively large disc 205. On the disc 204^a there is a long cam 206, and on the disc 205 is a short cam 207.

The wheels 208 of the ribbon inking device for the second printing unit corresponding to the wheels 195 already described, are arranged at the same side of the ribbon inking device slightly out of alignment with each other.

One of the wheels, indicated as at 208 in Figure 14, is arranged to co-act with the cam 206.

During the printing operations the parts are so timed that the cam 206 actuates the ribbon rollers for advancing the ribbon with the paper during the printing operation, whereas between printing operations the cam 207 returns the ribbon with a rapid movement.

Inking roller support.

For suitably supporting the inking rollers, I have shown one form of device in Figures 32 and 33. This device is constructed and arranged especially to secure a thorough distribution of the ink.

The shafts 113^a of the rollers 113 are mounted in spaced parallel curved supporting bars 113^b having at their forward ends short forward extensions 113^c pivoted on a pintle 113^d. The rollers 114, 115 and 116 have shafts 114^a mounted in curved parallel spaced supporting bars 114^b, the forward ends of which are pivoted on the pintle 113^d. At their rearward ends the bars 113^b and 114^b normally rest on the frame of the machine as shown in Figures 32 and 33.

The bars 114^b have near their forward ends upwardly projecting ears 114^c in which there is mounted a pintle 114^d. The rollers 121, 120 and 119 have shafts 122^a on parallel curved spaced supporting bars 122^b, as shown in Figure 32.

The bars 122^b are pivoted rearwardly of their front ends on the pintle 114^d. Pivoted to the forward ends of the bars 122^b are the hooks 122^c below which, on the frame of the machine are pins 122^d (see Figure 32).

On the bars 114^b are pivoted hooks 114^e and just above their hook ends, on the bars 113^b are pins 113^e.

It is well known that it is desirable to separate the metal and composition rollers and relieve the composition rollers from the imposition of weight thereon, when the machine is not in use, for the reason that otherwise the composition rollers sometimes become flat sided.

In order to secure the desired separation I have provided the supporting means described herein. When the machine is not in use, the operator may grasp the rear ends of the bars 114^b and raise them. As the bars 114^b move up the rollers thereon move out of contact with the rollers supported on the bars 113^b, and the hooks 114^e then engage the pins 113^e and raise the bars 113^b. The movement continues until the hooks 122^c slide over and clear and then engage the pins 122^d.

The operator then lets the parts hang. The pivot points of the hooks 122^c are above the lines from the pintles 114^d to the pins 122^d when the parts are lowered but when the supporting bars are raised as described, the parts move to position with said pivot points substantially in said lines. The bars 114^b can then drop away from the bars 122^b for separating the rollers on the bars 114^b from those on the bars 122^b.

In Figures 35 and 36 I have shown a slightly different form of inking roller support. In the form under consideration the printing roller is indicated at 122^m.

Pivoted as at 122^n on the main frame are the parallel inking roller supporting bars 122^o. In these bars are slots 122^p for vertically slidable bearings 122^q, in which are mounted the shafts 122^r of inking rollers 122^s. In the lower parts of these slots are supporting posts 122^t on which the shafts 122^r may rest. Above the bearings 122^q are springs 122^u for exerting yielding downward pressure on the adjustable bearings. Suitably mounted in the bars 122^o are shafts 122^v of ink distributing rollers 122^w. Pivoted to the bars 122^o are bars 122^x having notches 122^y. On the main frame are pins 122^z.

When the bars 122^o are lowered the parts are so arranged that the rollers 122^s engage the roller 122^m and rest thereon, and are raised off the supporting posts 122^t against the pressure of the springs 122^u, and in contact with the rollers 122^w. When the bars 122^o are raised, the rollers 122^s will be lifted out of contact with the rollers 122^m and the springs 122^u will force said rollers 122^s out of contact with the rollers 122^w.

The notches 122^y are placed over the pins 122^z for holding the bars 122^o in raised position.

Adjustable roller mounting.

In Figure 34 I have shown a means for mounting inking rollers adjustably in their supporting bars. This means may be used for rollers such as 133 and others.

In the device illustrated roller supporting bar 113^i has an opening 113^j in which is a tubular bearing 113^k of smaller diameter than the opening 113^j, having at one end an annular flange or head 113^l to engage the bar 113^i. The bearing 113^k is screw-threaded at its other end to receive a nut 113^m for engaging the other side of the bar 113^i. The

shaft 113^n of the roller 113^b is mounted in the bearing 113^k.

It will be seen that the nut 113^m may be loosened and the roller adjusted to various positions and the nuts then tightened for holding the bearings 113^k in their adjusted positions.

Knurled rollers.

It may be noted that the guide rollers such as the roller 104 over which the paper passes after having been printed, are knurled as shown in Figure 46, whereby the smearing of ink is prevented.

Sheet handling mechanism.

I have found that in a machine working at such speed as the one shown herein, it is desirable to provide special mechanism for handling the printed and cut sheets. Such a mechanism I have shown in Figures 37 to 41 inclusive.

At the front of the machine are laterally spaced frame members 127, already generally referred to. The shafts 126^a of the ejector rollers 126 are mounted in the frame of the machine, and rearwardly thereof in the members 127 are mounted shafts 126^b on which are similar rollers 126^c. Below the lower roller 126^c is a similar idler roller 126^d. A series of belts or conveyors 126^e travel over the upper rollers 126 and 126^c, and a similar series of belts 126^f travels over the lower rollers 126 and 126^c and over the roller 126^d as shown in Figure 39.

Mounted in suitable bearings 126^g outside the frame members 127 is a shaft 126^h arranged longitudinally in the machine. On the shaft 126^h is a helical gear 126^i in mesh with a helical gear 126^j on the shaft of the lower cutter roller.

On the shaft 126^h are worm wheels 126^k in mesh with worm wheels 126^l on the shafts of the upper rollers 126^c for transmitting motion from the shaft 126^h to the endless belts 126^e. On the upper shafts 126^a and 126^b are gears 126^m meshing with gears 126^n on the lower shafts 126^a and 126^b respectively for transmitting motion to the lower belts.

The gears are so arranged that the belts 126^e travel faster than the cutter rollers for causing the sheets of paper delivered to the belts 126^e to be moved away from the next sheets so delivered.

At the delivery end of the belts 126^e is a paper receiving and handling device including pairs of upright posts 127^b, located near the opposite sides of the machine.

There is provided a frame member 127^c, arranged longitudinally in the machine, having its ends 127^d lowered slightly as shown in Figure 37 and slidably mounted on the posts 127^b. Extending laterally in the machine from the frame member 127^c and arranged to receive paper discharged from between the belts 126^e and 126^f are paper supporting arms 127^e.

Arranged at one side of the machine between the posts 127^b and mounted in suitable bearings 127^f is an upright shaft 127^g, the lower portion of which is screw-threaded (Fig. 2).

Pivoted at 127^h on the member 127^c are internally screw-threaded half-bearing members 127^i, which receive between them the screw-threaded portion of the shaft 127^g. The bearing members 127^i have extensions 127^j extending across and away from each other as shown in Figure 41.

A push spring 127^k connects the ends of the extensions 127^j as shown in said figure for holding the shaft 127^g snugly and firmly in the screw-threaded bearing members and thereby causing the member 127^c and the arms 127^e to travel up and down on the shaft 127^g according to the rotation of said shaft.

Fixed on the smooth upper portion of the shaft 127^g is a disk 127^l having in its upper surface a series of holes 127^m arranged in a circle as indicated in Figure 47. Rotatably mounted on the shaft 127^g is a gear 127^n having a smooth under surface adjacent to the upper surface of the disc 127^l.

Mounted in the gear 127^n for vertical sliding adjustment is a pawl 127^o. A spring 127^p normally, yieldingly holds the pawl 127^o with its lower end projected into one of the holes 127^m. The pawl 127^o has a handle 127^q above the gear 127^n. The gear 127^n travels very slowly so that the operator of the machine may readily grasp the handle 127^q for withdrawing the pawl 127^o from the hole 127^m for disconnecting the gear 127^n from the shaft 127^g. The upper end of the shaft 127^g is adapted to detachably support a crank handle 127^r so that when desired the shaft 127^g may be rotated by hand for lowering the member 127^c.

It will be noted that by pressing the extensions 127^j toward each other, the bearing members 127^i may be released from the shaft 127^g and the paper supporting arms raised or lowered by hand.

Paper is fed from the belts on to the arms 127^e, and these arms are gradually lowered by the rotation of the shaft 127^g. Adjustably supported near the lower ends of the posts 127^b at one side of the machine are brackets 127^s on which are angle irons 127^t extending laterally in the machine, and supporting loosely a pan 127^u having grooves 127^v to receive the arms 127^e. The brackets 127^s are at the opposite side of the machine from the ends 127^d.

On the members 127 are supports 127^y having guide slots 127^w to receive the edges of a divider plate 127^x, which may be inserted as shown in Figure 37 for dividing the paper when the arms 127^e are near their

lowermost positions and it is desired to remove the stack of paper. After the paper below the plate 127^x is removed the arms 127^e are raised and the divider plate is removed.

In the practical operation of my machine as herein described, and in the performance of the various steps of the process, comprising the subject matter of my application, where the paper is not printed on the reverse side, it is threaded over the guide roller 14, and around the guide roller 15, and thence between the trimmer rollers where the side edges of the paper are trimmed smooth where such trimming is necessary. The paper may be cut into two strips by using the central cutter 21.

From thence the paper passes between the impression roller 22 and the printing roller 23, and is printed from type faced plates or the like on the printing roller 23.

It is sometimes desirable, especially in printing a form letter, to somewhat blur a signature, where a facsimile signature is being printed on the first printing unit.

It is well-known in the printing art that to get a clear impression, the impression roller and the printing roller must travel at the same rate of speed at points where the printing impression is made.

To secure the blurred effect in the signature, as above referred to, I use a printing plate somewhat thinner than the normal printing plate. The impression roller at the point of printing is built up by ordinary "lay on."

It will thus be seen that while the printing roller and the impression roller travel at the same rate of speed, they are of different diameters compared to their normal diameters, at the printing point, and the result is a slight blurring in the printing. That is to say while the speed of the printing and impression roller is the same, the surface speed at the point where the printing is done is slightly greater in the impression roller than in the printing roller, and the blurring is thus accomplished.

From the first printing unit, paper is threaded through the second printing unit and is there printed with the body of a form letter, or with any other desired subject matter.

From the second printing unit the paper passes over the impression roller 39, and is there printed from the address plates.

From the third printing unit the paper goes to the capstan device already described whereby the paper is advanced through the machine. By adjusting the roller 105 to different positions it will be noted that there is provided a convenient and easy means for varying the length of paper between the impression rollers 39 and 109, whereby the matter printed by the fourth printing unit may be even more easily registered with the other printed matter on the paper than by the other registration device already described. The adjustment of the roller 105 for securing registration may be accomplished while the machine is in operation.

The paper then passes to the fourth printing unit where a letter head or other subject matter is printed, and thence passes to the cutting rollers, where it is cut into sheets, and from which it is discharged into the receptacle 127.

In the practical operation of the sheet handling mechanism, in the form shown in Figures 37 to 41 inclusive, sheets of paper after having been cut from the strip by the cutting rollers are fed by the belts 126^e and 126^t. It will be remembered that these belts are traveling at a faster speed than the strip of paper in order that the cut sheets may be pulled away from the next succeeding sheets.

I have found that this is very necessary for the reason that the paper is pushed from the capstan device and must be free from interference. Unless the rapidly advancing belts or some similar device is provided the sheets will sometimes pile up when the sheets are discharged from between the belts, their rear edges are jerked quickly downwardly by the upright stretch of the belts 126^t.

Between the members 127 is a stop board B, shown in Figure 38, against which the sheets strike as they are discharged from the conveyor belts.

The member 127^c is placed at its upper limit of movement when the machine commences its operation. As the operation continues the shaft 127^s is slowly rotated, thereby carrying the bearing members 127^l and the arms 127^e supporting the stack of sheets slowly downwardly.

When the member 127^c has almost reached the pan 127^u the operator inserts the divider plate and rotates the shaft 127^s rapidly by hand by means of the crank 127^r for lowering the stack of paper below the divider plate, until the arms 127^e rest in the groove 127^v thereupon the pan 127^u is removed, carrying with it the stack of sheets.

The operator then grasps the extensions 127^j and releases the bearing members 127^l from the shaft 127^s and raises the member 127^c, and thereafter removes the divider plate.

The registering of the printed matter placed on the paper by the different units is accomplished as above described.

For the reason that form letters are usually printed on eleven inch sheets, I commonly use printing rollers eleven inches in circumference, but other sizes may be employed for printing different sized sheets.

In the case of the mechanism for the carrying of the address plates, it may be mentioned that the path of travel of the outer surfaces of the magnets is twenty-two inches, in order that the curvature of the address plates may not be too great. By using two magnets 11 inches apart, an address will be printed on each eleven inch portion of the paper passing through the machine.

When it is desired to print on the reverse side of the paper, the paper is first threaded over the roller 128, and around the roller 129 to the additional printing roller above described, and printed on the reverse side. The paper is then carried past the drying devices, and is threaded through the machine in the way heretofore set forth.

Assuming that the work to be done on the machine is the printing of a form letter, it will be noted that the signature may be printed on the first printing unit and may be a facsimile and may be given a blurred effect if desired, to imitate a blotted signature.

The body of the letter may be printed on the second printing unit. The address and salutation may be printed from the address plates, and the letter head may be printed from the type faced matter on the printing roller 112.

Different colors may be used for the letter head, letter body and signature.

Attention is called to the great variety of different printed matter which may be accomplished on my machine. For instance, the address printing mechanism may be thrown out of gear in any suitable way not here especially referred to, and I can then on the three other printing units print subject matter on a letter size sheet of paper in three different colors.

The matter printed in the different colors may be registered in any desired position on the eleven inch sheet. Where it is desired to print ordinary single wrappers for newspapers or the like, it will be obvious that addresses may be printed with the address printing mechanism, and that either or all of the other printing mechanism may be thrown out of gear in any suitable way.

If desired, either or any number of the other printing units may be employed for printing so called permanent matter on the eleven inch sheet.

The variety of matter, and the variety of arrangement of matter on the eleven inch sheet of which my machine is capable are practically unlimited.

Attention is called particularly to the advantage of my construction and process whereby my machine performs practically all of its operations with rotary devices.

My process contemplates particularly the employment of rotary devices, whereby I am enabled to secure a speed of operation otherwise non-attainable.

The steps of my process will be seen largely from the foregoing description of the construction and operation of my machine.

It will be seen that I can print suitable subject matter on the reverse side of a movable strip of paper during the movement of such paper, and that I can then dry the ink on the paper and while the paper is in movement through the machine, can print a signature or other subject matter and can, if desired, blur the signature.

I can then print the body of a letter or other subject matter, and thereafter place on the letter an address or salutation or other subject matter different for each eleven inch sheet.

Other subject matter such, for instance, as the letter head may be printed on the forward printing unit; and paper is then cut into suitable sheets and deposited in the receptacle.

It will be noted that I have provided a very thorough and thin distribution of the ink, so that while a clear impression is secured, the ink is so thin when applied to the paper that it dries very rapidly so that it is possible, with my machine, to stack the cut sheets in large quantities without "off setting", or blurring the freshly printed subject matter.

I have produced a machine and have worked out a process for printing form letters on continuously moving paper at an extremely rapid speed which operation includes the printing of the signature, the blurring of the same if desired, the printing of a body of a letter, the printing of an interchangeable address, the printing of a letter head, and the cutting of the paper into sheets, and all the printing can be done on the upper surface of the moving paper.

It will be obvious that for printing the letterhead or other parts of the letter or for printing the reverse side of the sheet, type plates may be used or any method of offset printing from a roller may be employed, and I do not intend to limit myself in my process claims to any particular kind of type plates or offset rollers.

It will, of course, be noted that when the strip is cut in two longitudinally, the addressing mechanism will print only on one of the separated strips, and that the sheet handling mechanism might have to be modified somewhat.

Some changes may be made in the construction and arrangement of the parts of my device without departing from the essential features and purposes of my invention, and it is my intention to cover by my

claims any modified forms of structure of use of mechanical equivalents which may be reasonably included within their scope.

I claim as my invention:

1. The process of printing a form letter, comprising the printing of the body of a letter on each predetermined length of a continuous moving strip of paper as it passes through a machine, the printing of additional type matter on a different place on each predetermined length of paper as it so passes, and the printing of a different address on still another portion of each predetermined length during such passage.

2. The process of printing a form letter comprising the printing of a signature on each predetermined length of a continuously moving strip of paper as it passes through a machine, the printing of the body of a letter at a different place on each of said predetermined lengths during such movement, and the printing of interchangeable type matter at still a different place on each predetermined length during such movement.

3. The process of printing a form letter comprising the printing on each predetermined length of a continuously moving strip of paper, while in motion through a machine, of a letter body, a letter head, an address and a signature.

4. The process of printing a form letter, comprising the printing on each predetermined length of a continuously moving strip of paper during its movement through a machine, of a signature with one color ink, and a letter head and an address and letter body with another color of ink.

5. The process of printing a form letter, comprising the printing on each predetermined length of a continously moving strip of paper during its movement through a machine, of a signature with one color of ink, and a letter body and an address with another color of ink, taken from a common source.

6. The process of printing a form letter, comprising the printing on each predetermined length of a continuously moving strip of paper during its movement through a machine, of a signature with one color of ink, and a letter head and an address with another color of ink, and the blurring of said signature.

7. The process of printing a signature, and the body of a letter, on each predetermined length of a continuously moving strip of paper, with different colors of ink, the printing of a different address on each predetermined length, and the cutting of said paper into sheets during its movement through the machine.

8. The process of printing on each predetermined length of a continuously moving strip of paper during its passage through a machine, of a letter body, a salutation and a signature, on one side and other matter on the other side of said length.

9. The process of printing on each predetermined length of a continuously moving strip of paper during its passage through a machine of a letter body, a changeable address and salutation and a signature on one side, and other matter on the other side of said length.

10. The process of printing on each predetermined length of a continuously moving strip of paper during its passage through a machine, of a letter body, a signature, a changeable address and a letterhead.

11. The process of printing on each predetermined length of a continuously moving strip of paper during its passage through a machine of a letter body, and a changeable address in one color, a signature in another color, and a letterhead.

12. The process of printing on each predetermined length of a continuously moving strip of paper during its passage through a machine of a letter body and a changeable address in one color, a signature in another color and a letterhead in a third color.

13. The process of printing on each predetermined length of a continuously moving strip of paper during its passage through a machine of a letter body, a blurred signature, a changeable address and a letterhead.

14. The process of printing on each predetermined length of a continuously moving strip of paper during its passage through a machine of a letter body, a signature, a changeable address and a letterhead, and printing subject matter on the reverse side of each of such length.

15. The process of printing on each successive predetermined length of a continuously moving strip of paper, during its passage through a machine of a complete form letter including a letterhead, a changeable address, a letter body and a signature.

16. The process of printing on each successive predetermined length of a continuously moving strip of paper, during its passage through a machine of a complete form letter including a letterhead, a changeable address, a letter body and a signature and different subject matter on the reverse side of each of said lengths.

17. The process of printing on each successive predetermined length of a continuously moving strip of paper during its passage through a machine of a complete form letter including a letterhead, a changeable address, a letter body and a signature with a plurality of colors.

18. The process of printing on each successive predetermined length of a continuously moving strip of paper during its passage through a machine of a complete form

letter including a letterhead having a plurality of colors, a changeable address, a letter body and a signature.

19. The process of printing from a series of rotary printing elements, on each successive predetermined length of a continuously moving strip of paper during its passage through a machine of a complete form letter including a letterhead, a changeable address, a letter body and a signature.

20. The process of printing on each successive predetermined length of a continuously moving strip of paper during its passage through a machine of matter on the reverse side of each of such lengths, then drying said length, and then printing on the obverse side of each of such lengths a complete form letter including a letterhead, a changeable address, a letter body and a signature.

21. In a machine of the class described, the combination of a frame, a rotary printing unit thereon, a second rotary printing unit on said frame adapted to successively bring different type faced plates to printing position, including magnetic plate holding means, means for stripping such plates from said last means, means for selecting out certain of the plates stripped from said magnetic means, means for imparting rotation to said units, means for disconnecting said last means with the respective printing units, and means for advancing paper past said units.

22. In a machine of the class described, the combination of a frame, a rotary printing unit thereon, a second rotary printing unit on said frame adapted to successively bring different type faced plates to printing position, including magnetic plate holding means, means for stripping such plates from said last means, means for separating the plates stripped from said magnetic means into groups, means for imparting rotation to said units, means for disconnecting said last means with the respective printing units, and means for advancing paper past said units.

23. In a machine of the class described, the combination of a frame, a rotary printing unit thereon, a second rotary printing unit on said frame adapted to successively bring different type faced plates to printing position, including magnetic plate holding means, means for stripping such plates from said last means, means for separating the plates stripped from said magnetic means into groups, means for mounting the groups on members projected therethrough, means for disconnecting said last means with the respective printing units, and means for advancing paper past said units.

24. In a machine of the class described, the combination of a frame, a rotary printing unit thereon, a second rotary printing unit on said frame adapted to successively bring different type faced plates to printing position, including magnetic plate holding means, means for stripping such plates from said last means, means for separating the plates stripped from said magnetic means into groups, means for mounting the groups on members projected therethrough, by the advancing movement of the plates, means for disconnecting said last means with the respective printing units, and means for advancing paper past said units.

25. In a machine of the class described, the combination of a frame, a rotary printing unit thereon, a second rotary printing unit on said frame adapted to successively bring different type faced plates to printing position, including magnetic plate holding means, means for stripping such plates from said last means, means for separating the plates stripped from said magnetic means into groups, said means being adjustable for determining the plates selected for the different groups, means for mounting the groups on members projected therethrough, means for disconnecting said last means with the respective printing units, and means for advancing paper past said units.

Des Moines, Iowa, July 14, 1920.

ERVIN E. STRAWN.