April 18, 1939. T. M. AVERY 2,155,353

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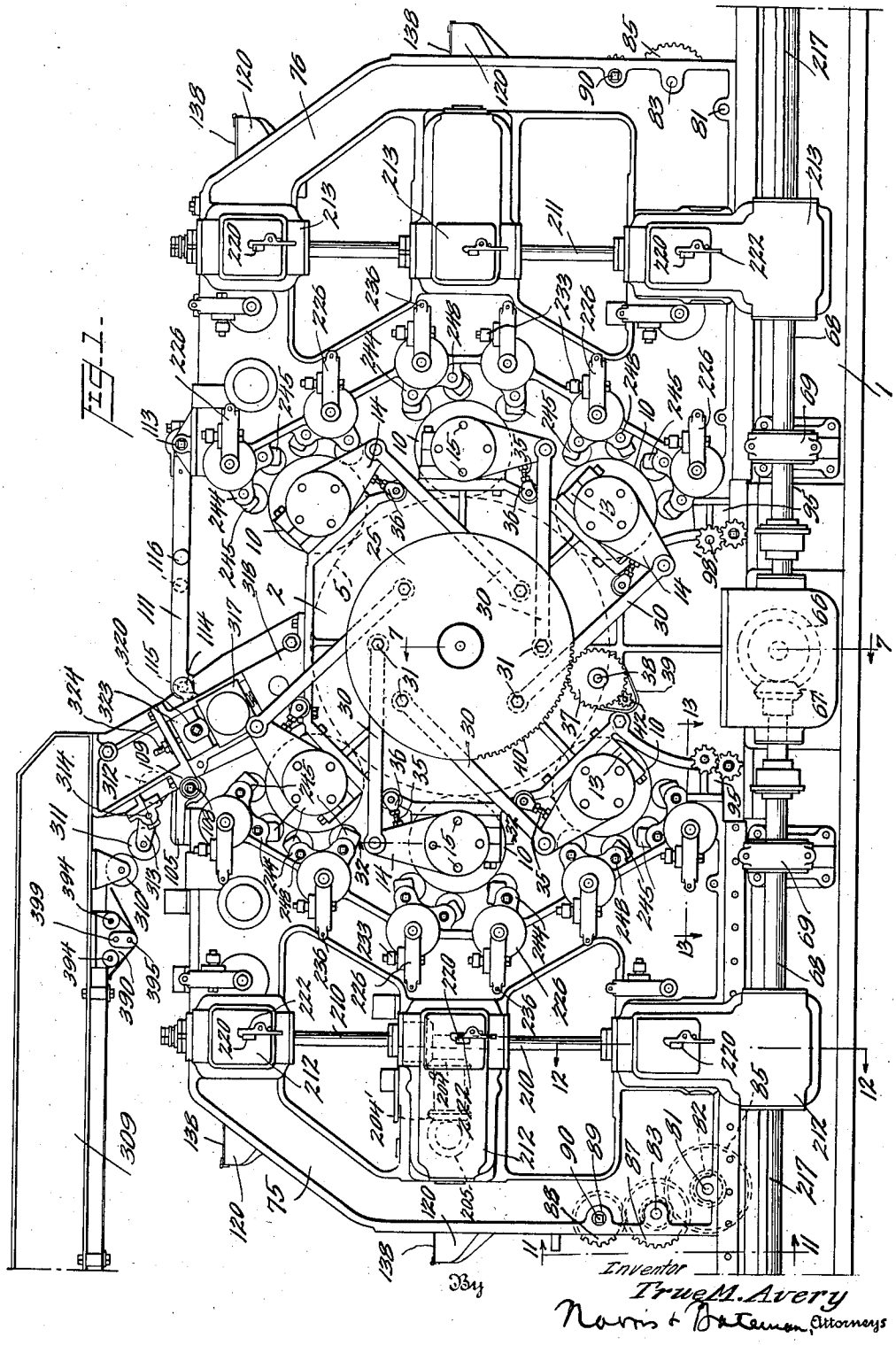

Inventor
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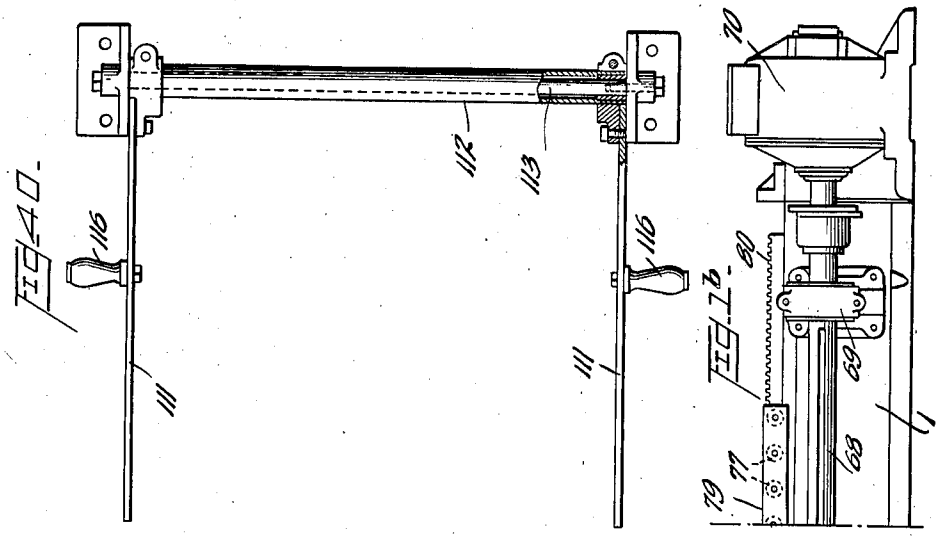

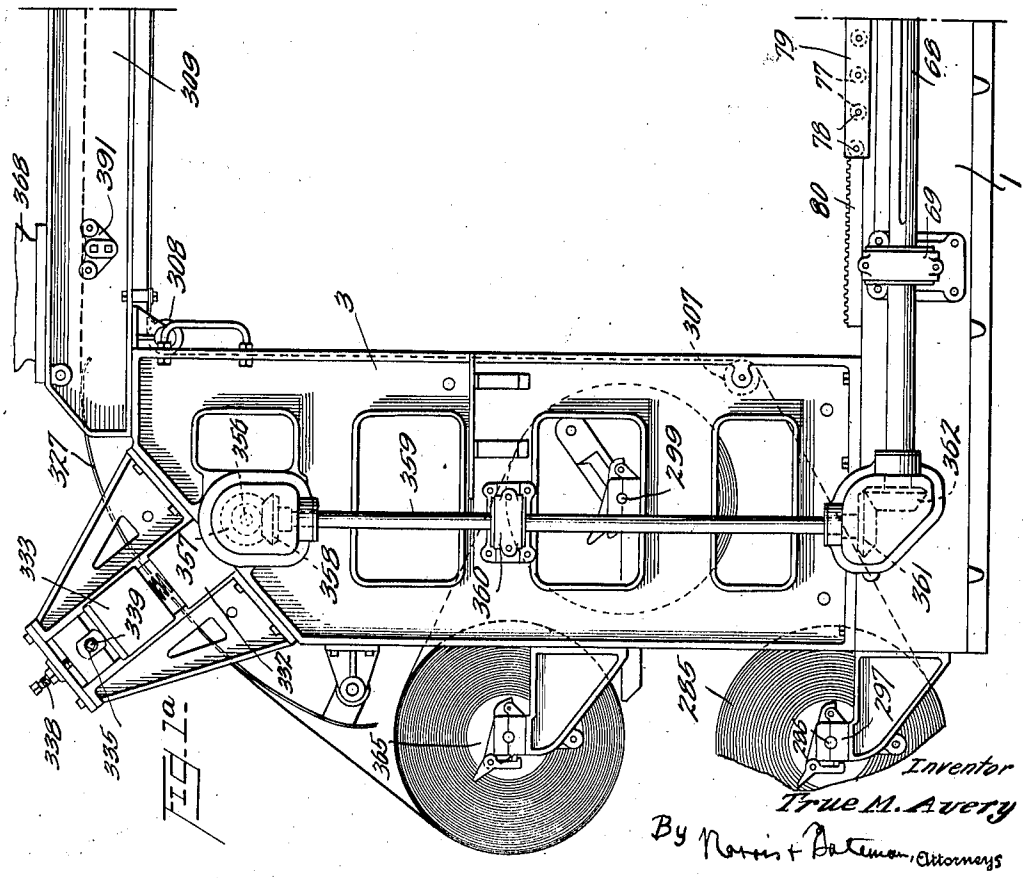

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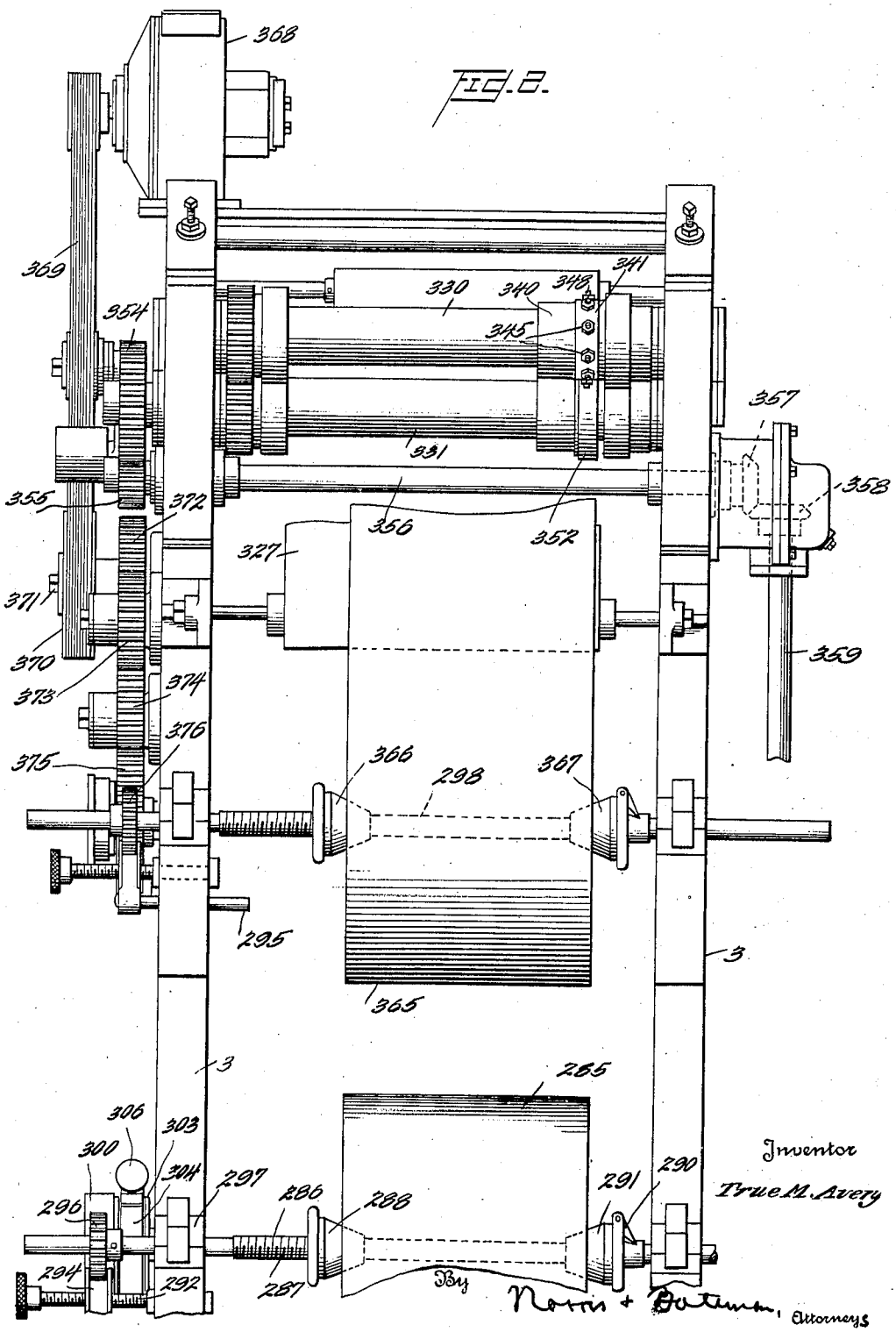
FIG. 2.



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April 18, 1939. T. M. AVERY 2,155,353

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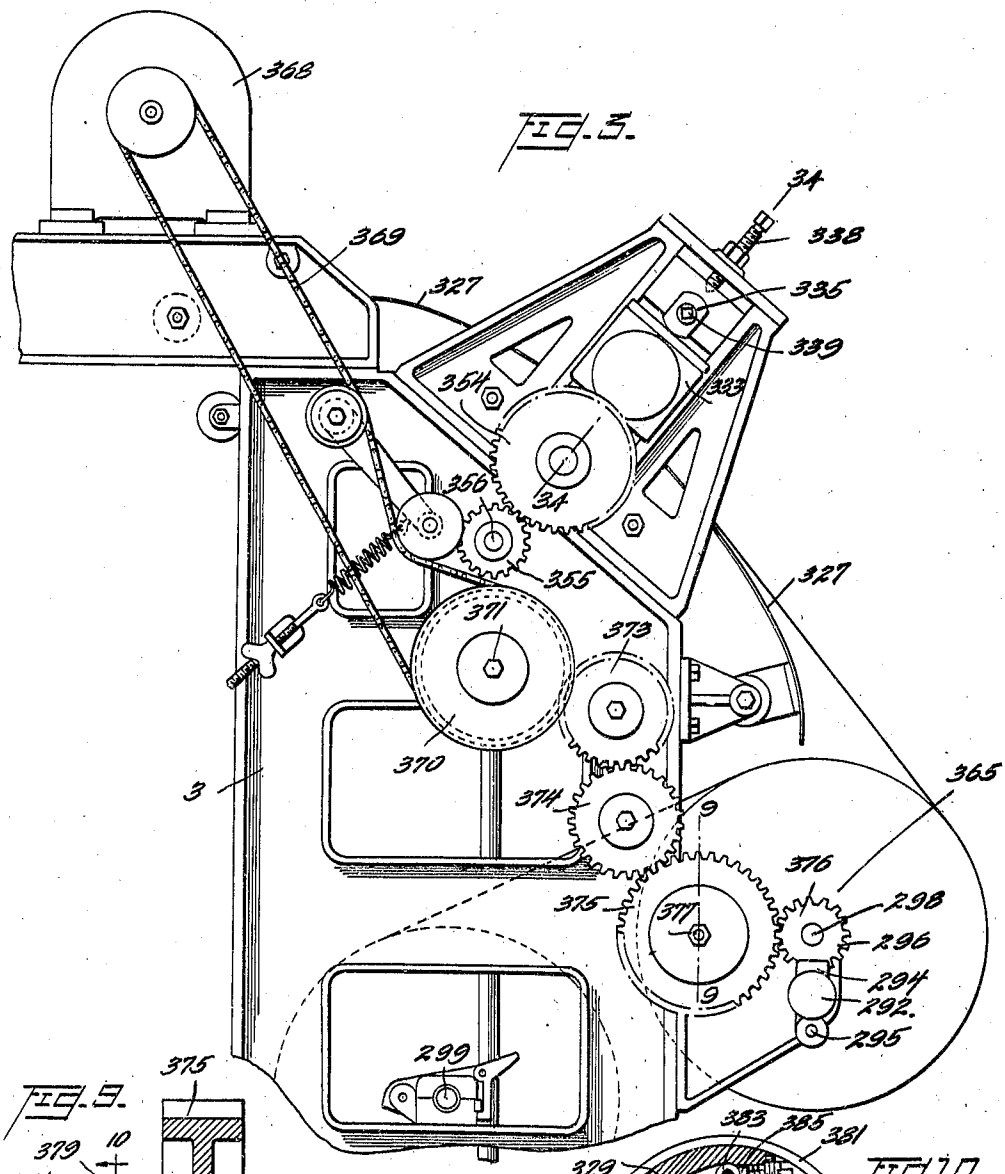

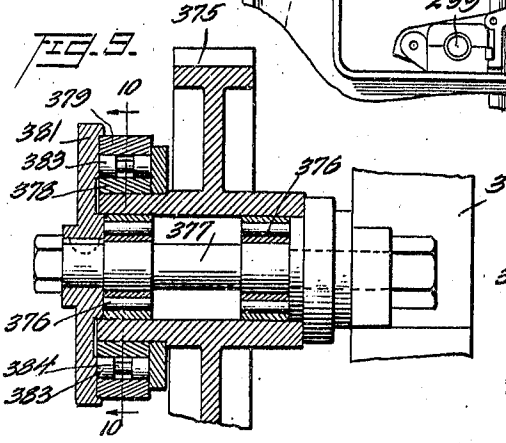

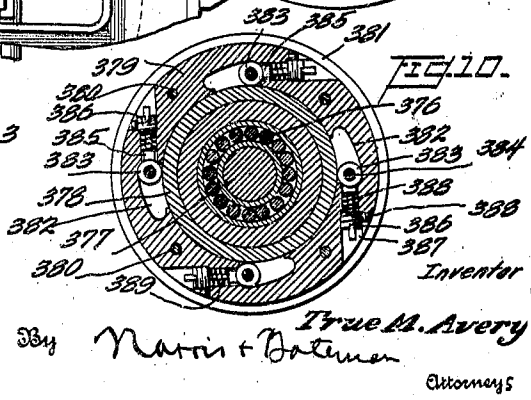

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April 18, 1939. T. M. AVERY 2,155,353

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FIG. 4.

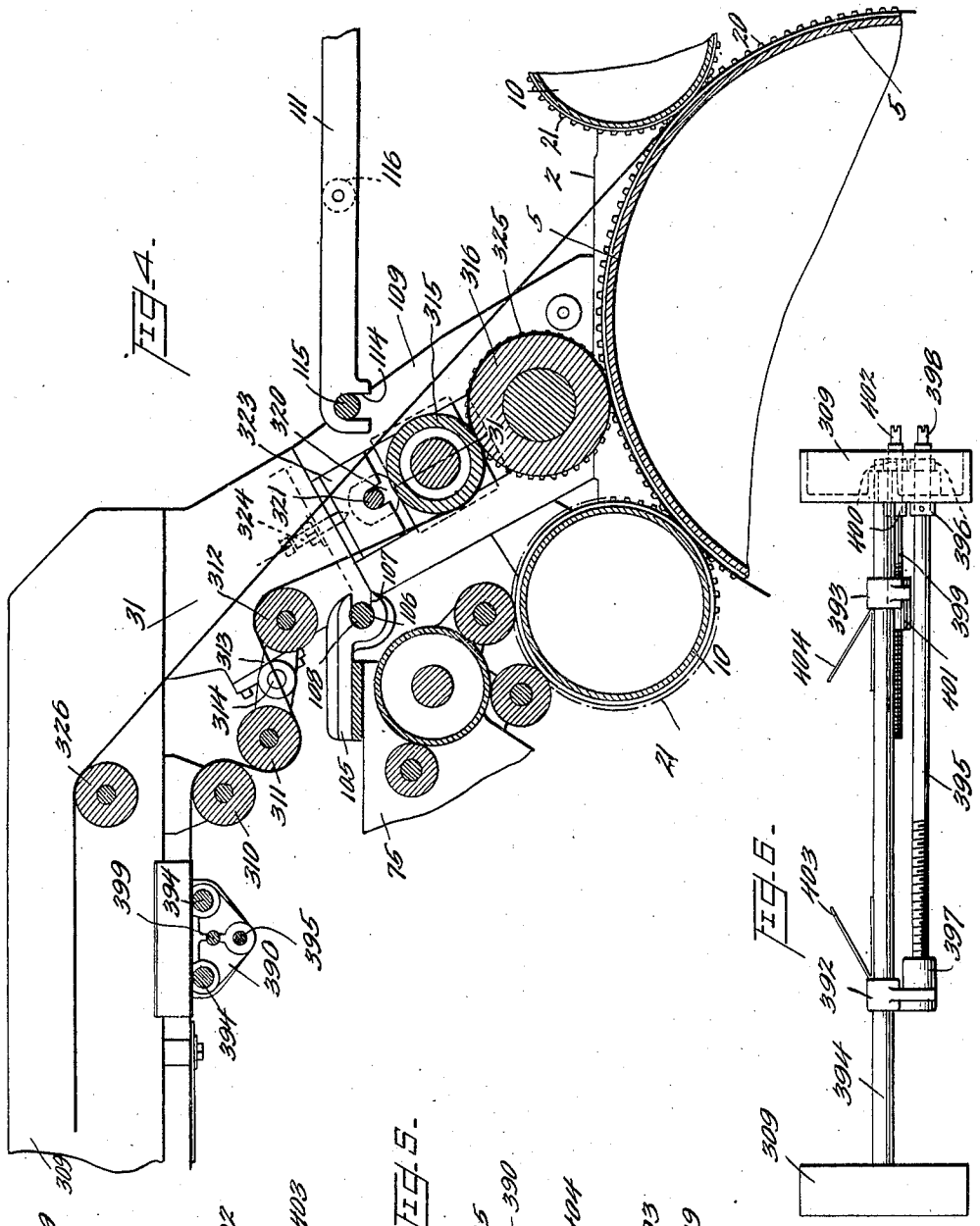
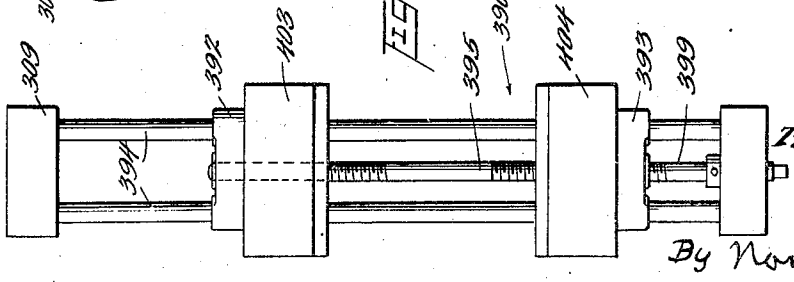


FIG. 6.

FIG. 5.



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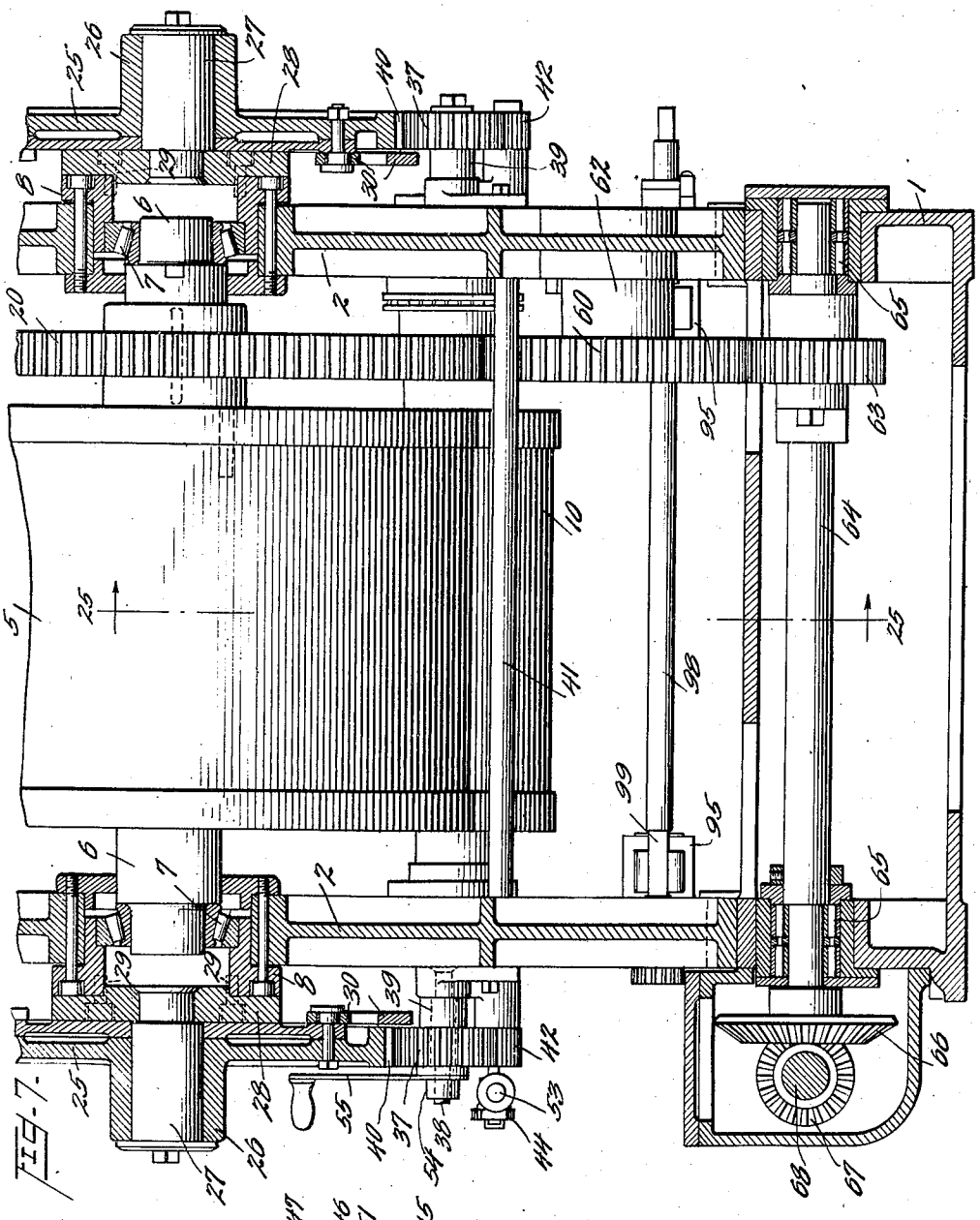

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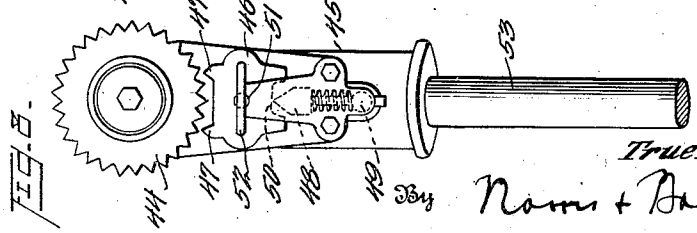

FIG. 8.

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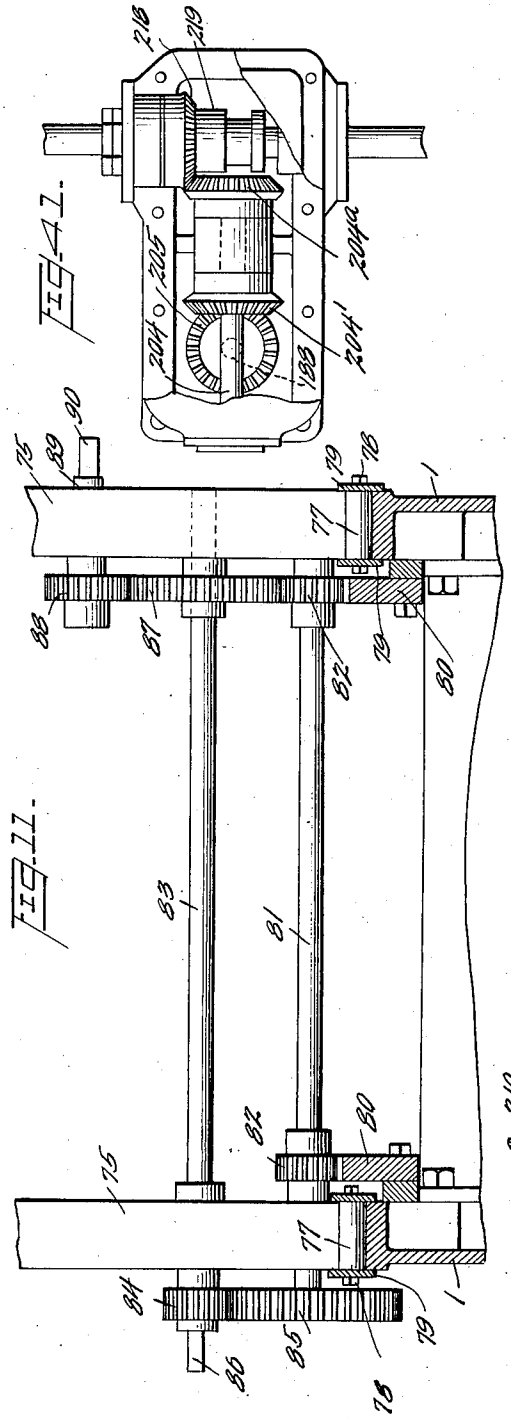

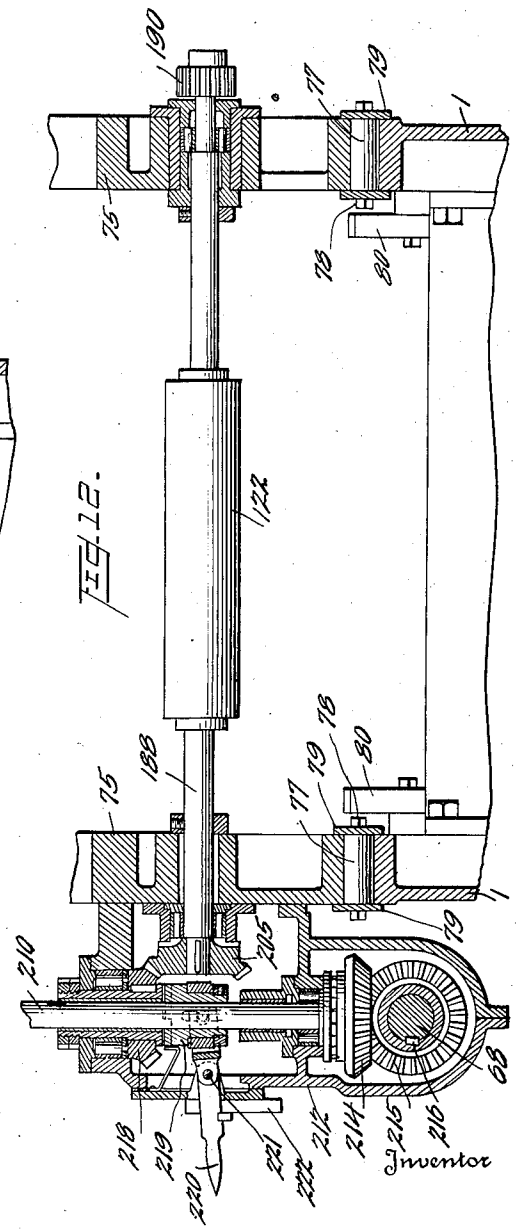

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April 18, 1939. T. M. AVERY 2,155,353

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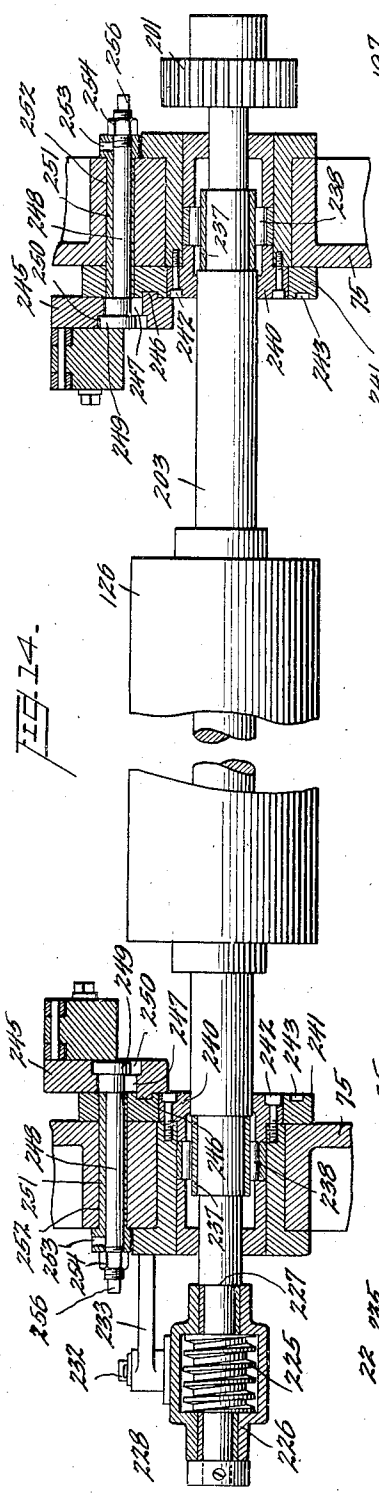

FIG. 14.

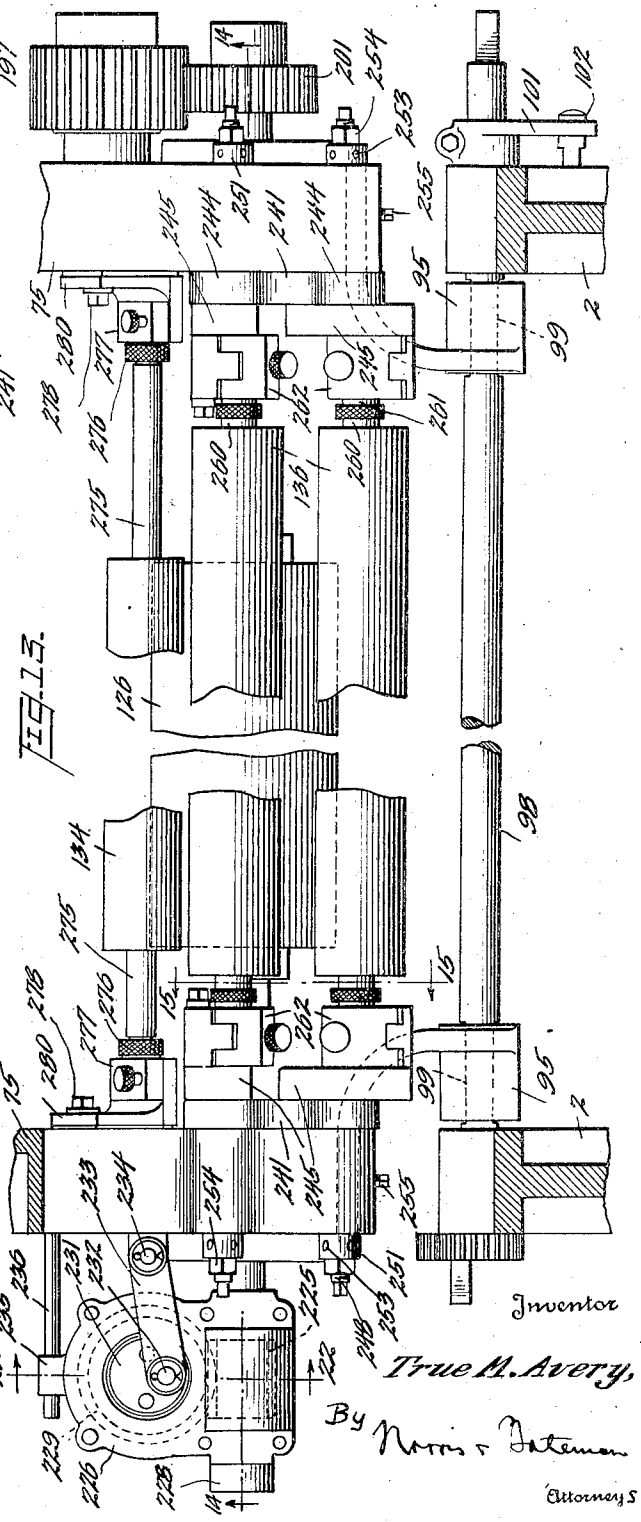

FIG. 13.

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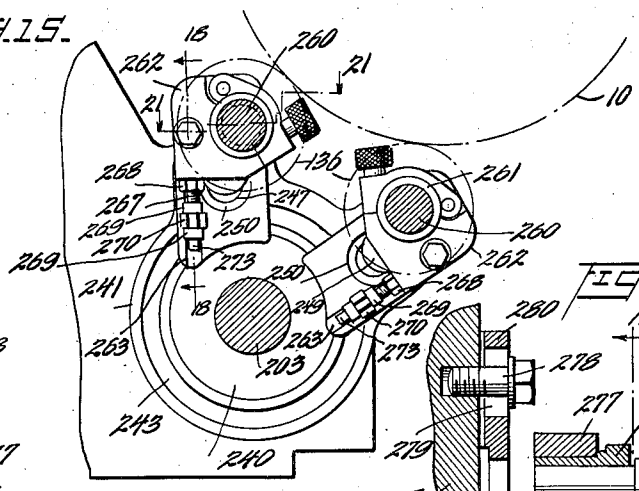
FIG. 15.



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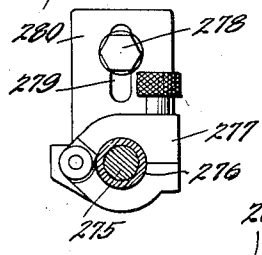

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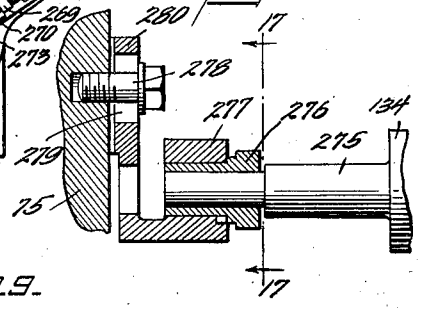
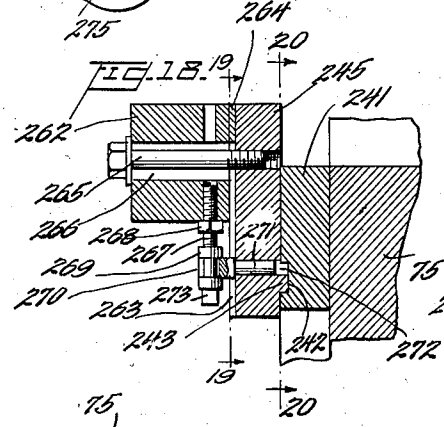


FIG. 18.



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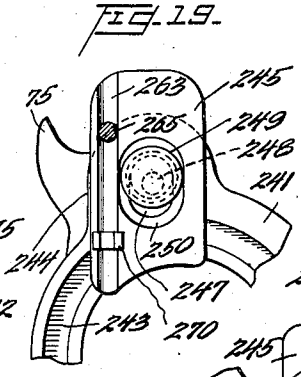

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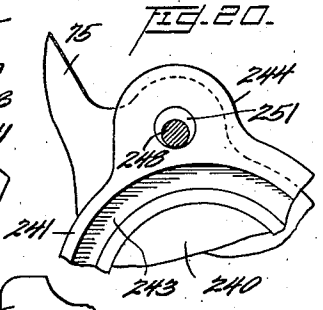

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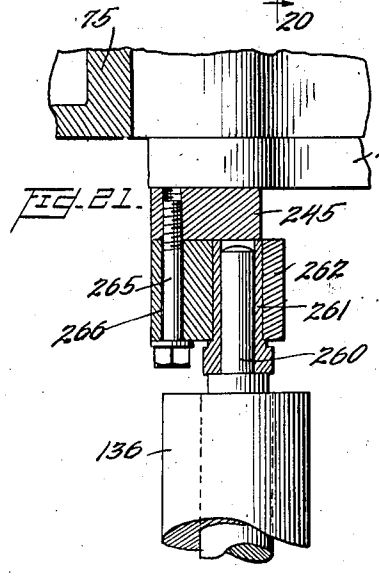

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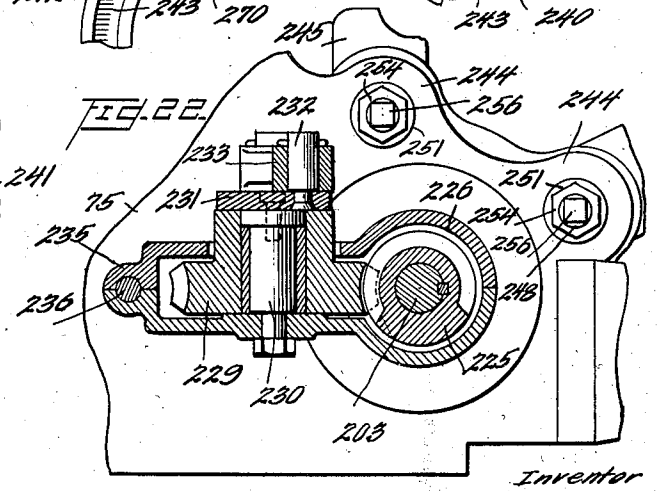

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April 18, 1939. T. M. AVERY 2,155,353

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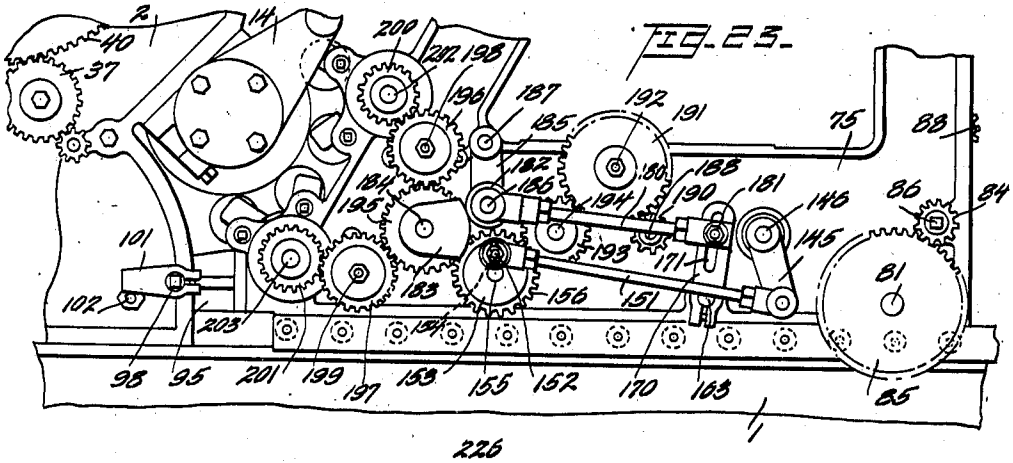
FIG. 23.



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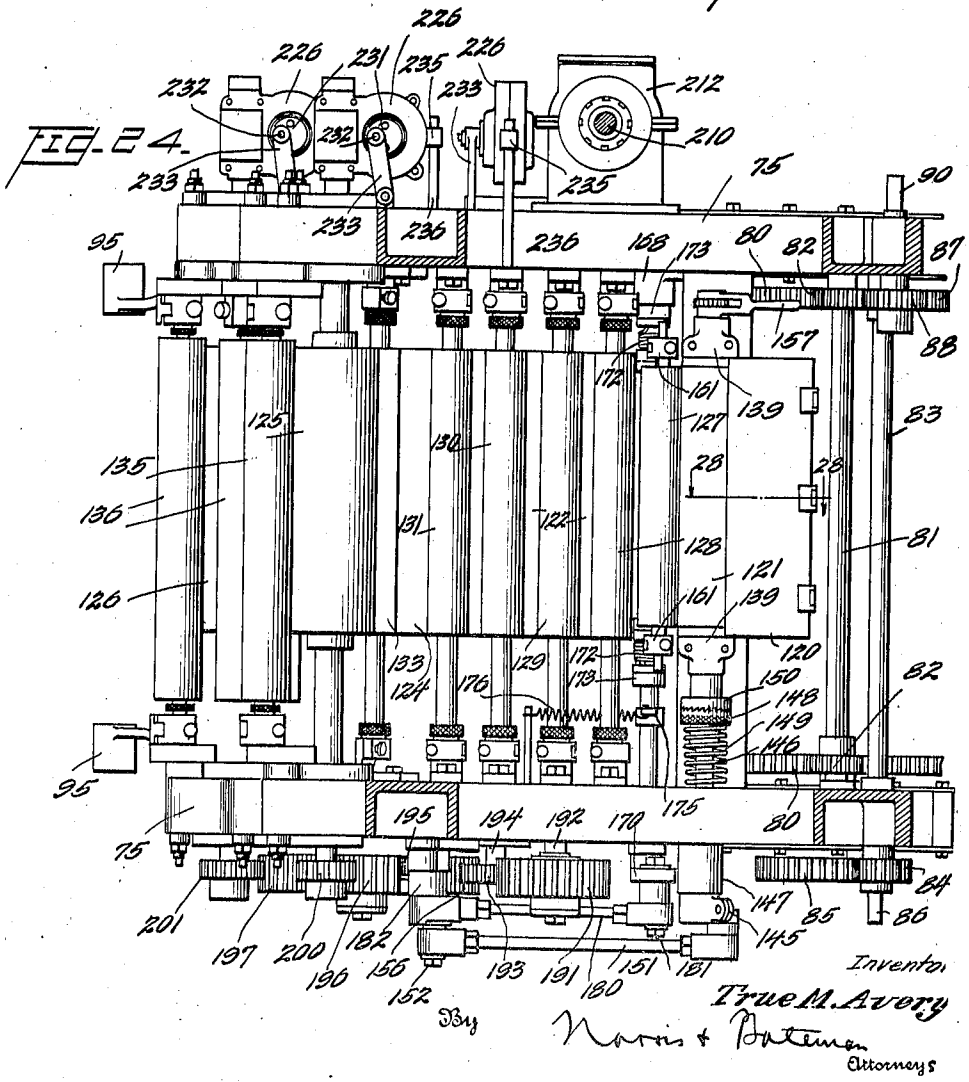

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April 18, 1939. T. M. AVERY 2,155,353

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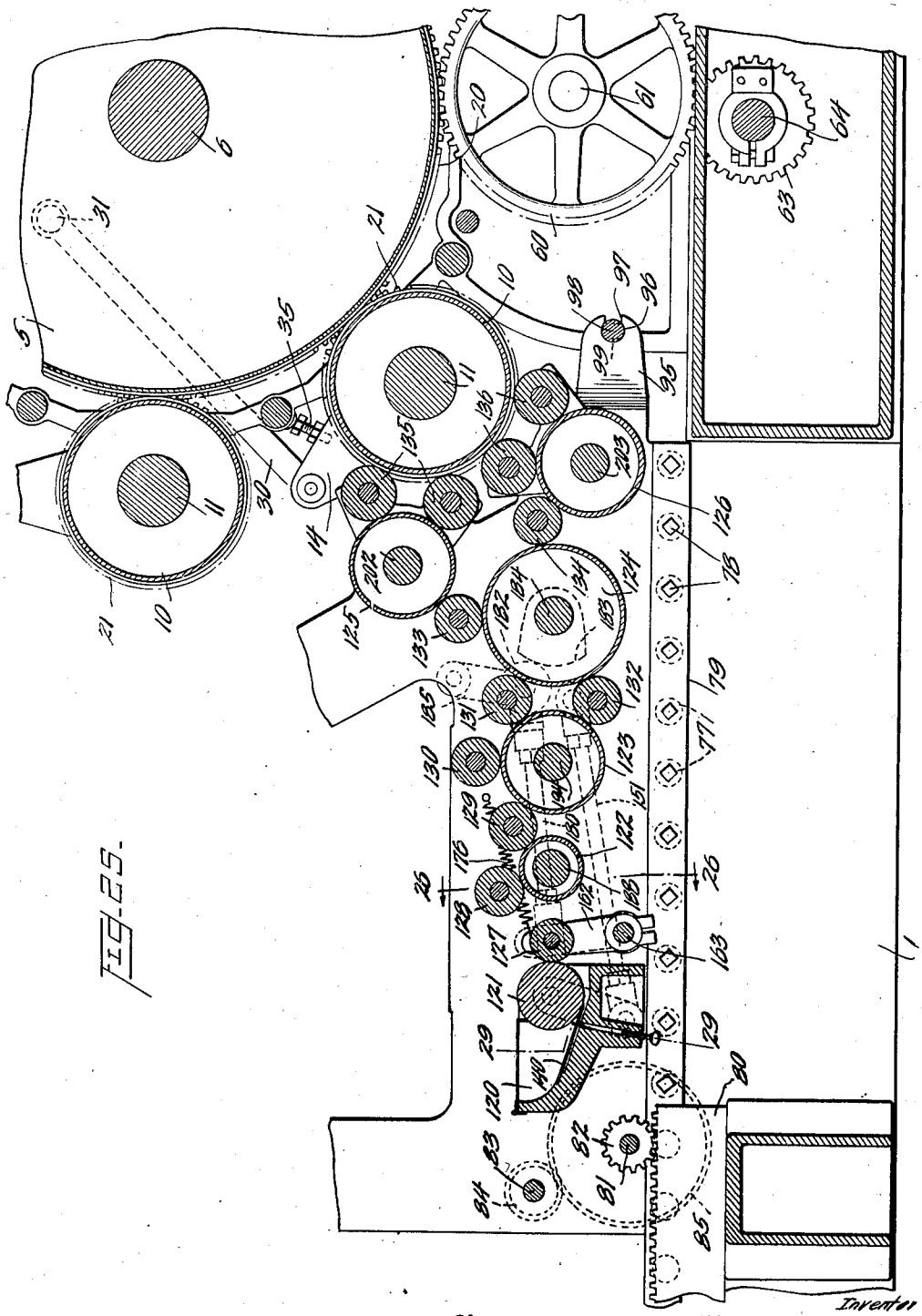

FIG. 25.

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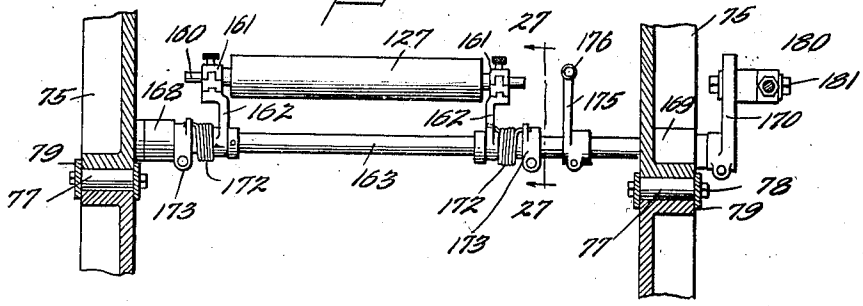
FIG. 26.



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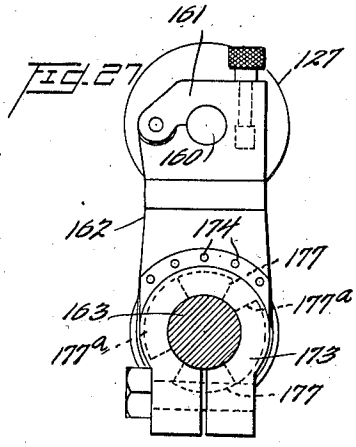

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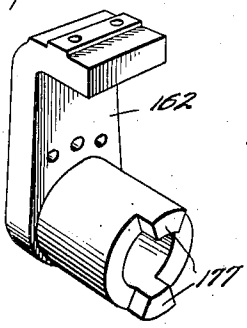

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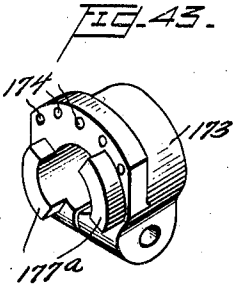

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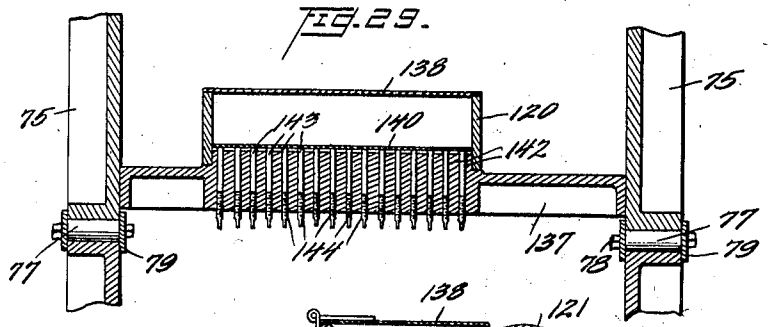

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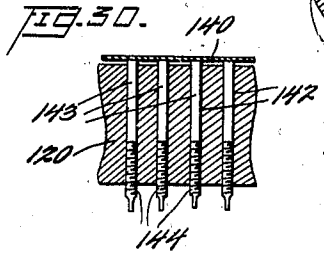

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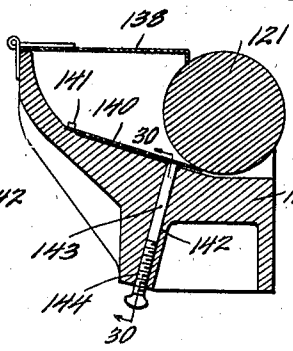

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April 18, 1939. T. M. AVERY 2,155,353

MULTICOLOR PRINTING PRESS

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FIG. 31.

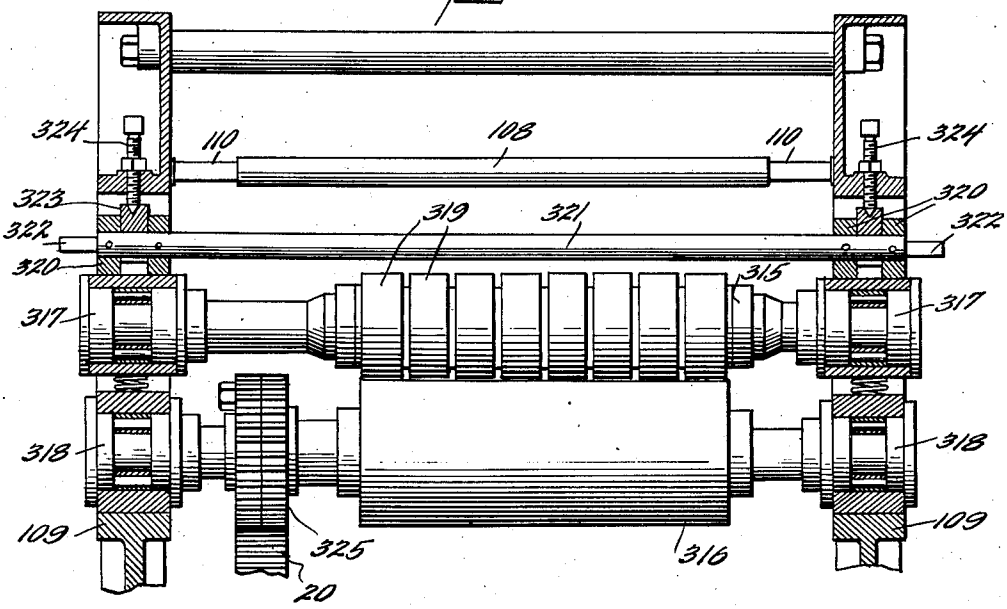


FIG. 32.

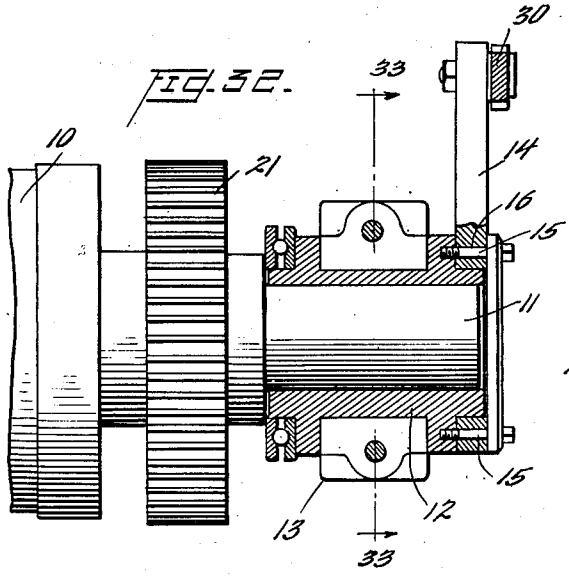
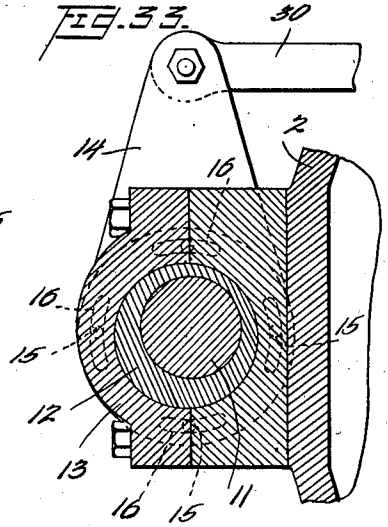


FIG. 33.



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MULTICOLOR PRINTING PRESS

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FIG. 34.

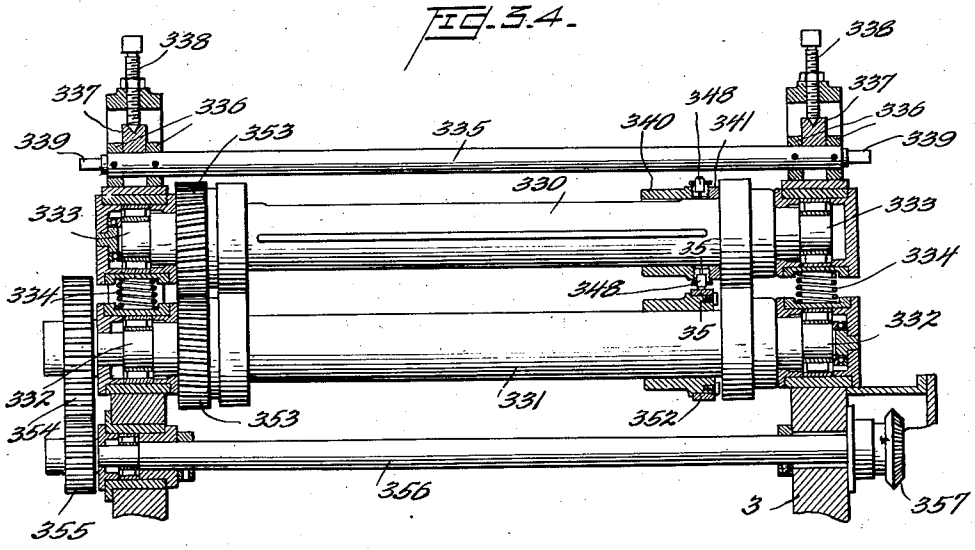
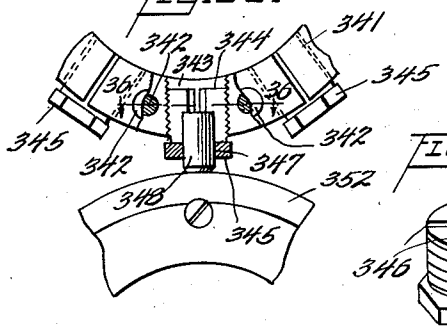


FIG. 35.



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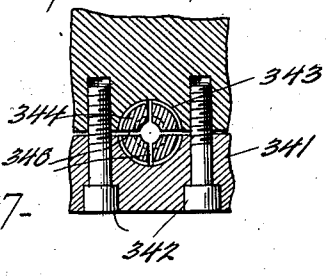


FIG. 37.

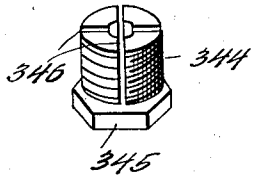


FIG. 38.

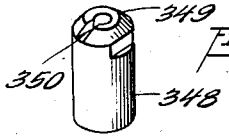
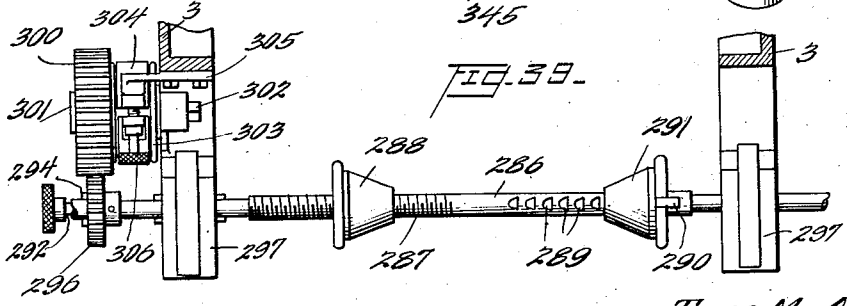


FIG. 39.



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Patented Apr. 18, 1939 2,155,353

UNITED STATES PATENT OFFICE

2,155,353

MULTICOLOR PRINTING PRESS

True M. Avery, Glens Falls, N. Y., assignor to Union Bag & Paper Corporation, Hudson Falls, N. Y., a corporation of New Jersey

Application December 12, 1936, Serial No. 115,622

16 Claims. (Cl. 101—182)

The present invention relates to improvements in printing presses, and more especially to multi-color presses of the class adapted to print in a plurality of colors on a continuous travelling web of paper or other material.

One of the primary objects of the invention is to provide a multi-color printing press which embodies a plurality of printing units each adapted to print in a given color upon the travelling web, each printing unit embodying inking mechanism to supply ink to the respective printing cylinder, and means being provided whereby any one or more of the inking mechanisms may be thrown out of operation.

Another object is to provide a printing press of this class wherein a plurality of printing cylinders are mounted to cooperate with the travelling web as it passes around an impression roller, means being provided for simultaneously moving the printing cylinders into and out of operative relation with the impression cylinder or the web thereon.

Another object is to provide means for individually adjusting the impression pressure produced between the different printing cylinders and the impression roller.

Another object is to provide a multi-color printing press comprising an impression roller around which the web to be printed passes, and groups of printing cylinders arranged to print on the web at opposite sides of the impression roller, and groups of inking mechanisms for the respective groups of printing cylinders mounted so that they are movable away from the respective groups of printing cylinders to render them readily accessible for changing printing plates or other purposes and are movable as a group into printing relation with the respective groups of printing cylinders.

Another object is to provide novel and improved inking mechanism for supplying ink to each printing cylinder, the inking mechanism comprising an inking roller and form rollers for supplying the ink therefrom to the respective printing cylinder, the form rollers having novel means for mounting them whereby they are adjustable in a direction toward and from the inking roller and also capable of being set in different positions around the axis of the printing roller, the inking mechanism also embodying an ink fountain having a roll for withdrawing ink therefrom, and a flexible blade mounted to cooperate intimately with the periphery of said roll and thereby govern the amount of ink withdrawn thereby for supply to the respective printing cylinder.

Another object is to provide a multi-color press embodying an impression roller around which the web to be printed passes and printing cylinders mounted around the periphery of said roller to print upon the web, and means for drawing the web from a roll or other supply and feeding it to the impression roller and printing cylinders, thereby insuring a proper and uniform feed for the travelling web irrespective of the number of printing cylinders that may be in use.

Another object is to provide a novel and improved means for rewinding the printed web into a roll, including a clutch which will operate automatically to prevent unwinding of the rewind roll when the operation of the machine is interrupted or stopped.

Another object of the invention is to provide novel and improved means for applying registration means such as perforations to the web in predetermined relation to the printed impressions thereon, when for example the printed web is to be used for the making of bags, whereby the printed web, when passed through a bag machine, will be synchronized therewith so that the web will be severed or otherwise operated upon at intervals in its length which will be in regular and predetermined relation with the printed impressions thereon.

To these and other ends, the invention consists in certain improvements and combinations and arrangements of parts, all as will be hereinafter more fully described the features of novelty being pointed out more particularly in the claims at the end of this specification.

In the accompanying drawings:

Figures 1, 1*a* and 1*b* are side elevations of the central portion and the end portions respectively of a multi-color printing press constructed in accordance with the present invention;

Fig. 2 is an end elevation of the machine as viewed from the left in Fig. 1*a*;

Fig. 3 is a side elevation of the upper part of the end portion of the machine shown in Fig. 1*a*, as viewed from the opposite side;

Fig. 4 is a vertical section taken through the upper part of the central portion of the machine shown in Fig. 1, illustrating a portion of the impression roller and cooperative printing cylinders, and the draw rolls for feeding the web to the impression roller;

Fig. 5 is a detail view, in top plan, of one of the web guides;

Fig. 6 is an elevation of the web guide shown

in Fig. 5, as viewed from the left hand side of that figure;

Fig. 7 is a vertical section taken transversely through the machine, on the line 7—7 in Fig. 1 but on an enlarged scale, and looking in the direction of the arrows;

Fig. 8 is a detail view, on an enlarged scale, of the ratchet for operating the mechanism for moving the printing cylinders into and out of cooperating relation with the impression cylinder;

Fig. 9 is a detail vertical section taken on the line 9—9 in Fig. 3, and on an enlarged scale, showing the clutch for preventing unwinding of the rewind roll;

Fig. 10 is a vertical section through said clutch, taken on the line 10—10 in Fig. 9;

Fig. 11 is a vertical section on an enlarged scale, taken on the line 11—11 in Fig. 1, showing the mechanism for shifting a group of the inking mechanisms into and out of cooperative relation with the printing cylinders;

Fig. 12 is a detail vertical section, on an enlarged scale, taken on the line 12—12 in Fig. 1, showing the clutch controlled driving means for one of the inking units;

Fig. 13 is a detail view in section on an enlarged scale, taken on the line 13—13 in Fig. 1, showing one of the inking rollers and the form rollers cooperative therewith;

Fig. 14 is a vertical section taken on the line 14—14 in Fig. 13;

Fig. 15 is a vertical section, on an enlarged scale, taken on the line 15—15 in Fig. 13;

Fig. 16 is a detail section, on an enlarged scale, of one of the bearing brackets for the ink distributing rollers;

Fig. 17 is a section taken on the line 17—17 in Fig. 16;

Fig. 18 is a detail section, on an enlarged scale, taken on the line 18—18 in Fig. 15;

Fig. 19 is a section taken on the line 19—19 in Fig. 18;

Fig. 20 is a section taken on the line 20—20 in Fig. 18;

Fig. 21 is a section, on an enlarged scale, taken on the line 21—21 in Fig. 15;

Fig. 22 is a detail vertical section, on an enlarged scale, taken on the line 22—22 in Fig. 13;

Fig. 23 is a side elevation of one of the printing or type cylinders and the inking mechanism therefor;

Fig. 24 is a horizontal section, showing in top plan the printing mechanism shown in Fig. 23;

Fig. 25 is a vertical section taken through the central portion of the machine and on an enlarged scale, showing one of the printing or type cylinders in cooperation with the impression roller, and the inking mechanism for the printing or type cylinder;

Fig. 26 is a vertical section through a portion of the machine on the line 26—26 in Fig. 25, showing the ink transfer roll for one of the printing units;

Fig. 27 is a section on an enlarged scale, taken on the line 27—27 in Fig. 26;

Fig. 28 is a vertical section through the ink fountain, taken on the line 28—28 in Fig. 24 and on an enlarged scale;

Fig. 29 is a vertical section, taken on the line 29—29 in Fig. 25;

Fig. 30 is a detail section taken on the line 30—30 in Fig. 28;

Fig. 31 is a section taken on the line 31—31 in Fig. 4, showing the draw rolls;

Fig. 32 is a section, on an enlarged scale, taken on the line 32—32 in Fig. 1, showing one of the eccentric mountings for one of the printing or type cylinders;

Fig. 33 is a vertical section taken on the line 33—33 in Fig. 32;

Fig. 34 is a section taken on the line 34—34 in Fig. 3, showing the rollers for punching registration perforations in the web;

Fig. 35 is a section on an enlarged scale, taken on the line 35—35 in Fig. 34, showing details of the punch;

Fig. 36 is a section through the punch mounting, taken on the line 36—36 in Fig. 35;

Fig. 37 is a detail perspective view, on an enlarged scale, of one of the punch holders;

Fig. 38 is an enlarged detail view of one of the punches;

Fig. 39 is a detail view of the shaft for mounting the web supply roll and the brake for controlling the unwinding of such roll;

Fig. 40 is a detail view of the locking links for the upper portion of one of the shiftable frames;

Fig. 41 is a detail view of part of the driving means for the inking mechanism of one of the intermediate printing units; and

Figs. 42 and 43 are detail perspective views of portions of the supporting and actuating means for one of the ink transfer rollers.

Similar parts are designated by the same reference characters in the different figures.

The present invention provides a novel and improved multi-color printing press which is capable of operating rapidly and efficiently to print in different desired numbers of colors on a continuous travelling web, the web being supplied from a supply roll and drawn therefrom by draw rolls and fed by the latter to the impression roller around which it passes and during which it is printed, after which the printed web is rewound in a roll, ready to be used in a bag machine for making bags, or otherwise used. Means is provided for supplying a slip sheet to the rewind roll during the rewinding of the printed web to prevent transfer of ink from the printed face of the web to the back thereof. The printing units which print in different colors on the web during its passage around the impression roller are so mounted that they may be rendered readily accessible for the changing of printing plates or for other purposes, and means is provided for simultaneously moving all of the printing or type cylinders into and out of printing relation with the impression roller whenever desired, and for adjusting the impression pressure between each printing or type cylinder and the impression roller to insure impressions of good quality in the different colors, each printing unit embodying novel and improved inking mechanism which insures efficient and uniform supply of ink to the respective printing or type cylinder. The preferred embodiment of the invention is shown in the accompanying drawings and will be hereinafter described in detail, but it is to be understood that the invention is not restricted to the precise construction shown, since equivalent constructions are contemplated and such will be included within the scope of the claims.

Referring to the accompanying drawings which show as an example a six-color printing press embodying the present invention, the press comprises generally an elongated base 1 embodying longitudinal side members connected rigidly at suitable intervals by cross members, a central frame 2 bolted or otherwise secured in fixed

position on the base and comprising side members connected rigidly by a suitable number of tie or cross members, and an end frame 3 bolted or otherwise fixed on one end of the base and comprising side members rigidly connected by a suitable number of tie or other cross members, the base and frames being shown in Figs. 1, 1a and 1b.

The central frame 2 supports a freely revoluble impression cylinder 5, this cylinder for example being supported by a shaft 6 the ends of which are mounted by roller bearings 7 in bearing housings 8, the latter being bolted or otherwise secured in the side members of the frame 2, as shown in Fig. 7. The printing or type cylinders for printing the web, which may be a continuous strip of paper, as it passes around the impression roller, are mounted at suitable intervals around the circumference of the impression roller they being six in number in the present instance and adapted to print in six different colors on the web, these printing cylinders being designated 10 and being supported at their ends in bearings on the side members of the relatively fixed central frame 2.

According to the present invention, the printing or type cylinders 10 are so mounted that they may be simultaneously moved into and out of cooperative relation with the impression roller. Accordingly, each printing cylinder 10, as shown in detail in Figs. 32 and 33, has a shaft 11 extending from each end thereof which is journalled in a bearing 12, and each shaft 12, the outer periphery of which is eccentric to the axis of the shaft 11, is journalled in a bearing housing 13 which is bolted or otherwise fixed to the respective side member of the frame 2, and a crank 14 is fixed to the outer end of the eccentric bearing 12 by bolts 15 which extend preferably through segmental slots 16 in the crank and into the bearing 12 to permit setting of the eccentric bearings 12 at the same angle on the opposite ends of each printing cylinder, and it will be understood that one of these cranks 14 is provided for each end of each printing cylinder. By this arrangement, rotation of the eccentric bearings 12 at the ends of each printing cylinder will move such cylinder toward and from the impression roller. The impression roller and the printing cylinders have a driving connection which insures driving of the printing cylinders at the same surface speed as that of the impression roller, the shaft 6 at one end of the impression roller having a gear 20 keyed or otherwise fixed thereon, the pitch diameter of this gear being equal to the diameter of the impression roller, and each of the printing cylinders has a gear 21 fixed thereon and meshing with the gear 20, each gear 21 having a pitch diameter equal to the diameter of the printing cylinder. The depth of the teeth of the gears 20 and 21 in relation to the extent of throw of the eccentric bearings 12 is preferably such that rotation of the eccentrics 12 will move the printing cylinders out of contact with the impression roller without however disengaging the gears 21 from the gear 20.

Means is provided for simultaneously rotating the eccentrics 12 for all of the printing cylinders and at both ends thereof, to withdraw the printing cylinders which will contact with the impression roller and thereby facilitate the threading of a new web or strip of paper around the impression roller, and for returning the printing cylinders to operative positions with respect to the impression roller. Such means comprises a pair of disks or equivalent members 25 which are mounted to rotate coaxially with the impression roller, these disks, which are located at opposite sides of the central frame 2 having hubs 26 thereon which are mounted rotatably on short shafts 27, the latter being fixed in plates 28 and the latter being secured by screws 29 or other suitable means to the outer sides of the bearing housings 8 for the impression roller. Each of the cranks 14 connected to the eccentric bearings for the printing cylinders is pivotally connected to one end of a link 30 and the opposite end of each link is pivotally connected to a pin 31 secured in the respective disk 25, the pins 31 being spaced circumferentially of the respective disk 25 to conform with the circumferential spacing of the printing cylinders around the periphery of the impression roller, and the cranks 14 being so set in relation to the eccentric bearings 12 for the different printing cylinders that when the disks 25 at opposite sides of the press are rotated in one direction, all of the printing cylinders of the set will be simultaneously moved outwardly or away from the impression roller so as to permit a strip of paper or other continuous web to be threaded around the impression roller and between it and the printing cylinders, and when the disks 25 are rotated in the opposite direction, all of the printing cylinders of the set will be moved inwardly into printing relation with the impression roller. Preferably, a set screw 35 is threaded into each of the cranks 14 and arranged to bear on or come to rest against a stop 36 provided on the respective side member of the frame 2, these set screws and stops serving to limit the extent of movement of the printing cylinders toward the impression roller and adjustment of the individual set screws enabling the printing pressure of each printing cylinder against a web passing around the impression roller to be set individually for each printing cylinder in order to insure the proper printing pressure for the different printing cylinders.

The disks 25 which thus simultaneously set the printing cylinders into or out of cooperative relation with the impression roller, the preferably rotated, whenever desired, by a pair of pinions 37 which are journalled to revolve on shafts 38 carried by brackets 39, the latter being bolted or otherwise fixed to the outer sides of the respective side members of the frame 2. The pinions 37 mesh with gear segments 40 formed on the peripheries of the disks 25 so that rotation of said pinions will rotate the respective disks, and a cross shaft 41 is journalled at its ends in the bearing brackets 39, this shaft having pinions 42 fixed on its ends and meshing with the pinions 37. The shaft 41 and the pinions thereon thus constitute a common operating means for rotating both disks 25 in unison, the disks being connected through the shaft 41 so that they will be rotated through an equal angle whenever the shaft 41 is rotated, and said shaft will maintain the disks 25 in corresponding angular relationship, and hence both ends of each printing cylinder will be moved an equal distance toward and from the impression roller when the shaft 41 is rotated. Equal printing pressure between the impression roller and the printing cylinders throughout their lengths will be thereby insured. The shaft 41 may be conveniently rotated to move the printing cylinders into and out of operative relation with the impression roller, by a ratchet which may be applied to one end of the shaft 41. This ratchet, which is preferably of the reversible

type, may be of the construction shown in Fig. 8, it comprising a toothed wheel 44 fixed on an end of the shaft 41, a lever 45 mounted on the shaft 41 to swing about it as a center, a dog 46 having a pair of teeth 47 thereon, one or the other of which may engage the teeth in the ratchet wheel 44, and a spring plunger 48 the stem of which is pivoted at 49 to the lever 45 and the point of which is shiftable to one or the other end of a recess 50 in the rear side of the dog 46 when the latter is rotated about its pivotal center 51 by manipulation of a handle 52 on the dog. By rotating the dog 46 into one position or the other about its pivotal center 51, one or the other of the teeth 47 is brought into engagement with the teeth on the ratchet wheel 44 and the point of the spring plunger 48 is shifted into the appropriate end of the recess 50 to yieldingly press such tooth into engagement with the ratchet wheel, and by swinging the lever 45 to and fro about the shaft 41 as a center, the dog 46 will rotate said shaft in one direction. By reversing the position of the dog 46, to and fro swinging of the lever 45 will rotate the shaft 41 in the opposite direction. A handle 53 may be fitted into the lever 45 for operating it. Operation of the ratchet device as just described will rotate the shaft 41 in the appropriate direction to rotate the disks 25 to simultaneously move the printing cylinders into or out of operative relation with the impression roller, and the printing cylinders are locked either in or out of operative relation with the impression roller preferably by a nut 54 which is screw-threaded on the shaft 38 on which the pinion 37 is rotatable, the nut 54 being fixed to a crank 55 by means of which it may be rotated either in a direction to clamp the pinion 37 against its supporting bracket 39 and thereby lock the disks 25 in any desired set position, or to unclamp the respective pinion 37 and thereby permit rotation of the shaft 41 to shift the printing cylinders into or out of operative positions.

The impression roller, and also the printing cylinders geared thereto, are driven through a gear 60 (Fig. 25) which is mounted revolubly on a journal 61 supported in a bracket 62 which is bolted or otherwise fixed to one of the side members of the frame 2, this gear meshing with the gear 20 fixed on the shaft of the impression roller (Fig. 7) and meshing with a pinion 63 which is fixed on a cross shaft 64, the latter being journalled in suitable bearings 65 in the side members of the base 1 and having a bevel gear 66 fixed on one end thereof. This bevel gear meshes with a bevel gear 67 fixed on a longitudinal shaft 68 which extends substantially throughout the length of the base at one side thereof, it being supported at suitable intervals by bearings 69, the shaft 68 constituting the main drive shaft for the press and being driven by an oil or other fluid pressure motor 70 of any suitable construction.

The printing cylinders are provided with inking mechanisms, each printing cylinder and its inking mechanism constituting a printing unit, it being understood that each printing unit is adapted to print in a different color on the continuous strip of paper or other web as it passes around the impression roller. According to the present invention, the inking mechanisms for the printing cylinders are so mounted that they may be retracted or withdrawn therefrom and thus render the printing cylinders readily accessible for the changing of printing plates or other purposes. Preferably and as shown in the present instance, the inking mechanisms are mounted in groups, one group of inking mechanisms being provided for the group of printing cylinders at each side of the impression roller, and the respective groups of inking mechanisms are mounted in frames which are shiftable on the base so as to carry the respective groups of inking mechanisms into and out of operative relation with the respective groups of printing cylinders. As shown in the present instance, the inking mechanisms for the printing cylinders at the left hand side of the impression roller in Fig. 1 are mounted in and carried by a frame 75, and the inking mechanisms for the printing cylinders at the right hand side of the impression roller in said figure are mounted in and carried by a frame 76. These frames are shiftable longitudinally on the base 1, these shiftable frames each comprising side members connected rigidly by a suitable number of ties or cross members and these frames resting on series of rollers 77 which are interposed between the upper edges of the side members of the base 1 and the lower edges of the respective frames, the rollers being revolubly mounted on bolts 78 which extend between and connect parallel bars 79, these bars overlapping the vertical sides of the side members of the base and the side members of the frames 75 and 76 and thus preventing relative lateral displacement thereof.

Each of the frames 75 and 76 may be shifted longitudinally on the base 1 to carry the inking mechanisms thereon into and out of operative relation with the respective groups of printing cylinders, by racks 80 which are bolted or otherwise fixed to the inner sides of the base beneath the respective frames 75 and 76, each of the shiftable frames 75 and 76 having a cross shaft 81 journalled in its side members as shown in Fig. 11, this cross shaft having pinions 82 fixed thereon and meshing with the respective racks 80, and each of these shiftable frames has a cross shaft 83 journalled in its side members, this shaft having a pinion 84 fixed thereon and meshing with a larger gear 85 fixed on the shaft 81. One end of the shaft 83 has a squared or other angular portion 86 thereon to receive a crank whereby it may be rotated, rotation of the shaft 83 being transmitted through the reduction gearing 84 and 85 to the shaft 81, causing the pinions 82 on the latter shaft to roll on the racks 80 and thereby shift the respective frame longitudinally of the base. A further gear reduction is provided which comprises a relatively large gear 87 fixed on the shaft 83 and meshing with a relatively small pinion 88 fixed on a shaft 89 journalled in one of the side members of the respective shiftable frame, the shaft 89 having a squared or other angular portion 90 extending therefrom beyond the frame to receive a crank for rotating it, the increased ratio of gear reduction afforded by the gears 87 and 88 enabling the respective shiftable frame to be shifted more slowly and accurately whereas rotation of the shaft 83 by a crank applied to its squared portion 86 enables the shiftable frame to be shifted rapidly.

Means is provided for locking the shiftable frames 75 and 76 when the inking mechanisms thereon have been brought into operative relation with the respective groups of printing cylinders. For this purpose, the lower inner end of the frame 75, at each side thereof, has a bracket 95 fixed thereto, each bracket having a circular aperture 96 therein and a slot 97 of reduced width leading to it (Fig. 25), and a fixed shaft 98 hav-

ing flattened portions 99 thereon is mounted rotatably in the adjacent portion of the central relatively fixed frame 2, this shaft having a squared or angular end 100 thereon whch projects from a side of the central frame to receive a crank for rotating it. By this arrangement, when the shaft 98 is rotated into a position to bring the flattentened portions 99 thereon into registry with the slots 97 in the brackets 95, the frame 75 is unlocked and may be moved away from the central frame 2 or returned to operative relation therewith, and by rotating the shaft 98 through a one-quarter turn after the flattened portions thereon have been brought into the circular portions 96 in the brackets 95, the shaft 98 will lock the frame 75 to the central frame 2, thereby maintaining the inking mechanisms on this frame in operative relation with the respective group of printing cylinders. An arm 101 (Fig. 23) may be fixed on the shaft 98 and arranged to cooperate with a stop 102 or with a portion of the central frame 2, when swung in one or the other direction, thereby limiting the rotation of the shaft 98 to a quarter revolution. The shiftable frame 76 is provided at opposite sides with brackets 95' and a shaft 98' similar to the brackets 95 and shaft 98, for locking or unlocking the lower inner end of the frame 76 with respect to the central frame 2. The upper portion of the shiftable frame 75 is locked with respect to the relatively fixed central frame 2 by brackets 105 fixed to its respective side members and having circular recesses 106 therein and slots 107 of reduced width leading thereto, and by a shaft 108 which is mounted rotatably in brackets 109 which are bolted or otherwise rigidly fixed to the tops of the side members of the frame 2, the shaft 108 having flattened portions 110 adapted and arranged, when the shaft 108 is rotated into one position, to enter or pass out of the slot 107 and circular recess 106 and, while in the recess 106 and rotated into another position, to lock the upper portion of the frame 75 to the brackets 109, the saft 108 being operative by a crank that may be applied to one end thereof. The upper portion of the shiftable frame 76 may be locked and unlocked with respect to the central relatively fixed frame 2 by a pair of links 111 which are fixed at one end to a sleeve 112 which is pivoted to swing upon a shaft or tie member 113 which extends between the side members of the frame 76, the other ends of the links 111 being provided with downwardly opening slots 114 which may be lowered upon and brought into straddling relation with a tie rod 115 which connects the brackets 109 when the frame 76 is in its operative relation with the central frame 2, thereby locking the frame 76 in such relation. Unlocking of the links 111 is accomplished by merely swinging them upwardly, thus disengaging them from the tie rod 115, these links being provided with handles 116 projecting to opposite sides of the machine for facilitating their manipulation. Since both links 111 are rigidly connected to the same sleeve 112, these links will swing in unison when raised or lowered from either side of the machine.

The inking mechanism for each printing cylinder 10 is the same for all of the printing units so that illustration and description of one of these mechanisms is deemed sufficient for all of them. Such inking mechanism, which is shown more particularly in Figs. 13 to 30 inclusive, corresponds with the inking mechanism for the lowermost unit or printing cylinder 10 at the left hand side of Fig. 1. As shown more particularly in Fig. 25, such inking mechanism comprises an ink fountain 120 and cooperative roller 121 for removing ink therefrom, the fountain containing an ordinary letter press or other suitable ink of the desired color which the respective unit is to print, a series of inking rollers 122, 123, 124, 125 and 126, an ink transfer roller 127 reciprocable between the rollers 121 and 122 and operative to transfer ink from the former to the latter, ink distributing rollers 128, 129, 130, 131, 132, 133 and 134 for conducting the ink between and distributing it on the rollers, and pairs of form rollers 135 and 136 for applying ink from the respective inking rollers 125 and 126 to the printing or type cylinder 10.

The ink fountain 120, as shown more particularly in Figs. 28, 29 and 30, comprises a tray-like receptacle, it being supported in fixed position between the side members of the respective frame by a suitable bracket 137 and having a hinged or other suitable lid 138 for closing it. The roller 121 is revolubly mounted in bearings 139 at the ends of the fountain and closes a side thereof, this roller being exposed at its inner side to the ink contained in the fountain so that its periphery will be coated therewith. A flexible plate 140, of thin steel or other flexible material, is mounted in the bottom of the ink fountain, it being secured thereto along one edge by screws 141, this plate extending throughout the width of the fountain and the roller 121, and the other or free edge of this plate engages the lower side of the periphery of the roller 121. In order to bring the free edge of this plate into conformity with the periphery of the roller 121 and compensate for any irregularities therein, and thus secure intimate contact between this plate and the periphery of this roller and thereby insure distribution of ink uniformly over the periphery of this roller and throughout its length, a row of holes 142 are bored upwardly through the bottom of the ink fountain to the underside of the plate 140, these holes being of a relatively large number, pins 143 are inserted in these holes so that they will be movable into engagement with the underside of the plate 140, and screws 144 are threaded adjustably in the lower ends of these holes. By this arrangement, the free edge of the flexible plate 140 may be adjusted at various points along its length into uniform or intimate contact with the periphery of the roller 121 by appropriate individual adjustment of the screws 144, so that as the roller 121 rotates in an anti-clockwise direction in Fig. 28, a uniform and predetermined amount of ink will be removed by its periphery from the ink fountain. The roller 121 is preferably rotated intermittently by a crank 145 fixed to the outer end of a shaft 146, the latter being journalled in a bearing 147 fixed to the adjacent side member of the frame and having a clutch member 148 provided with ratchet teeth on its inner face splined thereon, and a spring 149 acts on the ratchet clutch member 148 to press it yieldingly against a companion ratchet clutch member 150 fixed to the adjacent end of the shaft of the roller 121, as shown in Fig. 24. The crank 145 (Fig. 23), is swung to and fro during the operation of the press, by a rod 151 which pivotally connects this crank to a crank pin 152 secured to a crank disk 153, this crank pin being preferably in the form of a bolt which may be secured adjustably in different positions in a radial slot 154 in the crank disk 153 to vary the stroke of this crank and in consequence the extent of swing of the crank 145 and extent of rotation of the roller 121 at each actu-

ation thereof. The crank disk 153 is mounted rotatably on a shaft 155, the latter being secured to the outer side of the adjacent side member of the respective frame, and the crank disk 153 is driven by a gear 156 fixed thereto and by driving means which will be hereinafter described. In order to enable the roller 121 to be rotated manually, as when the press is being started, a ratchet lever 157 of any usual or well known construction, may be mounted on the end of the shaft of this roller opposite to that to which the clutch member 150 is fixed, as shown in Fig. 24.

The roller 127 which picks up ink from the roller 121 and transfers it to the roller 122, has its shaft 160 journalled in bearings 161 on arms 162 which are mounted loosely or rotatably on a rock shaft 163, as shown more particularly in Figs. 26 and 27. This rock shaft is journalled in bearings 168 and 169 in the side members of the respective shifting frame and has a crank 170 clamped or otherwise fixed to its outer end, this crank having a radial slot 171 therein. The arms 162 are operatively connected to the shaft 163 by springs 172, each of these springs having one end connected to a respective arm 162 and the other end connected to a collar 173 which is clamped or otherwise adjustably fixed to the shaft 163. Preferably and as shown, the ends of the springs 172 which engage the collars 173 are outturned and engageable in one or another of a series of apertures 174 which are spaced circumferentially on these collars, thereby enabling the power of these springs to be adjusted. The shaft 163 has an arm 175 clamped or otherwise fixed thereto and a tension spring 176 is attached to one end of this arm, its other end being attached to a suitable part of the respective shifting frame. The spring 176 acts to move the transfer roller 127 into yielding engagement with the roller 122 when the shaft 163 is rocked in one direction, and the springs 172 act to press the transfer roller 127 into yielding engagement with the roller 121 when the shaft 163 is rocked in the other direction. The outer sides of the arms 162 and the inner sides of the collars 173 are provided with jaws 177 and 177*a* which permit a limited amount of lost motion between the shaft 163 and the arms 162 when the roller 127 contacts with the roller 121, thereby allowing the springs 122 to press the roller 127 against the roller 121 as the rotation of the shaft 163 continues to a small extent, these jaws however engaging one another and retracting the roller 127 from the roller 121 when the shaft 163 is rocked in a direction to carry the roller 127 into engagement with the roller 122, the contact of the roller 127 with the roller 122 being a yielding one under the tension of the spring 176. The shaft 163 is rocked to and fro during the operation of the press, by a rod 180 which is pivotally connected at one end by a crank pin 181 to the crank arm 170 which is secured in the slot 171 therein, the other end of the rod 180 carrying a roller 182 which rides on the periphery of a cam 183 having inner and outer concentric portions whereby the rod 180 will be reciprocated as this cam rotates, the cam 183 being fixed on the shaft 184 of the inking roller 124. The roller carrying end of the rod 180 is supported in operative relation with the cam 183 by a link 185 which is pivotally connected at its lower end to the shaft 186 for the roller and is pivotally connected at its upper end to the adjacent side member of the respective shifting frame by a pivot pin 187. The tension spring 176 holds the roller 122 in contact with the cam 183, and rotation of this cam effects the rocking movements of the shaft 163 as hereinbefore described. Adjustment of the crank pin 181 in the radial slot 171 of the crank arm 170 serves to adjust the extent of the rocking movements of the shaft 163.

The various rollers comprising the inking mechanism, excepting the form rollers 135 and 136 and the distributing rollers, are driven at equal surface speed by a suitable train of gearing. As shown in the present instance, the shaft 188 of the roller 122 has a gear 190 fixed thereon, this gear meshing with a relatively wide idler gear 191 which is mounted on a shaft 192 supported on the adjacent side member of the respective shifting frame, the gear 191 meshing with a gear 193 which is fixed on the shaft 194 of the inking roller 123, the gear 193 meshes with the gear 156 which drives the crank disk 153, the gear 156 meshes with a gear 195 which is fixed to the shaft 184 of the inking roller 124 and on which the cam 183 is fixed, and the gear 195 meshes with idler gears 196 and 197 mounted loosely on shafts 198 and 199 respectively supported on the adjacent side member of the respective shifting frame, and the idler gears 196 and 197 in turn mesh with gears 200 and 201 fixed on the shafts 202 and 203 respectively of the inking rollers 125 and 126. The train of gears thus provided for the series of inking rollers are of appropriate sizes to cause these rollers to revolve at equal surface speed. The shaft 188 of the inking roller 122 of each of the inking mechanisms is utilized as the main drive for these inking mechanisms, but for each of the intermediate inking mechanisms at the right hand and left hand sides in Fig. 1, a short longitudinal shaft 204 is provided each of which has fixed to it a bevel gear 204' for driving the respective shaft 188, and also a bevel gear 204*a* for driving it. The shafts 188 are each provided with a bevel gear 205 for driving it and its respective inking mechanism, the gears 204' on the short shafts 204 meshing with the gears 205 for driving the respective inking mechanisms of the intermediate printing units. The groups of inking mechanisms on the shiftable frames 75 and 76 are driven by vertical shafts 210 and 211 which are mounted in upright position in suitable bearing housings 212 and 213 on the sides of these frames. The lower end of each of these vertical shafts is operatively connected to the longitudinal main drive shaft 68 by a bevel gear 214 fixed thereon and meshing with a bevel gear 215, the latter being splined on the longitudinal main shaft 68 by a key 216 which is slidable in a keyway 217 in the main longitudinal shaft so that these vertical shafts will be maintained in driving relation with the main longitudinal shaft although the shiftable frames 75 and 76 may be shifted into different positions on the base. Means is provided for connecting and disconnecting each of these vertical shafts with respect to any one or another of the inking mechanisms so that the inking mechanism of any printing unit not in use may remain idle. As shown in the present instance, a bevel gear 218 is provided to mesh with each of the bevel gears 204*a* or 205 for driving each inking mechanism from the respective vertical shaft, this bevel gear being loosely mounted on the vertical shaft but capable of being connected therewith by a sliding jaw clutch 219 which is splined on the vertical shaft, as shown in Fig. 12. Each of these jaw clutches may be shifted to connect the respective bevel gear 218

thereto or disconnect it therefrom by a lever 220 which may be pivoted at 221 to the bearing housing, this lever being accessible from the exterior on the bearing housing for convenient manipulation, and provided with a pivoted latch 222 which may engage it and lock it in its lowered position and thus maintain it in clutch engaging position. By thus providing the inking mechanism of each printing unit with an individual clutch for connecting and disconnecting it with respect to the main driving means, any one or more of the inking mechanisms may be rendered idle or inoperative, according to the number of colors being printed, it being understood that while the printing or type cylinder of an idle unit will continue to revolve due to its driving connection with the impression roller, such idly revolving printing cylinder will be out of contact with the web since no printing plate will be mounted on such idle cylinder.

Means is provided for vibrating or reciprocating certain of the rollers of the inking mechanism of each printing unit, as such rollers revolve, in order to uniformly distribute the ink along the lengths of such rollers. For example and as shown in Figs. 23 and 24, the inking rollers 123, 125 and 126 are provided with means for so vibrating them. The vibrating means for each of these rollers, as shown in detail in Figs. 13 and 14, comprises a worm 225 fixed on one end of the shaft of the roller to be vibrated, as for example the roller 126, a worm casing 226 journalled on said end of the roller shaft and engaging a shoulder 227 on the shaft and a collar 228 fixed on said shaft so that the worm casing will reciprocate axially with the shaft, a worm wheel 229 (Fig. 22) mounted rotatably in the worm casing on a shaft 230 fixed therein, a crank disk 231 fixed to the hub of the worm wheel, a crank pin 232 fixed to the crank disk, and a link 233 pivotally connected at one end to the crank pin and at its other end to a pivot pin 234 attached to the adjacent side member of the respective sliding frame. The worm casing is formed with a lug 235 in which is slidable a pin 236 which is fixed to and projects outwardly from the adjacent side member of the shiftable frame in parallelism with the axis of the shaft of the vibratory inking roller. The shaft of the vibratory inking roller is shiftable axially in its bearings, the shaft 203 for the roller 126 being shown provided with roller bearings the inner races 237 of which are movable axially with respect to the surrounding series of rollers 238, and the driving gear for the vibratory inking roller, as for example the gear 201 for the roller 126, is movable axially of the respective driving gear as for example the widened idler gear 197 so that it will remain in mesh or driving relation therewith during its reciprocatory movements. A similar vibrating or reciprocating means may be provided for the rollers 123 and 125, the gears 191 and 196 for driving these rollers being similarly widened, as shown in Fig. 24.

The pairs of form rollers 135 and 136 which serve to transfer ink from the ink rollers 125 and 126 respectively to the corresponding printing or type cylinder 10, are driven frictionally by contact with these rollers, and according to the present invention, these form rollers are mounted adjustably relatively to their inking rollers so that they may be adjusted in directions both radially thereof and also around the peripheries thereof in arcs concentric with the axes of the respective inking rollers. The mountings for these form rollers are shown more particularly in Figs. 13 to 22 inclusive. In these figures, the form rollers 136 for the inking roller 126 are shown, but as the mounting for the form rollers 135 for the inking roller 125 is of the same construction, the description of one will suffice for both. As shown in Figs. 13, 14 and 15, the bearing housing 240 in each side member of the shiftable frame and supporting the respective end of the shaft of the roller 126 is surrounded by a plate 241 which is fixed to the respective side member of the frame as by screws 242, this plate having a groove 243 in its inner face which is concentric with the axis of the ink roller shaft 203, the plate 241 having a pair of lugs or ears 244 projecting therefrom to provide supports for the mountings of the form rollers 136. Each of these mountings comprises a plate 245 adapted to fit against the inner face of the plate 241 and having a rib 246 of segmental form adapted to fit into the circular groove 243 in the inner face of the plate 241. Each of the plates 245, as shown in Fig. 19, is formed with an approximately radially elongated slot 247 through which passes a bolt 248 having an eccentric head 249, thereon which lies in an elongated counter-bore 250 surrounding the slot 247 in plate 245. The bolt 248 extends through an eccentric sleeve 251 which is fitted rotatably in a cylindrical hole 252 in the plate 241 and the adjacent side member of the frame, the outer end of this eccentric sleeve having capstan holes 253 therein to receive a rod or tool for rotating it, and the outer end of the bolt 248 has a nut 254 threaded thereon. A set screw 255 is threaded into the side frame to engage the eccentric sleeve 251 and thereby lock it in different positions into which it may be rotated. The outer end of the bolt 248 is also preferably formed at its outer end with a squared or other suitably shaped portion 256 to receive a wrench for rotating it. By this arrangement, by loosening the nut 254 and rotating the bolt 248, the eccentric head 249 of the bolt will act on the plate 245 to move it in an arc around the plate 241, the rib 246 on the plate 245 guiding the latter so that it will move in an arc concentric with the axis of the ink roller shaft 203, and by rotating the eccentric sleeve 251, a further arcuate movement of the plate 245 on the plate 241 may be obtained, since such rotation of the eccentric sleeve will shift the bolt 248 in an arc around the ink roller shaft. Tightening of the nut 254 will lock the bolt 248 in adjusted position and tightening of the set screw 255 will lock the eccentric sleeve in adjusted position.

Each end of the shaft 260 of each form roller is journalled in a bushing 261 and each of these bushings is clamped in a split bearing 262. Each of these bearings is mounted adjustably in the respective plate 245 so that it may be adjusted in a direction substantially radially of the axis of the inking roller shaft 203. As shown more particularly in Figs. 15, 18, 19 and 21, the plate 245 is formed on its inner face with a groove 263 and the contacting face of the bearing 262 is formed with a rib 264 which fits into said groove so that the bearing 262 may be adusted longitudinally of said groove, and the bearing 262 is secured in different adjusted positions with respect to the plate 245 by a clamping screw 265 which extends through an elongated slot 266 in the bearing 262 and is threaded in the plate 245. Means is provided for adjusting the bearing 262 longitudinally

of the groove 263 in the plate 245, such means comprising a screw 267 which is threaded into the bearing 262 and is provided with a lock nut 268, this screw having thrust collars 269 fixed thereon and engageable with opposite sides of a fork 270, the latter having a stem 271 which is forced tightly into a hole 272 bored into the plate 245, and the extremity of the screw 268 is provided with a squared or other suitably shaped portion 273 to receive a wrench for operating it. By this arrangement, by loosening the lock nut 268 and rotating the screw 267 in the appropriate direction, the bearing 262 will be adjusted in the respective plate 245 in a direction approximately radially of the axis of the inking roller shaft 203, and by tightening the lock nut 268 and the clamping screw 265, the bearing will be held firmly in its desired adjusted position. Accordingly, the form rollers for each of the inking rollers 125 and 126 are so mounted at both ends that they may be adjusted around the periphery of the respective inking roller in an arc concentric with the axis of such roller and may also be adjusted substantially radially or in a direction toward and from the respective inking roller to insure the proper reception of ink from the inking roller and the transfer thereof to the printing or type cylinder with which they cooperate.

The ink distributing rollers 128 to 134 inclusive are driven frictionally by contact with the inking rollers with which they cooperate. Each of these distributing rollers may be mounted adjustably as shown in Figs. 16 and 17 wherein the mounting for the distributing roller 134 for example is shown but since the mountings for the rest of the distributing rollers may be similar, the illustration and description of one will suffice for all. As shown in Figs. 16 and 17, each end of the shaft 275 of the distributing roller is journalled in a bushing 276 which is clamped in a bearing 277, and this bearing is secured to the respective side member of the shiftable frame by a clamping screw 278 which extends through a slot 279 in a plate-like extension 280 attached to the bearing, the screw being threaded into the respective side member of the frame, the slot 279 extending in a direction which enables the particular distributing roller to be adjusted toward and from the inking roller or rollers with which it cooperates, and tightening of the screw 278 secures the distributing roller in its adjusted position. The continuous strip of paper or other web to be printed is supplied from a supply roller 285, which as shown in Figs. 1*a* and 2, may be supported on a supply roll shaft 286. This supply roll shaft is threaded toward one end as at 287 to receive a threaded cone 288 to engage in one end of the paper roll and is provided with notches 289 toward its other end to receive a pawl 290 carried by a cone 291 which is engageable in the other end of the supply roll, these cones being thus adjustable along the supply roll shaft to conform with the width of the paper roll and to position the paper roll and the strip or web drawn therefrom, in a direction laterally as it passes through the machine. A fine adjustment of the lateral positioning of the supply roll may be obtained by fitting a screw 299 rotatably in the adjacent side of the end frame 3, this screw being threaded in a slide 294 which is guided by a pin 295 slidable in the frame 3 in parallelism with the supply roll shaft 286. The slide 294 is recessed so that it straddles a gear 296 fixed on the supply roll shaft 286. The shaft 286 is mounted rotatably and slidably in bearings 297 supported on the end frame 3, these bearings having hinged caps to facilitate removal of an empty shaft and replacement thereof by a shaft having a fresh paper roll thereon. Turning of the screw 292 in the appropriate direction serves to shift the paper roll shaft 286 endwise, thereby enabling the paper roll and the web to be properly positioned laterally in the machine. Similar mountings may be provided for a shaft 298 upon which the printed web is to be rewound and a shaft 299 for supporting a roll of paper or other material to be fed to the printed web during its rewinding to serve as a slip sheet to prevent transfer of ink between the face of the printed sheet and the back thereof.

Means is provided for resisting or retarding the unwinding of the strip or web from the supply roll, such means consisting, as shown more particularly in Fig. 39, of a gear 300 which is mounted rotatably on a shaft 301 fixed by a bolt 302 to a side member of the end frame 3, the gear 300 meshing with the gear 296 fixed on the supply roll shaft 286 and having a brake or friction drum 303 secured to it to turn therewith, this brake or friction drum on the gear 300 having a brake band 304 surrounding it to engage it frictionally, one end of the brake band being secured to a bracket 305 attached to the adjacent side member of the frame 3 and the other end of the brake band being engaged by a screw 306 which is threaded into the bracket 305 and, when rotated in one or the other direction, tightens or loosens the brake band and thereby increases or decreases the amount of resistance to the unwinding of the supply roll.

The web or strip of paper from the supply roll, as shown in Fig. 1*a*, passes around a guide roller 307 and around a guide roller 308, both mounted revolubly in the end frame 3 and then travels beneath a top frame member 309 fixed to the end frame 3, to a roller 310 on said top frame member, thence around a pair of tension equalizing rollers 311 and 312 carried by a yoke 313 mounted to rock on a pivot 314, and the web or strip of paper then passes between a pair of draw rolls 315 and 316 which serve to pull or draw the web or strip from the supply roll and feed it to the impression roller, these draw rolls functioning to feed the paper strip or web to the impression roller without depending upon the frictional contact of the printing or type cylinders therewith, so that the feeding of the web around the impression roller and past the printing cylinders will be uniform, irrespective of the number of printing cylinders in use. These draw rolls, as shown in detail in Figs. 4 and 31, are mounted at their ends in suitable bearings 317 and 318 supported in the sides of the bracket 109. The bearings 318 for the lower roll 316 may be fixed in the brackets 109, but the bearings 317 for the roller 315 are preferably slidable in the bracket 109 in a direction toward or from the bearings 318, whereby the draw roll 315 may be retracted relatively to the draw roll 316 and thus facilitate the insertion of an other paper strip or web in the machine. The upper draw roll 315 is provided preferably with circumferential rubber ribs or rings 319 and the lower draw roll is preferably in the form of a smooth cylinder of steel or other suitable material, so that the draw rolls will secure a firm grip upon the paper strip or web and will effectively feed it between them. The upper draw roll 315 is normally held in working relation with the lower draw roll by cams 320 fixed on a transverse shaft 321, the latter extending transversely between the sides of

the bracket 109 and having squared or other suitable portions 322 on its ends to receive a crank for rotating it. Recessed blocks 323 bear on the shaft 321 and are engaged by adjusting screws 324 threaded in the sides of the bracket 109. By this arrangement, rotation of the shaft 321 through a quarter revolution, in the appropriate direction, will cause the cams to either force the upper draw roll 315 into working engagement with the lower draw roll 316, or to release the upper draw roll to facilitate the introduction of another paper strip or web between them. Adjustment of the screws 324 enables the proper pressure to be obtained between the draw rolls to effectively feed the strip or web. The draw rolls are driven by a gear 325 which is fixed to the shaft of the lower draw roll 316, this gear having a pitch diameter equal to the diameter of the lower draw roll and meshing with the gear 20 which is fixed to and rotates with the impression roller 5, so that the draw rolls will be driven from the impression roller and at the same surface speed therewith.

The paper strip or web is printed in the different desired colors by the series of printing or type cylinders 10 as the strip or web passes around the impression roller, the impression roller rotating in an anti-clockwise direction in Fig. 4, and the printed strip or web passes from the impression roller to a guide roller 326 in the top frame 309 thence to a curved guide plate 327 mounted in the upper portion of the end frame 3 as shown in Figs. 1a and 3. Means is provided for perforating or otherwise applying registration means to the printed web in predetermined relation to the printed impressions thereon so as to enable the strip or web to be cut off and otherwise operated upon at predetermined intervals in its length and in definite relation to the printed impressions thereon. In the present instance means is provided for punching a series of perforations along an edge of the printed strip or web to cooperate with a web controller or registering means such as that disclosed in my Patent No. 1,517,099 granted November 25, 1924, such being particularly advantageous when the printed strip or web is to be supplied to a bag machine. Such punching means, which is shown more particularly in Figs. 1a, 2, 3 and 34 to 38 inclusive, comprises a pair of rollers 330 and 331 between which the printed strip or web passes. The roller 331 is mounted at its ends in bearings 332 which may be supported in fixed positions in the side members of the end frame 3. The ends of the roller 330 however are preferably mounted in bearings 333 which are slidable in the side members of the end frame in a direction toward or from the lower roller 331. Compression springs 334 interposed between the bearings 332 and 333 act to normally lift the roller 330 from the roller 331. The roller 330 however is moved into operating relation with the roller 331 and held in such relation by a cross shaft 335 having cams 336 fixed thereon and engaging the tops of the bearings 333, notched blocks 337 bearing on the shaft 335 and being engaged by adjusting screws 338 which are threaded in the side members of the frame 3. The ends of the shaft 335 are provided with squared or other suitable portions 339 to receive a crank or handle for rotating the shaft. Rotation of the shaft 335 in the appropriate direction will cause the cams 336 to force the upper roller 330 into working relation with the roller 331, or to allow the roller 330 to move out of working relation with the roller 331 under the action of the springs 334. The screws 338 provide means for adjusting the pressure exerted by the rollers 330 and 331 upon the strip or web passing between them.

The roller 330 carries the strip or web punching means, such means comprising a sleeve 340 which is fixed to one end of this roller, this sleeve having a plate 341 secured thereto by a series of screws 342, and a series of threaded sockets 343 are formed between the sleeve 340 and the plate 341, these sockets being spaced equidistantly and circumferentially around the sleeve and adapted to receive correspondingly threaded punch holders 344. Each punch holder comprises an outer hexagonal or other suitably shaped portion 345 suitable to receive a wrench for rotating it, and the portion of the holder beyond such hexagonal portion is split, as by the intersecting slots 346. The holder is formed with a central bore 347, preferably of cylindrical form, into which a correspondingly shaped punch 348 is adapted to be inserted. By inserting the punch 348 in the holder and then screwing the holder into its socket and clamping it between plate 341, the split holder will contract on the punch and thereby firmly retain it in position therein. The outer or working end of each punch is formed with a cutting edge 349 which is preferably of keyhole shape, leaving a gap 350 therein, so that the punch will cut a tongue from the strip or web but which will remain attached to the web at one point.

The punches and holders are inserted in the sleeve 340 on the roller 330 so as to form an annular series thereon, and the lower roller 331 is provided with a steel or other hard metal ring 352 which is concentric with the roller 331 and provides a die or anvil against which the punches work to punch the tongues from the strip or web as an edge of the latter passes between the series of punches and the ring 352. The rollers 331 and 332 are driven so that the outer operative ends of the punches and the surface of the ring 352 travel at the same surface speed, by gears 353 of equal size fixed on the respective rollers and intermeshing, and the punch rollers are driven in proper timed relation with the printing mechanism of the machine by a gear 354 fixed on the shaft of the roller 331 and meshing with a gear 355 fixed on a cross shaft 356 journalled in bearings in the sides of the end frame 3, the opposite end of this shaft having a bevel gear 357 fixed thereon which meshes with a bevel gear 358 fixed on the upper end of a shaft 359 (Fig. 2). The shaft 359, which is supported in suitable bearings 360 on a side of the end frame 3, is provided at its lower end with a bevel gear 361 which meshes with a bevel gear 352 fixed to an end of the main longitudinal drive shaft 68 which drives the impression roller and printing or type cylinders. The ratio of gearing between the main drive shaft 68 and the punching rollers 330 and 331 is such that these rollers will punch the perforations in the travelling strip or web in predetermined or definite relation with the printed impressions thereon.

The curved guide plate 327 directs the printed strip or web to the punching rollers and then directs the printed and punched web to a roll 365 on which the printed web is rewound, this rewind roll being mounted on the shaft 298 and connected thereto so as to turn therewith by the cones 366 and 367 which are forced into the ends of the rewind roll. The rewind roll may be driven from an oil or other fluid pressure motor 368

through a multiple belt 369 which passes around a multiple belt pulley 370 mounted rotatably on a shaft 371 supported on a side of the end frame 3. The pulley 370 has a gear wheel 372 fixed to it, and this gear wheel is connected, through a train of gears 373, 374 and 375 mounted on shafts supported on a side of the frame 3, to a gear 376 which is fixed on the rewind roll shaft 298. Means is preferably provided to prevent retrograde or unwinding rotation of the rewind roll 365 when the machine is stopped. Such means as shown in detail in Figs. 9 and 10, is combined with the gear 375, this gear being mounted by anti-friction bearings 376 on a stud shaft 377 which is bolted or otherwise fixed to a side of the end frame 3, the hub of this gear having a circular band or drum 378 fixed thereto and having a clutch ring 379 surrounding it and within which it is revoluble, the clutch ring 379 being fixed, as by bolts 380 to a plate 381, the latter being keyed or otherwise fixed to the fixed shaft 377. The clutch ring 379 is formed with a suitable number of recesses 382 in its inner circumference which are inclined or eccentric to the axis of the ring 378, and each of these recesses contains a roller 383 which is movable in the respective recess and is engageable with the outer periphery of the ring 379 and the outer wall of the respective recess. Preferably, each roller is reduced in diameter intermediately of its ends thus forming a central shaft 384 thereon, and a plunger 385 is provided having a fork at one end to straddle the shaft 384 of the respective roller, the plunger having a stem which is slidable in a plug 386, the latter being threaded into and adjustable axially in a bore 387 in the clutch ring 379. A set screw 388 is preferably threaded into the clutch ring 379 to engage the respective plug 386 and thereby lock this plug in adjusted position. A coiled compression spring 389 is interposed between the fork on each plunger and the respective plug 386, these springs acting to force the respective rollers 383 toward the narrower ends of the respective recesses 382, the strength of these springs being controlled by adjustment of the respective plugs 386. In operation, during rotation of the rewind roll 365 in a direction to wind the printed strip or web thereon, the clutch ring 378 fixed on the hub of the gear 375 will rotate in a clockwise direction in Fig. 10, the frictional engagement of the periphery of this ring with the rollers 383 causing these rollers to move toward the larger ends of the respective recesses 382 in the stationary clutch ring, and thereby permitting the gear 375 and the rewind shaft 298 to rotate without interference in a direction to wind the strip or web on the roll 365. However if the operation of the machine is stopped or interrupted for any reason and the rewind roll 365 should tend to rotate backwardly or in a direction to unwind the strip or web thereon, due to tension on the web or otherwise, the clutch ring 378 fixed on the gear 375 will then begin to rotate in an anti-clockwise direction in Fig. 10, and the frictional contact of this ring with the rollers 383, together with the action of the springs 389, will cause the rollers 383 to move toward the smaller ends of the recesses 382, thereby wedging these rollers between the ring 378 and the relatively fixed clutch ring 379 and thus locking the gear 375 and the rewind roll shaft 298 connected to it, against retrograde or unwinding rotation.

Means is preferably provided for guiding the paper strip or web laterally as it passes to the impression roller and printing cylinders and as it passes to the punching rollers, these lateral guides 390 and 391 respectively being mounted on the top frame member 309. Since each of these guides is of the same construction, a description of one will suffice for both. Each of these guides, as shown in detail in Figs. 5 and 6, comprises a pair of slides 392 and 393 which are mounted to slide on a pair of rods 394 which extend between and connect the side members of the top frame 309, the slides 392 and 393 being thus movable in a direction transversely of the frame. A screw 395 is journalled rotatably in one of the side members of the top frame 9, it having thrust collars 396 fixed thereon for preventing endwise movement, and the inner end of this screw is threaded in a nut 397 fixed to the slide 292, the outer end of this screw having a squared or other suitable portion 398 thereon to receive a crank or holder for rotating it. Another screw 399 is also mounted rotatably in a side member of the frame 309, it having thrust collars 400 for preventing endwise movement thereof, and this screw is threaded into a nut 401 fixed to the slide 393, the outer end of this screw having a squared or other suitable portion 402 thereon to receive a crank or the like for rotating it. The slides 392 and 393 are thus provided with means for individually adjusting them in a direction laterally or transversely of the machine. The slides 392 and 393 carry guide plates 403 and 404, these guide plates being composed preferably of sheet metal bent into V-form with their apices directed outwardly, one of the flat sides of each guide overlying horizontally the rods 394 and providing horizontally alined surfaces over which the longitudinal margins of the paper strip or web travel, and the other sides of these guides being inclined upwardly and inwardly to overlie the longitudinal margins of the strip or web, the longitudinal edges of the strip or web engaging in the apices of these guides. By rotating the screws 395 and 399 in the appropriate direction, the guides 403 and 404 may be individually adjusted laterally of the direction of travel of the strip or web to position the latter properly in a direction transversely of the machine, and to properly adjust the guides to conform with the width of the paper strip or web.

The construction and mode of operation of the various mechanisms composing the press having been hereinbefore described, the general operation of the press is as follows:—

Assuming a roll of paper 285 or other material to be printed to be mounted in the end frame 3 of the machine on the supply roll shaft 286 and the strip or web from this roll to be extended past the rollers 307 and 308, between the guides 390 and past the rollers 310, 311 and 312 and between the draw rolls 315 and 316 (Fig. 4) which, during the passing of the strip therebetween may be relatively separated by operation of the shaft 321, the strip of web may be readily passed around the impression roller 5 and between the printing or type cylinders grouped around it by manipulation of the ratchet handle 53 to rotate the disks 35 in the appropriate direction to cause the eccentric bearings for the ends of the shafts of the printing cylinders to simultaneously retract or move the printing cylinders away from the periphery of the impression roller a sufficient distance to permit the paper strip or web to be passed between them and around the impression roller, and the paper strip or web, after being passed around the impression roller, is extended over the roller 326 and between the guides 391, thence over the guide plates 327 and between the punch rollers 330 and 331 and is thence attached to the rewind shaft

298, the punch rollers 330 and 331 being relatively separated during the passing of the strip or web between them, by rotation of the shaft 335. A roll of paper or other material may also be mounted on the shaft 299 and its end placed in position so that the strip from this roll will be wound with the printed web and thus serve as a slip sheet to prevent transfer of ink from the printed face to the back of the printed web.

After the strip or web has been thus threaded through the machine, the printing or type cylinders are simultaneously brought into printing relation with the impression roller by rotation of the disks 25 in the appropriate direction by operation of the ratchet handle 53, and the draw rolls and punch rolls are brought into operative relation with the strip or web by rotation of the shafts 321 and 335 respectively. Ink contained in the ink fountains of the different printing units may be then distributed upon the respective rollers 121 by manually rotating these rollers by the ratchets 157. Assuming that the clutch levers 220 for the inking mechanisms of all of the printing units, or all of the printing units which are to be used, are set to connect such inking mechanisms to their driving means, the press may be started into operation, the printing mechanism being driven from the fluid pressure or other motor 70 which drives the main longitudinal drive shaft 68, and the rewind roll shaft 298 being driven from the fluid pressure or other motor 368.

During the operation of the press, the paper strip or web is pulled or drawn from the supply roll 285, against the resistance or drag of the friction brake, by the draw rolls 315 and 316 which are driven from the impression roller and travel at the same surface speed therewith, and the draw rolls feed the strip or web to the impression roller so that it will pass evenly around this roller, and during the passing of the strip or web around the impression roller it is printed in the different desired colors by the printing or type cylinders 10 which are driven from the impression roller and rotate at the same surface speed therewith, the printing or type cylinders being supplied with ink in the different colors from the respective inking mechanisms associated therewith.

The printed web passes from the impression roller to the punching rollers 330 and 331 which are driven at the same surface speed at which the strip travels, and as the strip passes between these rollers, a margin thereof is punched to form a series of perforations therein, the punchings however remaining attached to the strip, thus adapting the printed strip or web to cooperate with registering means such for example as that disclosed in my prior patent hereinbefore referred to. The printed and punched strip or sheet then passes to the rewind roll 365 upon which it is rewound, and a slip sheet may be wound with the printed strip from a roll of paper or other material mounted on the shaft 299.

Whenever it becomes necessary to place a fresh roll of paper in the machine, the operation of threading the strip or web therefrom around the impression roller is facilitated by rotating the disks 25 under the action of the ratchet lever 53 to retract the printing or type cylinders 10, after which these printing cylinders may be restored to operative relation with the impression roller.

Whenever it becomes necessary to change the printing plates on the printing or type cylinders 10, such an operation is facilitated by shifting the frames 75 and 76 away from the opposite sides of the impression roller and printing cylinders and toward the respective ends of the machine, such being accomplished by operation of a crank applied to an end of the shaft 83 or the shaft 89, such retraction of the frames 75 and 76 carrying the inking mechanisms for the printing cylinders away from these cylinders and thereby rendering the printing cylinders readily accessible for the changing of the printing plates, and after the printing plates have been changed, the frames 75 and 76 are returned to their normal operative positions, thereby restoring the inking mechanisms to operative relation with the respective printing cylinders, and the frames 75 and 76 are locked in fixed operative relation with the printing cylinders and impression roller by the locking means hereinbefore described.

Any one or more of the printing units may be rendered idle or inoperative, according to the number of colors to be used in printing the web, by removing the printing plate from such cylinder or cylinders and disconnecting the respective inking mechanism or mechanisms from the driving means by manipulation of the respective clutch levers 220. Since the strip or web is drawn from the supply roll by the draw rolls, the feeding of this strip does not depend upon the frictional engagement of the printing cylinders therewith as it passes around the impression roller, and consequently accurate movement of the strip or web around the impression roller and past the printing cylinders in use to produce high quality printing will be insured, irrespective of the number of printing cylinders in operation.

I claim as my invention:

1. In a multi-color printing press, the combination of an impression roller around which a web to be printed is adapted to pass, a plurality of printing cylinders common to and cooperative with the impression roller to print such web, one or more of the printing cylinders being capable of being rendered inoperative upon the web, a source of supply for the web, and means driven continuously with the impression roller for drawing the web from its source of supply and feeding it to the impression roller in conformity with the surface speed thereof independently of the action of the printing cylinders on the web.

2. In a multi-color printing press having an impression roller, a plurality of printing cylinders common to and cooperative with the impression roller and having means for driving them positively and continuously at the same surface speed as the impression roller and adapted to print in different colors on a web passing around the impression roller, one or more of the printing cylinders being capable of being rendered inoperative with respect to the web, and a source of supply for the web, means driven continuously from the impression roller for drawing the web from its source of supply and feeding it to the impression roller to travel at the surface speed thereof irrespective of the number of printing cylinders in operative relation with the web.

3. In a multi-color printing press having an impression roller, a plurality of printing cylinders common to the impression roller and having means for driving them positively and continuously from and at the same surface speed as the impression roller and adapted to print in different colors on a web passing around the impression roller, one or more of the printing cylinders being capable of being rendered inoperative with respect to the web, and a source of supply for

the web, means driven continuously from the impression roller at a predetermined speed with respect thereto for drawing the web from its source of supply and feeding it to the impression roller to travel at the surface speed thereof irrespective of the number of printing cylinders in operative relation with the web.

4. In a multi-color printing press having an impression roller, means for supplying a web thereto for printing, and a plurality of printing units cooperative with the impression roller and the web thereon, each printing unit embodying a printing cylinder and inking mechanism for supplying ink thereto, driving means common to the inking mechanisms of said units, and means for selectively connecting and disconnecting one or another of said inking mechanisms with respect to said driving means.

5. In a multi-color printing press having an impression roller, means for supplying a web thereto for printing, and a plurality of printing units cooperative with the impression roller and the web thereon, each printing unit embodying a printing cylinder and inking mechanism for supplying ink thereto, a common drive shaft, and means embodying clutches for selectively and individually connecting one or another of the inking mechanisms to said drive shaft.

6. In a multi-color printing press, the combination of a rotatable impression roller, means for supplying a web thereto for printing, a set of printing units to cooperate with the impression roller and the web thereon, each unit embodying a printing cylinder having means for connecting it to the impression roller to rotate at the same surface speed therewith and an inking mechanism for supplying ink to the printing cylinder, means supporting the printing cylinders for movement to and from operative relation with the impression roller, driving means common to the inking mechanisms for driving them, and means for selectively connecting one or another of the inking mechanisms to said driving means for operation thereby.

7. In a multi-color printing press, the combination with a base having a rotatable impression roller mounted thereon, of groups of printing cylinders mounted to cooperate with said roller at opposite sides thereof, inking mechanisms for the respective printing cylinders, frames mounted to reciprocate along said base and supporting the inking mechanisms for the respective groups of printing cylinders for movement away from said cylinders to render them accessible and for movement toward said cylinders to cooperate therewith, driving means for the inking mechanisms, and driving means on the base having a driving connection with the driving means for the inking mechanisms which is maintained during the movements of said frames along the base.

8. In a multi-color printing press, the combination of an elongated base having a relatively fixed frame thereon, an impression roller rotatably mounted in said frame, groups of printing cylinders rotatably mounted in said frame at opposite sides of the impression roller for cooperation therewith, a pair of frames mounted on said base at opposite sides of said relatively fixed frame and movable toward and from it, groups of inking mechanisms for the respective groups of printing cylinders, said groups of inking mechanisms being carried by the respective movable frames and movable thereby to and from operative relation with their respective groups of printing cylinders, driving means on each movable frame for the respective group of inking mechanisms thereon, driving means extending along the base, and means for maintaining driving connections between the driving means on the base and the driving means for the inking mechanisms during movements of the movable frames along the base.

9. In a multi-color printing press, the combination of an elongated base having a relatively fixed frame thereon, an impression roller rotatably mounted in said frame, groups of printing cylinders rotatably mounted in said frame at opposite sides of the impression roller for cooperation therewith, a pair of frames mounted to move longitudinally on said base at opposite sides of said relatively fixed frame and movable toward and from it, and groups of inking mechanisms for the respective groups of printing cylinders, said groups of inking mechanisms being carried by the respective movable frames and movable thereby to and from operative relation with their respective groups of printing cylinders, driving devices for said inking mechanisms carried by the movable frames, driving means extending longitudinally of and in fixed relation to said base, and means for connecting said driving devices to said relatively fixed longitudinally extending driving means and maintaining such connection during the movements of the movable frames along the base.

10. In a multi-color printing press having a revoluble impression roller, means for supplying a web thereto for printing, and a plurality of printing units driven from the impression roller and cooperative with the web thereon, adjustable stops for individually setting the printing units in operative relation with the impression roller, and positively operative means for rendering the printing units simultaneously operative against said stops or inoperative with respect to the impression roller and the web thereon while the driving relation between the impression roller and printing units is maintained.

11. In a multi-color printing press having a revoluble impression roller, means for supplying a web thereto for printing, and a set of printing cylinders movable toward and from and gear driven from the impression roller and cooperative with the web thereon, adjustable stops for individually limiting the movements of the printing cylinders toward the impression roller, and means for simultaneously and positively moving the printing rollers of the set toward the impression roller and against said stops and for simultaneously moving the printing cylinders out of printing relation with the web on the impression roller while the gear drive between the impression roller and the printing cylinders is maintained.

12. In a multi-color printing press having a revoluble impression roller, means for supplying a web thereto for printing, and a set of printing cylinders cooperative with the impression roller and the web thereon, gearing connecting the printing cylinders to the impression roller for driving the printing cylinders from the impression roller and at the same surface speed therewith, means supporting the printing cylinders for movement to and from printing position, adjustable stops individual to the printing cylinders for positively limiting their movements into printing position, and means cooperative with said supporting means for positively moving the set of printing cylinders simultaneously

into printing position against the respective stops and for moving the printing cylinders out of printing position simultaneously while the engagement of the gearing connecting the printing cylinders and the impression roller is maintained.

13. In a multi-color printing press, a frame, an impression roller revolubly mounted therein, a set of printing cylinders cooperative with said roller to print in different colors on a web thereon, eccentric bearings mounted in said frame and supporting the printing cylinders around the impression roller for movement toward and from the periphery of the impression roller, cranks having means for securing them in rotatably adjusted positions on the respective eccentric bearings, a member mounted rotatably in said frame coaxially with the impression roller, means connecting said member to said cranks on the eccentric bearings of the printing cylinders for simultaneously moving the set of printing cylinders toward and from the periphery of the impression roller when said member is rotated, and adjustable stops for individually limiting the movements of the printing cylinders of the set toward the impression roller.

14. In a multi-color printing press, a frame, an impression roller revolubly mounted therein, a set of printing cylinders cooperative with said roller to print in different colors on a web thereon, eccentric bearings mounted in said frame and supporting the printing cylinders around the impression roller for movement toward and from the periphery of the impression roller, cranks having means for securing them in rotatably adjusted positions on the respective eccentric bearings, stop means individual to each printing cylinder and adjustable supplementarily to the adjustments of said cranks for individually determining the extent of movement of the printing cylinders of the set toward the impression roller, a member mounted rotatably in said frame coaxially with the impression roller, and means connecting said member to said cranks on the eccentric bearings of the printing cylinders for simultaneously moving the printing cylinders toward and from the periphery of the impression roller when said member is rotated.

15. In a multi-color printing press, a frame, an impression roller revolubly mounted therein, a set of printing cylinders cooperative with said roller to print in different colors on a web thereon, eccentric bearings mounted in said frame and supporting the printing cylinders around the impression roller for movement toward and from the periphery of the impression roller, a member mounted rotatably in said frame coaxially with the impression roller, individually adjustable means connecting said member to the respective eccentric bearings of the printing cylinders for simultaneously moving the printing cylinders positively toward and from the periphery of the impression roller when said member is rotated, adjustable stop means individual to the respective printing cylinders for positively limiting the movements of the printing cylinders toward the impression roller, means for rotating said member to move the printing cylinders toward the impression roller until arrested by said stop means, and means for locking said member in different set positions.

16. In a multi-color printing press having an impression roller, means for supplying a web thereto to be printed, and a group of printing cylinders at a side of the impression roller for printing the web in different colors, a frame carrying inking mechanisms to cooperate with the printing cylinders, said frame being movable to carry the inking mechanisms to and from operative relation with the printing cylinders, and a two-speed means for moving said frame to carry the inking mechanisms at different speeds toward and from the printing cylinders.

TRUE M. AVERY.