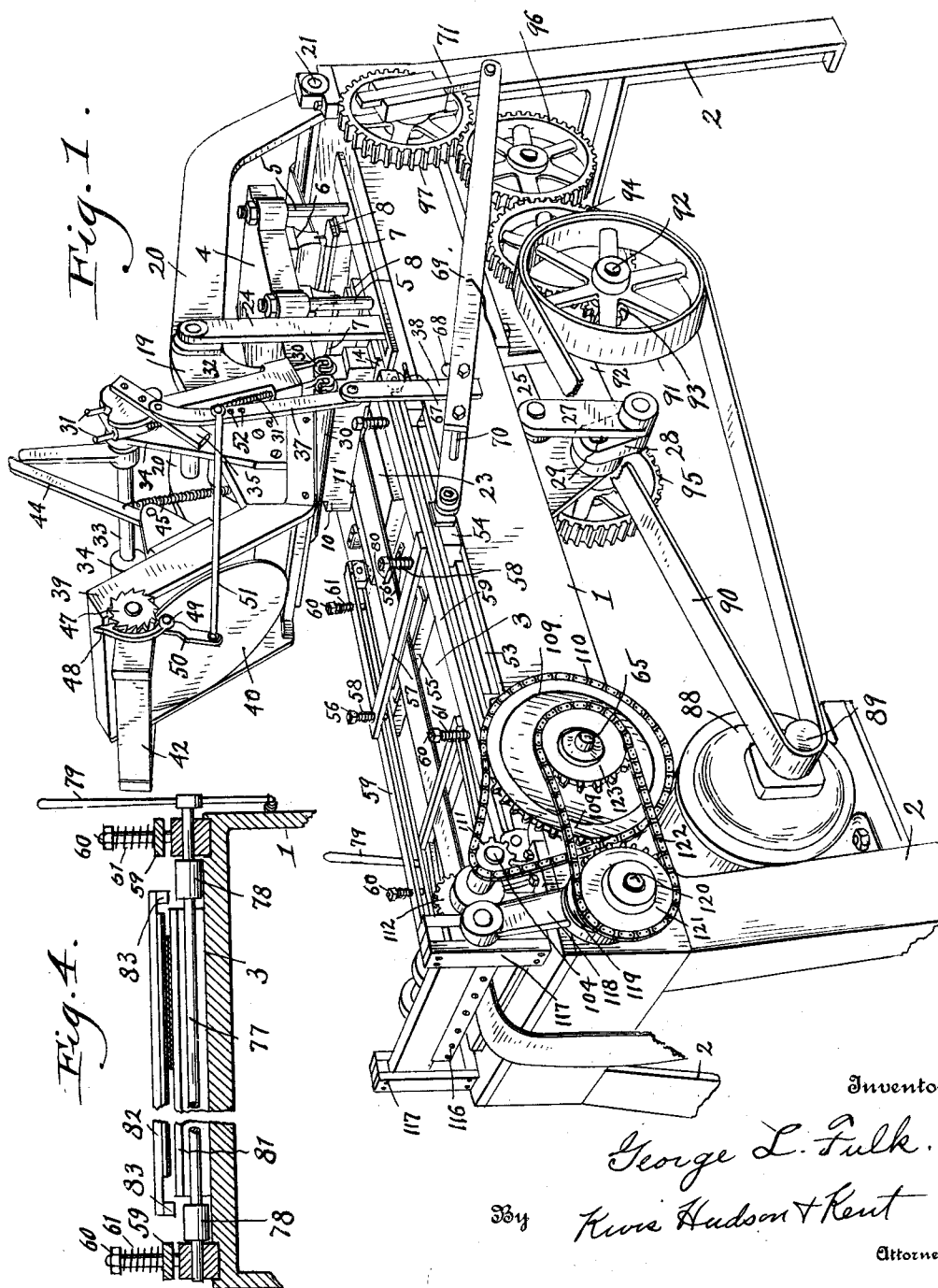


June 24, 1930.

G. L. FULK
MACHINE FOR PERFORMING PRINTING, PERFORATING,
AND OTHER OPERATIONS ON STRIP MATERIAL
Filed Nov. 3, 1927

1,765,414

3 Sheets-Sheet 1



Inventor

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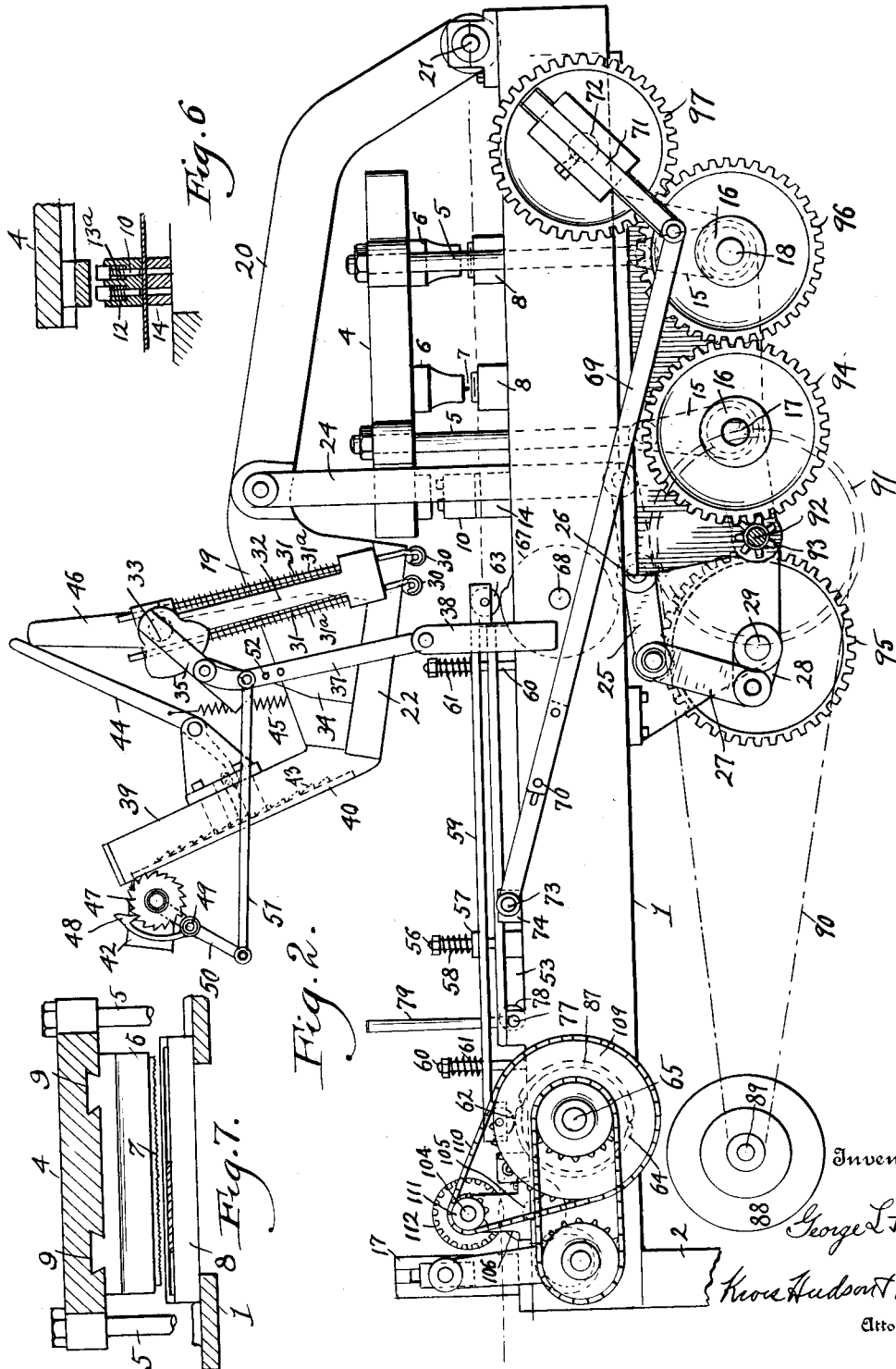
Attorneys

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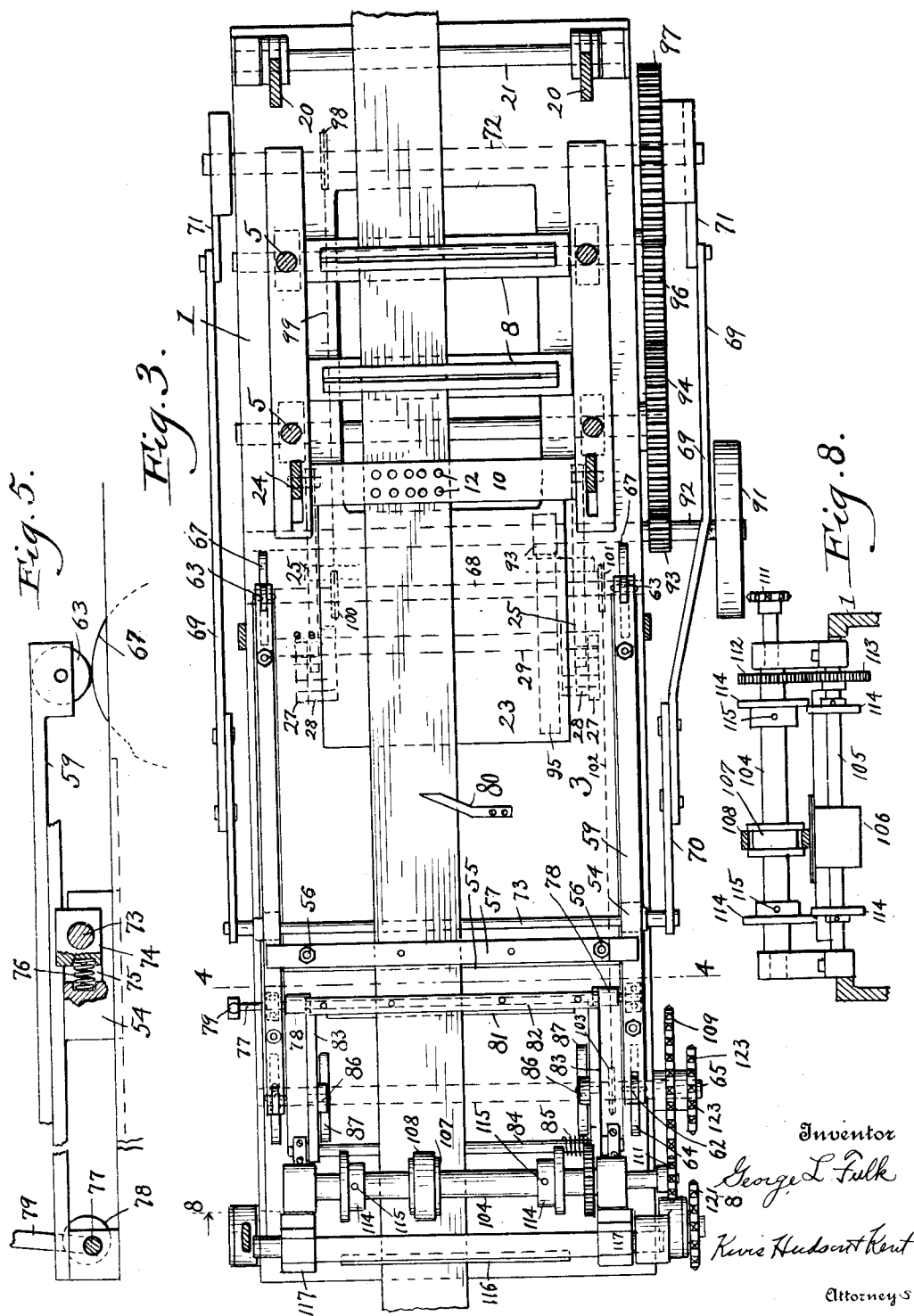
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3 Sheets-Sheet 3



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UNITED STATES PATENT OFFICE

GEORGE L. FULK, OF CLEVELAND HEIGHTS, OHIO, ASSIGNOR, BY MESNE ASSIGNMENTS,
TO BONNAR-VAWTER FANFORM COMPANY, INC., OF CLEVELAND, OHIO, A COR-
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MACHINE FOR PERFORMING PRINTING, PERFORATING, AND OTHER OPERATIONS ON
STRIP MATERIAL

Application filed November 3, 1927. Serial No. 230,732.

This invention relates to a machine for performing printing, perforating and other operations on strip material and is designed particularly for use in the manufacture of printed manifold forms.

In the manufacture of manifold forms, the forms are ordinarily printed in transverse rows upon a wide sheet of paper in a cylinder press and the sheet is then folded along longitudinal lines to superimpose the sheets of each form one upon another. The folded strip must then be either perforated transversely or cut apart between forms and in most cases the individual forms must have holes punched through them for filing purposes. Also in some instances, the edges of the folded strip must be trimmed to free the sheets of the forms from each other.

Different printed matter specified by the particular concern for whom the forms are made is required for each job and this makes it necessary to remove the printing cylinders from the press and replace them with another set of cylinders for each job. Standard forms in many instances differ only in the printed matter upon the top sheet of the form and it will be apparent that if a special machine were to be provided which is capable of properly printing the distinctive matter upon the top leaf of the folded strip considerable saving could be effected by employing the large cylinder press for printing only the matter common to a number of different forms and subsequently printing the distinctive subject matter upon the top leaf of the folded strip, thus avoiding frequent changing of the cylinders of the large press and enabling a reserve supply of printed and folded forms to be carried in stock. There are, however, a number of serious difficulties to be overcome in such a subsequent printing operation and in so far as I am aware, the large cylinder press has always prior to the present invention been used to print the entire subject matter on the forms and it has consequently been necessary to provide a new set-up on the large press for each job.

The present invention has for its object to provide a simple and relatively inexpen-

sive machine which is capable of rapidly performing any or all of the above mentioned finishing operations upon a folded strip of forms.

In perforating, cutting or printing the folded strip subsequently to the original printing and folding operations, it is essential that the proper spacing be maintained and the performance of these operations in a continuously operating machine is made exceedingly difficult by shrinkage of the paper and by reason of the impossibility of maintaining perfectly uniform spacing in the original printing on the strip throughout the length of a large roll of paper.

One of the main objects of the present invention is to provide a manually controlled power operated feed device for the combined machine of the present invention by which the operations performed on the strip may be at all times maintained in proper spaced relation with respect to the original printed matter on the strip regardless of lack of uniformity in the spacing of this printed matter due to shrinkage of the paper, lack of uniformity in the original printing and other causes.

A further object is to provide a strip feeding means by which the portions of the folded strip acted upon in the machine are maintained flat upon the bed of the machine and taut during each operation performed upon the strip.

A further object is to provide a machine which can be quickly adjusted to perform any or all of the above mentioned finishing operations during the passage of a folded strip therethrough.

A further object is to provide a machine which may be quickly adapted to perform the desired operations upon strips of different widths and upon strips having forms of different width and length.

With the above and other objects in view the invention may be said to comprise the machine as illustrated in the accompanying drawings hereinafter described and particularly set forth in the appended claims, together with such variations and modifications thereof as will be apparent to one

skilled in the art to which the invention appertains.

Reference should be had to the accompanying drawings forming a part of this specification, in which:

Fig. 1 is a perspective view looking downwardly toward a front corner of the machine;

Fig. 2 is a side elevation of the machine;

Fig. 3 is a top plan view of the machine with the perforator and printing heads omitted;

Fig. 4 is a transverse section taken on the line indicated at 4—4 in Fig. 3;

Fig. 5 is a fragmentary detail view showing the strip feeder slide in side elevation;

Fig. 6 is a sectional detail view showing one of the punches;

Fig. 7 is a transverse section through the perforating head; and

Fig. 8 is a transverse section taken on the line 8—8 of Fig. 3.

Referring to the accompanying drawings, the machine is supported with an elongated supporting frame 1, provided with supporting legs 2 and a bed 3 extending the full length thereof. At the rear end of the frame there is mounted directly over the bed a vertically movable head 4 which is supported on vertical guide rods 5 which are slidably mounted in the frame. One or more transverse cross bars 6 are mounted upon the under side of the head 4 and these bars carry serrated perforating plates 7 which coact with stationary dies 8 mounted upon the bed of the machine. The perforating plates 7 serve to form transverse lines of perforations across the strip between successive forms and in order that the lines of perforations may be properly spaced and to adapt the machine for different lengths of forms, the cross bars 6 are adjustably mounted in ways 9 formed on the under side of the head 4 so that they may be adjusted to the desired position beneath the head. Beneath the forward portion of the head 4 a cross bar 10 is rigidly secured to the frame and extends across the bed, the bar 10 being provided centrally thereof with a notch 11 on its under side through which the folded strip is guided. The bar 10 is provided with a series of vertical apertures 12 each adapted to receive a punch 13 which projects above the top of the bar and is normally held in its uppermost position clear of the strip by a spring 13^a. Secured to the bed beneath the bar 10 is a stationary die 14 with which the punch or punches carried by the bar 10 cooperate, the strip being fed between the bars 10 and 14 and the punches being operated by the head 4 upon its downward movement. The head 4 is reciprocated during the operation of the machine by means of connecting rods 15 which are pivotally connected at their

upper ends to the vertical guide rods 5 which support the head and which are mounted at their lower ends upon an eccentric 16 which are fixed to transverse shafts 17 and 18. The folded strip of forms is intermittently fed through the machine as will be hereinafter explained in detail and during the intervals between the movements of the strip, the head 4 moves downwardly to form the transverse perforated lines and to operate the punches 13 to punch the holes in the forms.

Immediately in advance of the head 4 there is mounted a printing head 19 which also moves up and down away from and toward the bed 3. The head 19 is carried by rearwardly extending arms 20 which are pivoted at 21 to the rear end of the frame and the head 19 carries a platen 22 which is adapted to carry the printing plates, the bed being provided beneath the platen 22 with a bed plate 23 upon which the strip rests during the printing operation. The head 19 is constantly reciprocated during the operation of the machine by means of connecting rods 24 pivoted at their upper ends to the arms 20 and at their lower ends to levers 25 which are pivoted upon a transverse shaft 26, the levers 25 being actuated by links 27 connecting the same to eccentrics 28 carried by a cross shaft 29. The head 19 carries inking rollers 30 which are supported by rods 31 extending upwardly on opposite sides of the head and yieldingly pressed against the platen 22 by means of springs 31^a acting on the rods 31. The rods 31 are carried by a rock shaft 33 journaled in the upper ends of brackets 34 attached to the head 19. Fixed to the rock shaft 33 at one side of the frame there is a forwardly extending arm 35 which is connected by a link 37 to the upper end of a post 38 fixed to the side of the frame 1 so that the movement of the head causes the rollers 30 to travel over the face of the platen 22 to apply ink to the plates on the platen.

The head 19 is provided with an upwardly extending forwardly inclined extension 39 upon which is mounted an inking disk 40 which receives ink from a suitable inking receptacle 42 carried by the extension 39 at the upper end thereof. The swinging movement of the arms 32 during the upward and downward movement of the head 19 is such as to cause the rollers 30 to move from the position shown in Fig. 2 across the face of the platen 22 and upwardly over the face of the disk 40 during the downward movement of the head and to move back over the disk 40 and the face of the platen 22 to the position shown in Fig. 2 during the upward movement of the head. The disk 40 is provided on its rear face with ratchet teeth 43 which are engaged by a pawl lever 44 which is actuated by spring 45 in a direc-

tion to impart a turning movement to the disk. The arm 44 is engaged during the movement of the head 19 by an arm 46 on the rock shaft 33, the movement of the arm 46 being such that upon the downward movement of the head 19, the arm 46 moves away from the arm 44 and permits the spring 45 to actuate the lever 44 in a direction to turn the disk 40. During the upward movement of the head, the arm 46 is rocked toward the lever 44 and moves the lever in opposition to the spring 45 to shift the pawl end of the lever into engagement with another ratchet tooth on the disk 40. The disk 40 is thus intermittently turned during the operation of the printing head. The ink receptacle 42 is provided with the usual ink feed roller to which is attached a ratchet 47 which is engaged by a pawl 48 pivoted at 49 and having an extending arm 50 which is connected by a connecting rod 51 to the link 37 so that during each reciprocation of the head, the ratchet 47 is advanced one tooth. The link 37 is preferably provided with a series of spaced holes 52 so that the connection between the link 37 and the connecting rod 51 may be adjusted to obtain the proper amount of movement for the actuating pawl 48.

The operation of the printing head 19 is substantially simultaneous with that of the head 4 so that the printing as well as the punching and perforating is performed during the intervals in which the folded strip is at rest. A reciprocating feed device is provided for imparting the proper amount of longitudinal movement to the strip in the intervals between the perforating, punching and printing operations and this feed mechanism will now be described.

The frame 1 is provided along opposite sides thereof with guide ways 53 in which is mounted a transverse slide 54 which has fixed thereto a lower clamping bar 55 which extends across the bed and slides beneath the folded strip. The bar 55 carries vertical pins 56 which project upwardly therefrom and slidably mounted on these pins is an upper clamping bar 57 which is pressed downwardly toward the bar 55 by springs 58 carried by the pins 56. The upper clamping bar 57 rests at its opposite end upon longitudinally extending bars 59 which are slidably mounted upon vertical pins 60 fixed to the side members of the frame and projecting upwardly therefrom, the bars 59 being pressed downwardly by springs 61 carried by the pins 60. The bars 59 are provided at their front and rear ends with rollers 62 and 63, the rollers 62 resting upon cams 64 carried by a transverse shaft 65 and the rollers 63 being supported upon cams 67 carried by a transverse shaft 68. The cams 64 and 67 each have two semi-circular portions of different diameters and

are rotated in unison so that during one-half of the revolution, the rollers 62 and 63 are resting upon the smaller portions of the cam and during the remainder of the revolution upon the larger portions of the cams. When the rollers 62 and 63 are resting upon the larger portions of the cams, the bars 59 are raised and the clamping bar 57 is held against the pressure of the spring 58 out of contact with the strip. The cams 64 and 67 are driven at a speed such that during the forward stroke of the slide 54, the bars 59 are in their lowermost position and the clamping bar 57 is held against the paper strip clamping the same upon the bar 55 so that during the forward stroke of the slide, the strip is pulled forward. When the slide reaches its forward limit of travel, the rollers 62 and 63 ride up onto the larger portions of the cams lifting the bars 59 and clamping bar 57 to release the strip while the slide is on its return stroke.

The slide 54 is actuated by means of connecting rods 69 extending from the slide rearwardly along opposite sides of the frame and connected at their rear ends to cranks 71 which are mounted for radial adjustment upon a transverse shaft 72. The connecting rods 69 are made in sections connected by a telescopic joint 70, the radial adjustment of the cranks 71 together with the telescopic adjustment of the connecting rods 69 enables the stroke of the slide to be adjusted to any desired length, as is desirable to adapt the machine to operate upon strips in which the forms are of different lengths. The connecting rods 69 are connected to the slide 54 by means of pivots 73 which are carried by blocks 74 slidably mounted in notches 75 in the slide 54 at opposite ends thereof. The notches 75 permit a slight amount of play between the connecting rods and the slide and these blocks are normally held against the rear ends of the notches 75 by means of compression coil springs 76 so that the movement of the slide normally corresponds to the stroke of the connecting rod. Adjacent the forward limit of movement of the slide there is mounted a cross shaft 77 which extends between the side members of the frames immediately above the bed 3. This cross shaft has a pair of cams 78 thereon adjacent the ends thereof which lie in the path of movement of the slide. At one end the shaft 77 has attached thereto a hand lever 79 by means of which the operator may adjust the positions of the cams. The cams 78 are so positioned that by turning the lever 79, they may be moved to a position overlapping the stroke of the slide so that the slide will engage with the cams and be stopped slightly short of its normal forward limit of movement, the springs 76 permitting the slide to stop and the connecting rod

to move through its normal cycle. By adjusting the cams 78, small adjustments may be made in the stroke of the feeder slide to vary the extent of movement of the strip and compensate for slight variations in the spacing of the printed matter on the forms. A pointer 80 is rigidly attached to the frame and projects over the strip in a position to register with a selected line of printed matter on the forms. Each time the strip comes to rest, the operator can see how closely the selected line of printed matter aligns with the pointer 80 and if the printed matter is slightly offset with respect to the pointer, he can move the lever 79 forwardly or rearwardly to lengthen or shorten the stroke and maintain proper registration of the forms with the perforating, punching and printing devices.

Immediately to the front of the cross shaft 77, there is mounted a holding clamp which comprises a lower bar 81 fixed to the bed of the machine and a movable upper bar 82 carried by arms 83 pivoted on a cross shaft 84 and normally pressed in a downward direction by springs 85. The arms 83 carry rollers 86 which travel on cams 87 fixed to the cross shaft 65. The cams 87 are identical with the cams 64 except that they are oppositely positioned so that the arms 83 are lowered as the bars at 59 are raised causing the strip to be gripped between the bars 81 and 82 and held against movement while the slide 54 is being returned to its rearmost position and while the printing, punching and perforating operations are being performed.

The entire mechanism of the machine is operated by an electric motor 88 mounted beneath the forward portion of the frame and having a shaft 89 which drives a belt 90 extending over a pulley 91 carried by a transverse shaft 92 rearwardly of the motor. The shaft 92 is located midway between the shafts 29 and 17 and has a pair of small gears 93 thereon one of which meshes with a large gear 94 on the shaft 17 and the other of which meshes with a large gear 95 on the shaft 29. The gear 94 meshes with a gear 96 of the same size on the shaft 18, so that the eccentrics 16 are driven at the same speed, and the gear 96 with a gear 97 on the crankshaft 72, which operates the feeder slide. The shaft 72 has a sprocket 98 thereon which drives a sprocket chain 99 which runs over a sprocket 100 on the cam shaft 68. The cam shaft 68 has a second sprocket 101 which drives a sprocket chain 102 which extends over a sprocket 103 on the cam shaft 68, the sprockets 101 and 103 being of the same size so that the two cam shafts 65 and 68 are driven in the same direction and at the same speed. The shafts 17, 18, 29, 72, 65 and 68 are all driven at the same speed and the eccentrics carried by the shafts

17, 18, 29, and 72 are so disposed that the heads 4 and 19 and the slide 54 are operated in the proper timed relation. Adjacent the discharge end of the frame, there is mounted a pair of shafts 104 and 105, one above the path of travel of the strip, and one below. The lower shaft 105 has fixed thereto a feed roller 106 which has a smooth peripheral surface over which the strip passes. The upper shaft 104 has keyed thereto a pulley 107 upon which is loosely and rotatably mounted a ring 108 of friction material such as rubber. The lower roller 106 is positively driven while the friction ring 108 is free to turn with respect to the pulley 107 and is driven by frictional engagement with the strip. The shaft 65 carries a sprocket 109 which drives a sprocket chain 110 which passes over a sprocket 111 fixed to the shaft 104. The shaft 104 has fixed thereto a gear 112 which meshes with the gear 113 on the shaft 105 so that the shafts 104 and 105 are driven in opposite directions, the shaft 105 being driven in a direction to feed the strip forwardly. The smooth roller 106 maintains a tension on the strip to keep the strip taut and prevent any buckling of the strip in the machine but does not have sufficient frictional engagement with the paper to prevent its slipping freely when the strip is held by the holding clamp. The friction ring 108 exerts a slight pressure upon the strip by its weight so that the smooth roller 106 can exert the necessary pull upon the strip while it is released from the holding clamp.

It is sometimes desirable to trim the longitudinal edges of the folded strip to sever the superimposed leaves of the forms from each other and this is accomplished by means of rotating trimmer knives 114 keyed to the shafts 104 and 105. These knives may be adjusted to the proper position with respect to the strip and are held in adjusted positions by means of set screws 115. When the knives 114 are in operation, they engage with the periphery of the feed roller 106 and act to trim off the edges of the strip.

At the discharge end of the machine there is mounted a vertically reciprocable shear blade 116 which slides in vertical standards 117 fixed to the forward end of the frame. The opposite ends of the shear blade 116 are attached to connecting rods 118 which are supported at their lower ends on eccentrics 119 carried by a cross shaft 120. The shaft 120 may be driven from the shaft 65 through a sprocket 121 on the shaft 120, a sprocket chain 122 and a sprocket 123 on the shaft 65.

The machine may perform all of the above described operations upon a strip passing through the same or, if desired, it may be adapted to perform only some of the operations. The perforating bars and punches are removable and in cases where

the punching and perforating operations are not desired, the perforating bars and punches may be omitted. If it is desired to omit the printing operation, all that is necessary is to disconnect the link 27 from the eccentric 28 and prop the head 19 in its uppermost position. The trimmer knives 114 are simply adjusted to positions adjacent the ends of the shaft 104 so that the strip can pass freely between them when the trimming operation is omitted. The shear blade 116 may be rendered inoperative by disconnecting the sprocket chain 102. Obviously, any desired combination of the operations which the machine is designed to perform may be performed upon a given strip of material passing through the machine.

Although a preferred embodiment of the invention has been shown and described, it should be understood that the invention is not to be limited thereto except in so far as the appended claims so limit it.

Having thus described my invention, what I claim is:

1. In a machine of the character described, a supporting frame having a bed extending longitudinally thereof, a plurality of heads mounted for vertical movement above the bed and arranged one in advance of the other, means carried by one head for forming lines of perforations across the strip, means carried by the other head for printing upon the strip, a bar extending across said bed, punches carried by said bar in the path of movement of one of said heads, and means for simultaneously reciprocating said heads.

2. In a machine of the character described, a supporting frame having a bed extending longitudinally thereof adapted to support a paper strip, a slide mounted for movement longitudinally of the bed, said slide having upper and lower gripping members between which the strip extends, means for reciprocating said slide, means operable during forward movement of the slide for pressing said gripping members together to grip the strip, means for holding said gripping members apart during the return movement of the slide and for holding the strip against movement during return movement of the slide, the time intervals between forward movements of the strip affording an opportunity for performing operations upon the paper at spaced points along the length of the strip, means for indicating the extent of feed movement of the strip, and manually controlled means operable during actuation of the slide for varying the extent of movement thereof.

3. In a machine of the character described, a supporting frame having a bed extending longitudinally thereof adapted to support a paper strip, means including a reciprocating slide for intermittently ad-

vancing said strip, means for reciprocating said slide, and manually controlled means operable during movements of the slide for varying the extent of movement thereof.

4. In a machine of the character described, a supporting frame having a bed extending longitudinally thereof adapted to support a paper strip, a slide mounted for movement longitudinally of the bed, said slide having upper and lower gripping members between which the strip extends, means for reciprocating said slide, means operable during forward movement of the slide for pressing said gripping members together to grip the strip, means for holding said gripping members apart during the return movement of the slide and for holding the strip against movement during return movement of the slide, means for indicating the extent of feed movement of the strip, a yieldable connection between said slide and the slide reciprocating means, and an adjustable stop member in the path of movement of said slide.

5. In a machine of the character described, a supporting frame, a slide mounted on the frame and having upper and lower gripping members adapted to receive a strip of material between them, means for reciprocating said slide, means operable during movement of the slide in one direction for pressing said gripping members together to grip the strip, means operable during the movement of the slide in the opposite direction for holding said gripping members apart, means for holding the strip against movement while it is released from said gripping members, and manually controlled means operable during movement of the slide for varying the extent of movement thereof.

6. In a machine of the character described, a supporting frame, a slide mounted on the frame and having upper and lower gripping members adapted to receive a strip of material between them, means for reciprocating said slide, means operable during the movement of the slide in the opposite direction for holding said gripping members apart, means for holding the strip against movement while it is released from said gripping members, a yieldable connection between said slide and the means for reciprocating the same, a stop in the path of movement of the slide to limit the forward movement thereof, and a hand lever connected to the stop for shifting the same to vary the extent of movement of the slide.

7. In a machine of the character described, a supporting frame, a slide mounted on the frame and having upper and lower gripping members adapted to receive a strip of material between them, means including an eccentric and connecting rod for reciprocating said slide, a spring interposed between

- said connecting rod and slide, a spring acting on one of said gripping members to press the same toward the other, means for holding said gripping members apart in opposition to the spring during movement of the slide in one direction, a rotatably mounted cam in the path of movement of said slide, and manually operable means operably connected to said cam for turning the same to vary the extent of movement of the slide. 70
8. In a machine of the character described, a frame having a bed extending longitudinally thereof, guideways along opposite sides of the bed, a slide mounted in said guideways, said slide having a lower bar extending across said bed and an upper bar mounted for movement toward and from the lower bar and spring pressed toward the same, said bars being adapted to receive a strip of material between them, a pair of bars extending longitudinally of the frame on opposite sides of the bed and beneath opposite ends of the upper bar of the slide, cams supporting opposite ends of said bars, springs pressing said bars downwardly against the cams, means for reciprocating said slide, and means for rotating said cams at a speed such that said longitudinal bars are lifted during movement of the slide in one direction. 75
9. In a machine of the character described, a frame having a bed extending longitudinally thereof, guideways along opposite sides of the bed, a slide mounted in said guideways, said slide having a lower bar extending across said bed and an upper bar mounted for movement toward and from the lower bar and spring pressed toward the same, said bars being adapted to receive a strip of material between them, a pair of bars extending longitudinally of the frame on opposite sides of the bed and beneath opposite ends of the upper bar of the slide, cams supporting opposite ends of said bars, springs pressing said bars downwardly against the cams, means for reciprocating said slide, means for rotating said cams at a speed such that said longitudinal bars are lifted during movement of the slide in one direction, a vertically movable bar extending across the bed beyond the forward limit of movement of said slide, springs for pressing said movable bar downwardly toward the bed to grip the strip, cams for lifting said movable bar to release said strip, and means for rotating said last mentioned cams at a speed such that the strip is alternately gripped and fed forward by the bars of the slide and held against movement while released from the bars of the slide. 80
10. In a machine of the character described, a supporting frame having means thereon for intermittently advancing a strip of sheet material, upper and lower rollers receiving the strip between them, the lower of said rollers having a smooth surface and being continuously driven, the upper of said rollers having a friction surface and being an idler loosely mounted to impose its weight upon the lower roller. 85
11. In a machine of the character described, a supporting frame having means thereon for intermittently advancing a strip of sheet material, means on said frame for marking said strip during each interval between advancing movements of said strip, a pointer fixed to said frame and positioned to extend over said strip whereby after each movement the position of the markings with respect to the pointer may be determined, and manually controlled means operable during movement of the strip advancing means for varying the extent of movement of the strip. 90
12. In a machine of the character described, a supporting frame having a horizontal bed, means for intermittently advancing a paper strip along said bed comprising a slide having means for gripping the paper, paper perforating means including a vertically movable head above the rear end of said bed, printing means including a vertically movable platen in advance of said head, shafts having eccentrics and means operatively connecting the eccentrics to said slide, perforating head and platen, respectively, means for actuating said gripping means to grip the paper during the forward movement of the slide and to release the same during rearward movement of the slide, and means for driving said shaft simultaneously, said eccentrics and connecting means being arranged to move the perforating head and platen downwardly to perforate the paper and print upon the same during the rearward movement of said slide. 95
- In testimony whereof, I hereunto affix my signature. 100
- GEORGE L. FULK. 110
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