

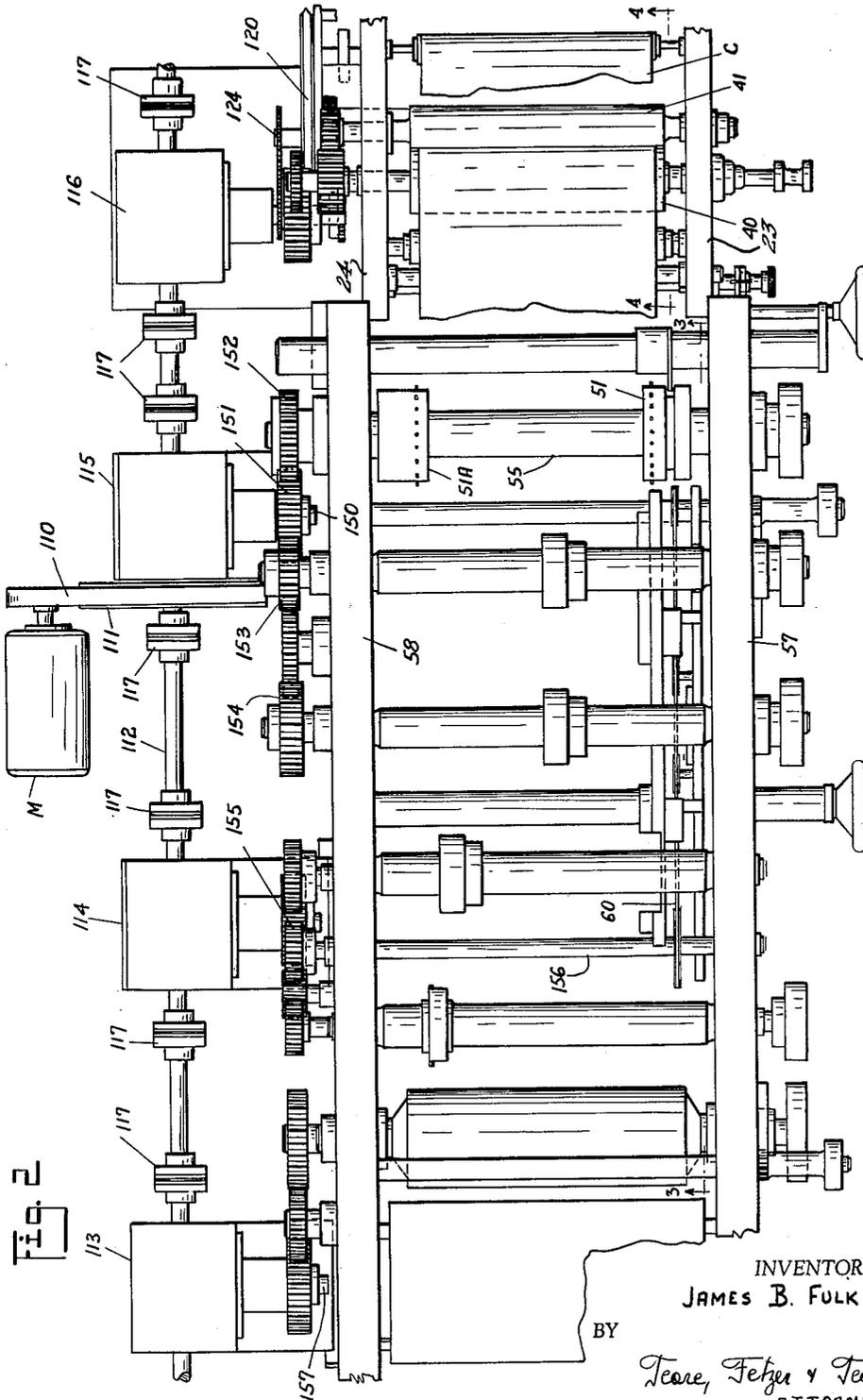
Sept. 1, 1964

J. B. FULK
METHOD AND APPARATUS FOR PRINTING AND/OR
PROCESSING WEBS OF MATERIAL

3,147,006

Filed July 9, 1963

10 Sheets-Sheet 2



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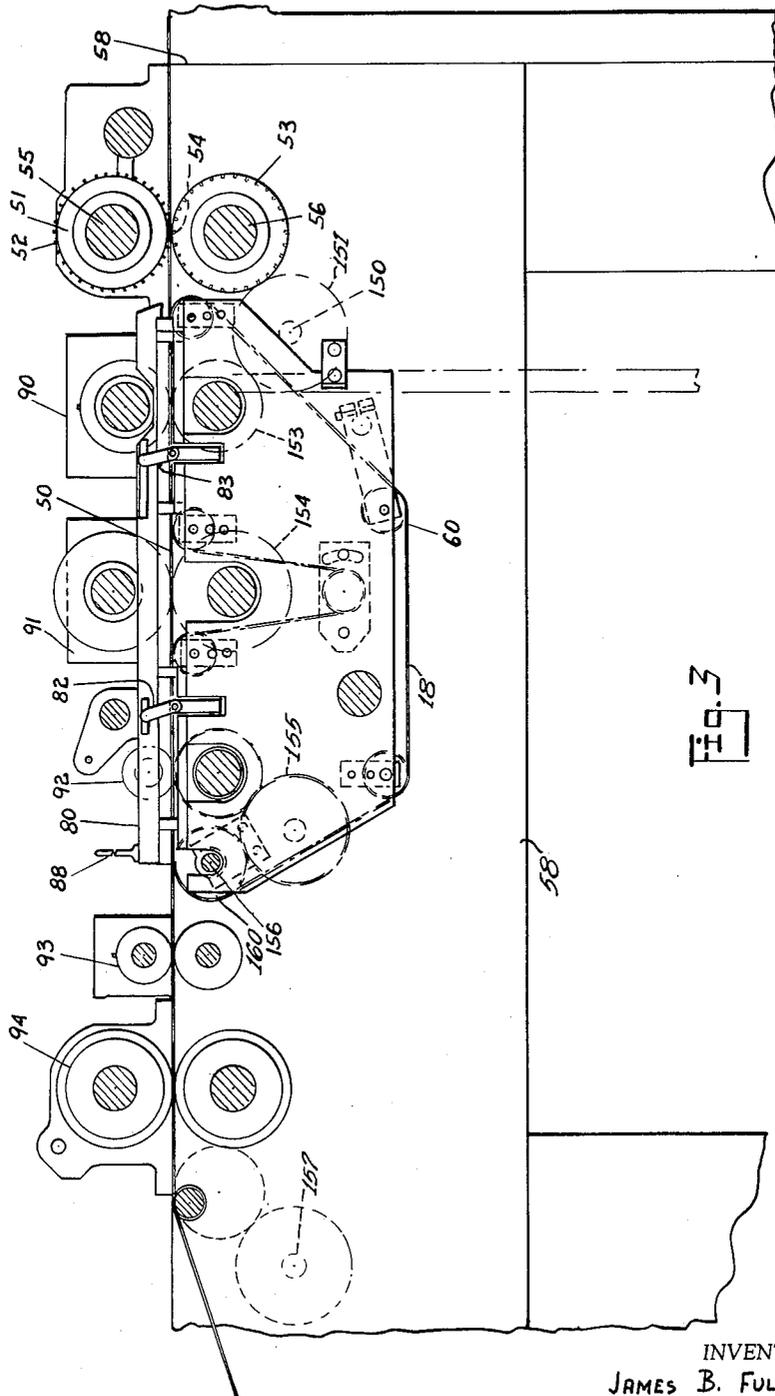


FIG. 3

INVENTOR
JAMES B. FULK

BY

Teare, Feffer & Teare
ATTORNEYS

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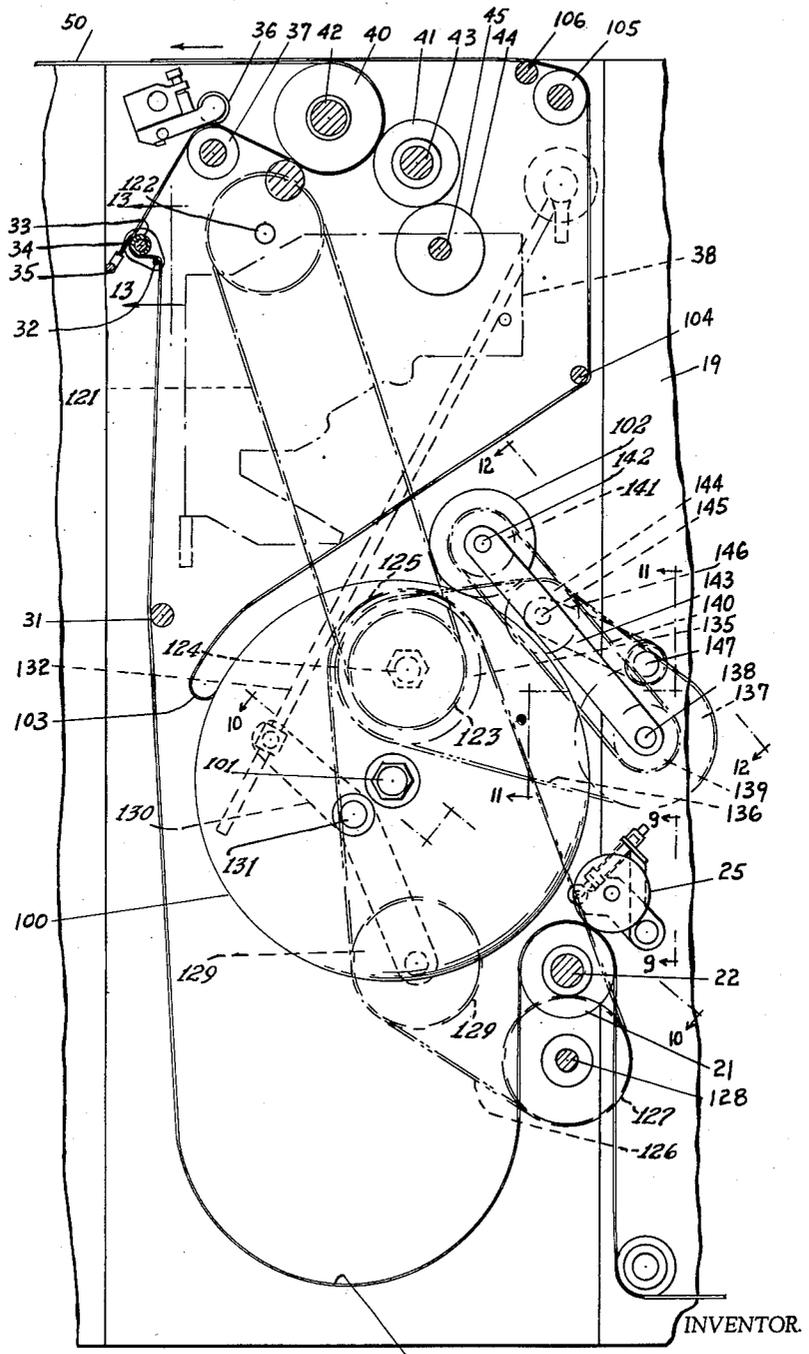


Fig. 4

BY JAMES B. FULK
Teare, Felton & Teare
ATTORNEYS

Sept. 1, 1964

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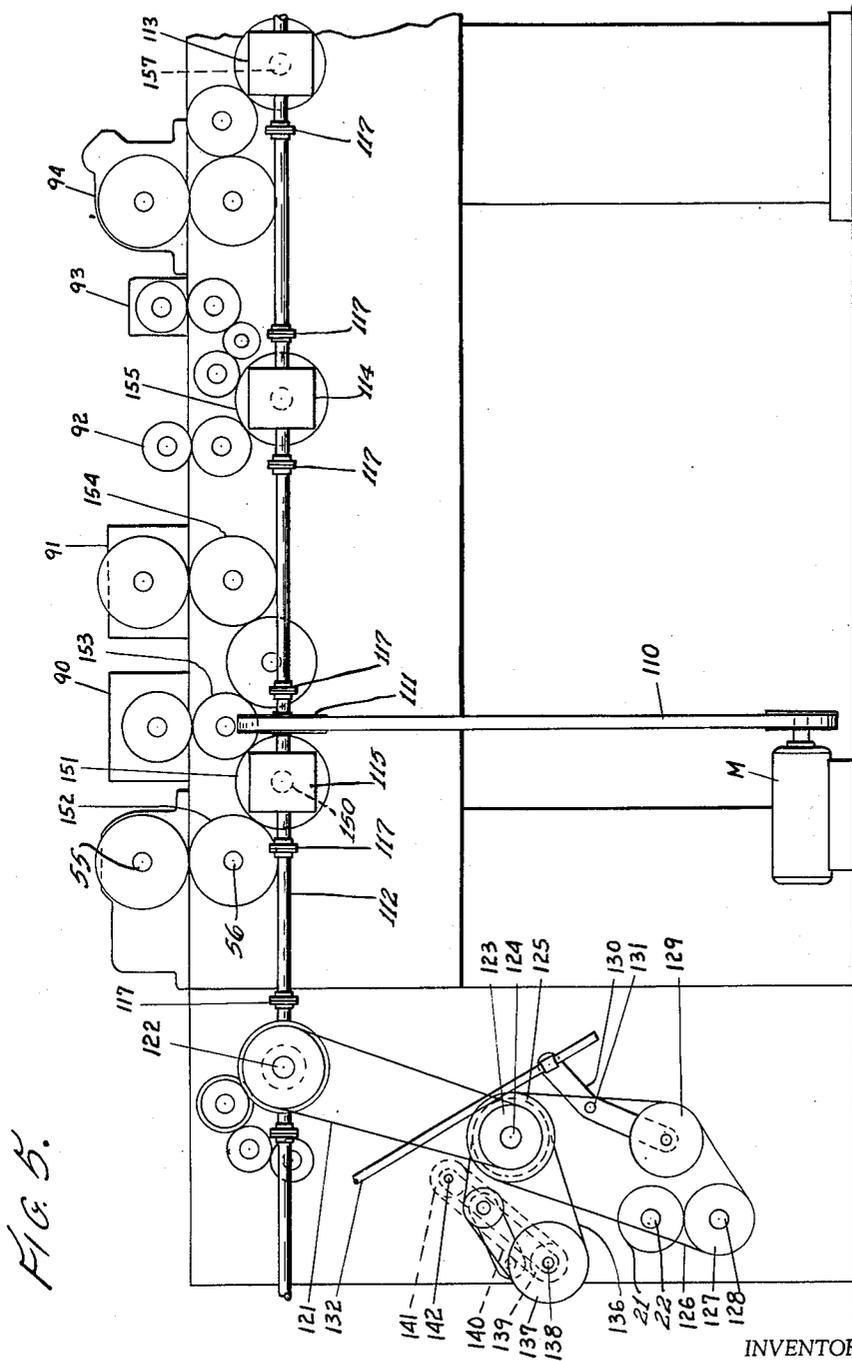


FIG. 5.

INVENTOR

JAMES B. FULK

BY

Teane, Fetzer & Teane
ATTORNEYS

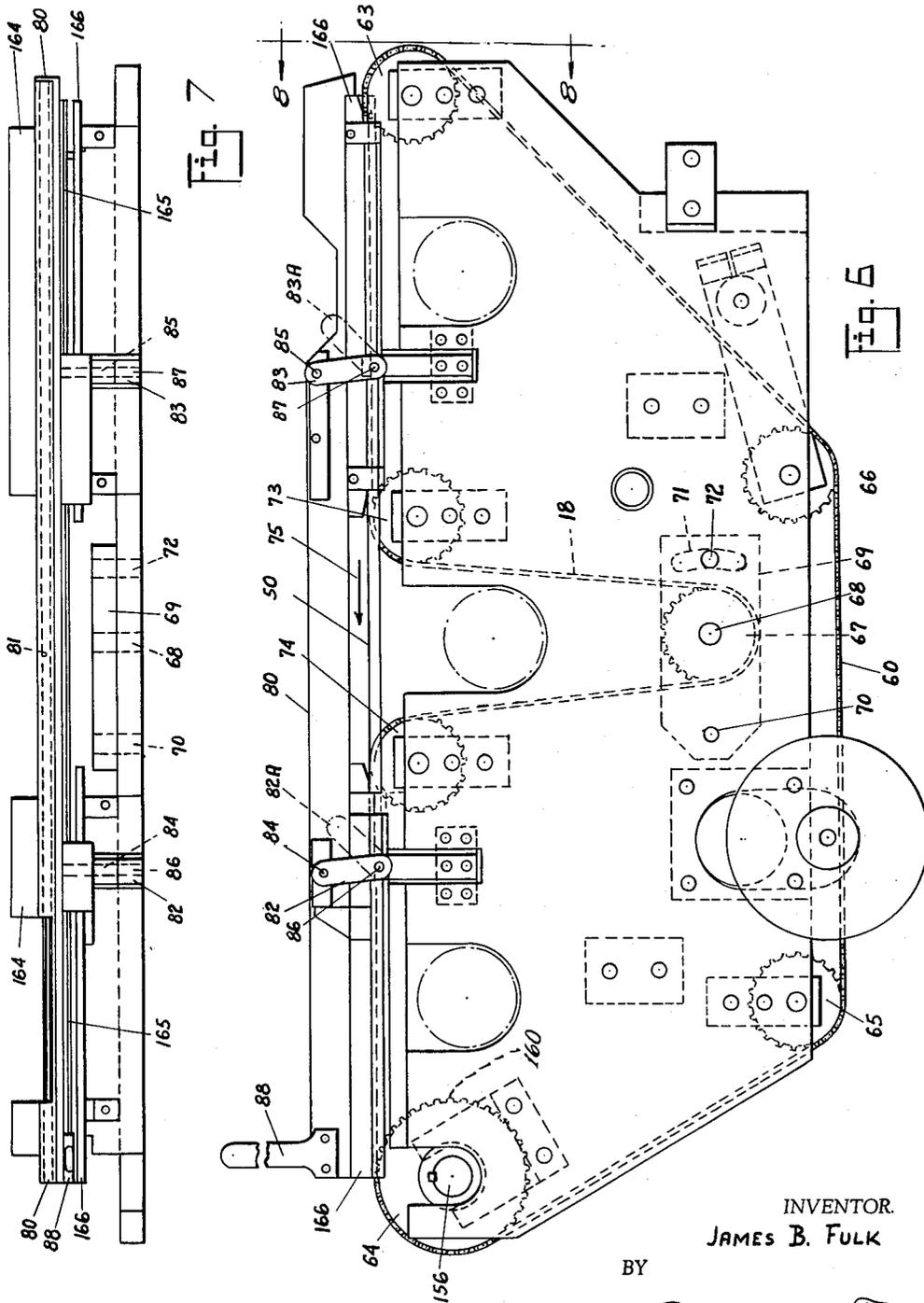
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INVENTOR.
JAMES B. FULK

BY

Teare, Feltzer & Teare
ATTORNEYS

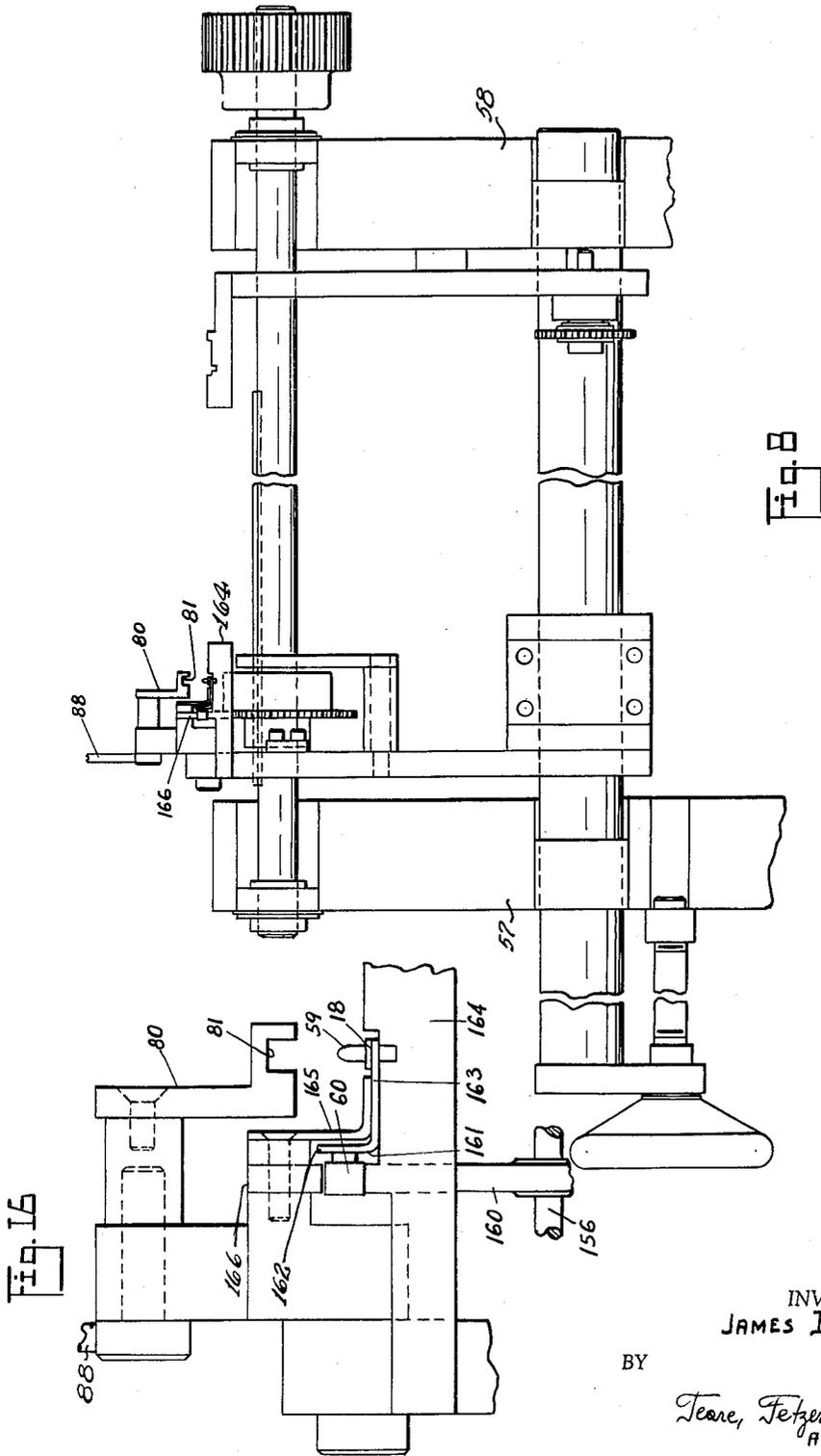
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J. B. FULK
METHOD AND APPARATUS FOR PRINTING AND/OR
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INVENTOR.
JAMES B. FULK

BY

Teare, Fetzer & Teare
ATTORNEYS

Sept. 1, 1964

J. B. FULK
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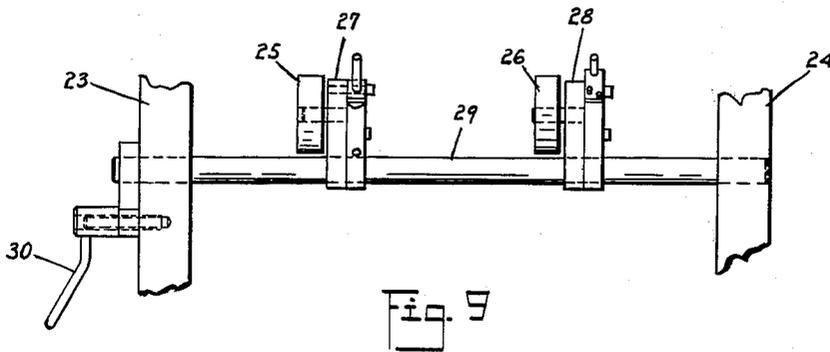


Fig. 9

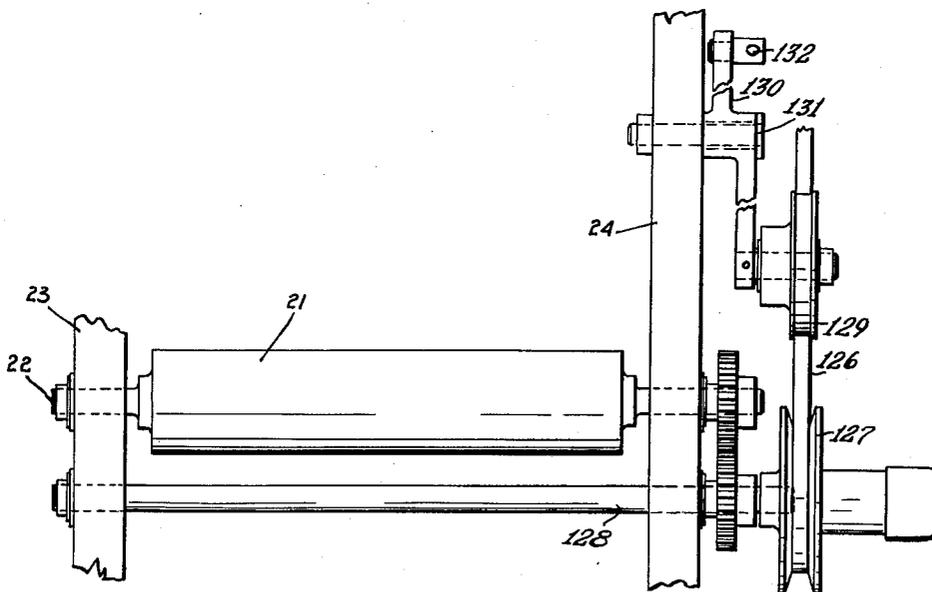


Fig. 1A

INVENTOR.

JAMES B. FULK

BY

Teare, Fetzer & Teare
ATTORNEYS

Sept. 1, 1964

J. B. FULK
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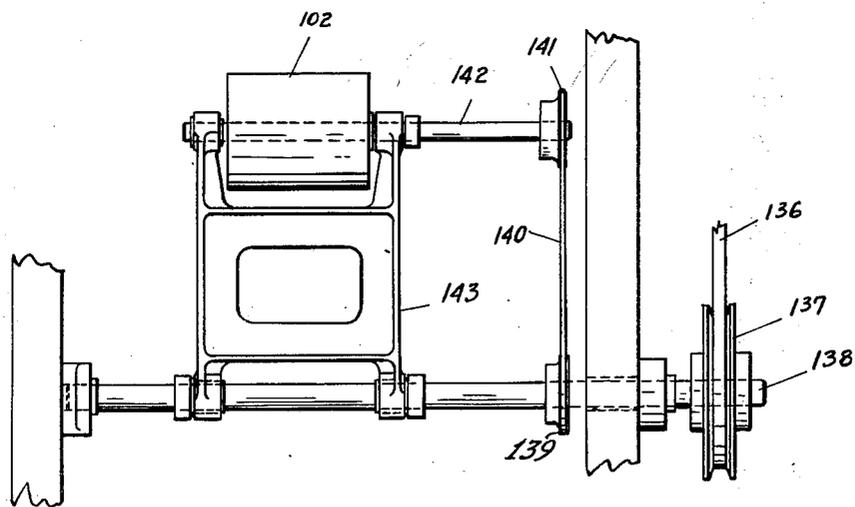
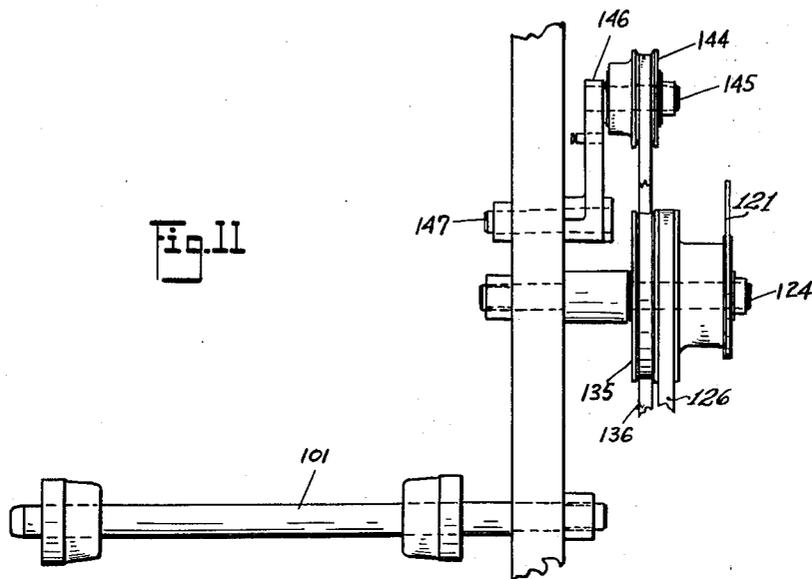


Fig. 12

INVENTOR.
JAMES B. FULK

BY

Teare, Teebe & Teare
ATTORNEYS

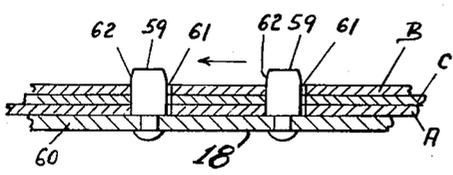
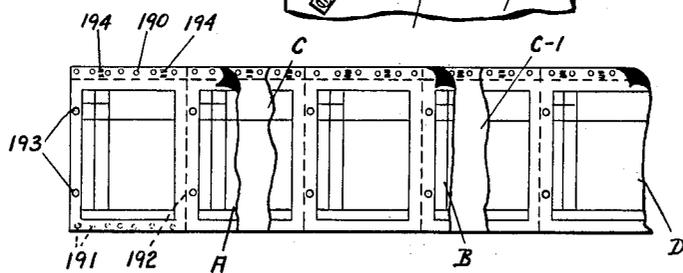
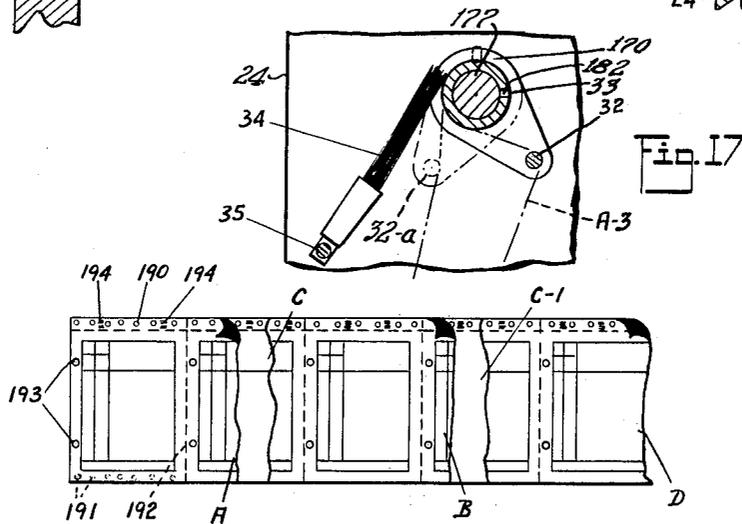
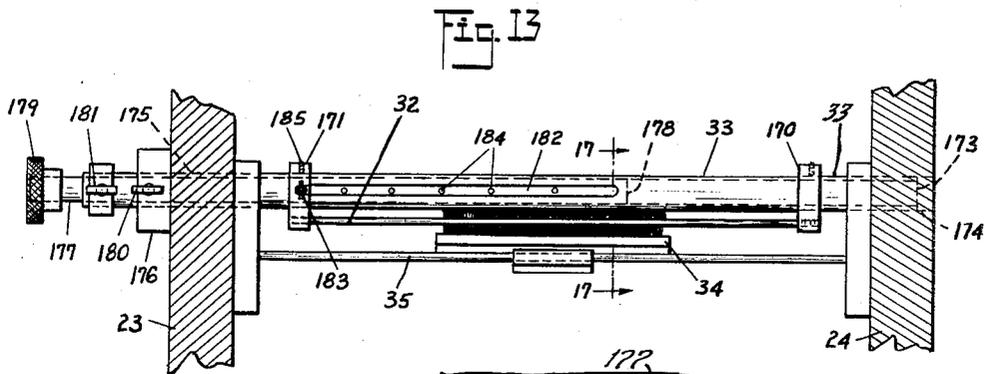
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INVENTOR.
JAMES B. FULK
BY
Teare, Fetzer & Teare
ATTORNEYS

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3,147,006
**METHOD AND APPARATUS FOR PRINTING
 AND/OR PROCESSING WEBS OF MATERIAL**

James B. Fulk, 18309 Lexington Drive,
 Monte Sereno, Calif.

Filed July 9, 1963, Ser. No. 293,673
 16 Claims. (Cl. 270-18)

This invention relates to a method and apparatus for printing or processing a plurality of webs of paper which are intended for use as business forms.

In the art of manufacturing continuous multiple part business forms, the most difficult problem to overcome is that of combining webs of various kinds of material having different weights, widths and surface characteristics into continuous strips of predetermined equal lengths and exact register. It is necessary not only that the webs be maintained in a predetermined equal length, but that the transfer webs (carbon) with which the webs are interleaved must also be of equal length and in exact register. Thus, in the manufacture of single set forms, the various webs must be in exact register and equal lengths to progress through the presses and collators properly. Again, in the manufacture of tabulating continuous business forms, it is not only imperative to maintain such registration and equal length during the manufacturing process, but, due to the fact that the forms are processed by the ultimate user in long continuous strips, the lengths are of even greater importance, for the reason that a variation of even one of the webs in the set will cause the forms to fail in operation on the tabulating printer, or on other machines utilizing the continuous forms. A web which is shorter or longer than it is supposed to be will cause mal-feeding of the tabulating printer or typewriter thus rendering the product worthless.

Heretofore, in the operation of a multiple web rotary printing press, the practice has been to feed the paper to the printing and punching cylinders in a taut condition at the speed which hopefully will result in exact press circumference length. In an effort to accomplish this result the feeding or metering rolls are timed to the press circumference length closely, and various mechanisms are provided to alter the speed of the rolls to compensate for variables in an attempt to keep the paper feeding in perfect lengths. Thus, the presses are equipped with various feed rollers along the path of the webs through the press to maintain the paper in a proper position, and to move the webs through the machine to the folder or cut-off or rewind. There are quite a number of factors which cause variation in the relative speed at which the paper passes through the press, and such factors, with their variances, cause the relationship between the exact circumferential speed of the press and the speed of the paper to differ. Thus, although mechanically the surface speed of the plates and punch units on the rotary cylinders and the draw rolls of the press are exactly proper and matching, nevertheless the actual amount (lengths) of material fed into and drawn out of the press does not exactly match the repeat lengths of the press revolutions. For example, 10 revolutions of a 22 inch cylinder should deliver exactly 220 inches of material but, because of the variables existing in present methods, the paper will leave the press as 220-plus inches or 220-minus inches.

Even though adjustments are made at the beginning of a roll to the feed rollers, tensioning devices, etc. so that the relative speed is correct, nevertheless the variable factors aforesaid start affecting the webs as soon as the run is under way. Some of the variables are the thickness of the webs of material, the widths of the webs, the surface characteristics of the material, the original size and constant change in the diameter supply roll, and the

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change in speed of the press itself. Any or all of such factors can cause a change in the relationship of the web and the press, thereby resulting in changes of register of the printing and punching, as well as the length of the webs. It is common practice to check the lengths on measured distances very frequently in an effort to compensate for differences, and then to pull or push the web and to apply tension and strain in an effort to correct the condition. In some instances, stroboscopes are utilized in an effort to observe the register and to attempt to make adjustments for variations in length during a press run.

Heretofore, another problem has been the maintenance of proper widthwise adjustment to a moving web, particularly where the adjustment had to be made at a point remote from the printing couple and adjacent the supply roll, or at an intermediate point between the roll and the press.

An object of the present invention is to provide a method and apparatus for controlling the web, or webs, of paper and transfer material, into and through a machine for manufacturing forms, so as to eliminate the difficulties previously described. Thus, in the case of a single web, for example, an object of the invention is to have the web leave the press folded or rewound in exact register and in perfect predetermined lengths so that when it is combined with other webs which have been run by means of the method of the present invention, all will possess the same length and be in exact register.

It is a further object of the invention to enable a plurality of webs to be run in one operation through the machine, and to obtain printed parts, or transfer (carbon) webs, which are of predetermined equal length and in exact register with each other.

A further object of the present invention is to obtain the aforesaid equality of length and exactness of register, without the necessity for tension controlling devices, such as brakes, variable speed drive rolls, and other expedients, and without the necessity for mechanism for detecting an error and then automatically initiating the actuation of a tensioning or slackening equipment, in order to correct the error while the press is in operation.

An additional object of the present invention is to maintain the exactness of length and register aforesaid, regardless of the speed at which the press is operated, up to the maximum speed for which the press is designed. In this connection my invention contemplates a continuous operation of the press, without the necessity for any checking, as aforesaid, of paper lengths and register during the operation of the press.

Still another object of the invention is to maintain proper widthwise adjustment so as to solve the problem which has heretofore existed, as stated aforesaid, and which has been difficult to control.

Briefly, the foregoing objects are accomplished by pulling the web, or a plurality of them between rotary printing or processing members, by means of force exerted in a plane on the discharge side of the members, and by arranging to have the web or webs approach the printing or processing units from a slack web in the form of a festoon, or free falling loop. A slight amount of brush pressure, which is constant, is exerted on the web at the end of the free falling loop so that the printing or processing operation is accomplished by members which are not utilized for feeding the web at the instant of performing operations thereon. In the preferred arrangement, the pulling force is exerted in a plane by pins which physically engage holes punched in the web, or webs, thereby precluding slippage and maintaining constant travel, regardless of variable factors in the thickness of the webs or surface characteristics thereof. The pulling speed is timed exactly with the printing, punching and other processing

units. The brush which engages the paper after the free loop or festoon is formed, keeps the web in the guide collars and exerts a constant pressure which overcomes and invalidates the tendency of the cylinder and plate pressures to feed the web during its passage through the printing unit. Moreover, the pulling of the web on a plane by the engagement of pins in holes, which are punched in the web while the web is passing through the machine, controls the linear footage of material exactly. The use of the festoon in conjunction with the brush pressure divorces the movement of the supply roll from the printing or processing unit, thus enabling the press to perform its operation without incurring any variable inherent in the withdrawal of the paper from a supply roll, or in the passage of the web over the arc of the operating cylinders. By pulling the web or webs in a plane, which is mechanically fixed at the exact speed required, and by mechanically engaging and exerting the pulling force after the printing or processing operation has been accomplished, eliminates slippage resulting from the use of drive wheels and cylinders.

The present invention also solves the problem of widthwise adjustment by utilizing two arms which engage the side edges of the web and are adjustable with relation to each other, and which engage the web immediately preceding the entry of it into the printing or processing couple. By working with a slack web in the form of a festoon and locating the guiding arms at the discharge end of the festoon and immediately preceding the entry of the web into the printing or processing couple, the widthwise control is adequately maintained, thereby resulting in a substantial reduction in waste material.

Referring to the drawings,

FIG. 1 is a side view of a machine embodying the present invention;

FIG. 2 is a top plan view of a part of the machine shown in FIG. 1 but on a scale larger than that of FIG. 1;

FIGS. 3 and 4 are vertical sections taken on planes indicated by the lines 3—3 and 4—4 respectively in FIG. 2;

FIG. 5 is a side elevation showing the driving connections for some of the units on the machine;

FIG. 6 is a side view showing the apparatus utilized for exerting a pulling force in a plane on the webs;

FIG. 7 is a top plan view of the equipment shown in FIG. 6;

FIG. 8 is an end elevation as viewed along the line 8—8 in FIG. 6;

FIG. 9 is an end elevation as viewed along the line 9—9 of FIG. 4;

FIG. 10 is a view taken on a plane indicated by the line 10—10 in FIG. 4;

FIG. 11 is a view taken along the line 11—11 in FIG. 4;

FIG. 12 is a view taken along the line 12—12 in FIG. 4;

FIG. 13 is a sectional view along the line 13—13 of FIG. 4 and illustrating the side guide bars;

FIG. 14 is a top plan view of webs removed from the press;

FIG. 15 is a vertical section on an enlarged scale taken longitudinally through the pinned belt and webs;

FIG. 16 is an enlarged detail end view of the pinned belt, and

FIG. 17 is a section taken on the line 17—17 in FIG. 13.

The present invention is intended for use on either single or multiple webs. As applied to single webs it is intended for use with or without printing, and with a line of holes either along one or both sides of the web. As applied to a multiple web, it is intended for use either with or without printing, and with marginal holes along either one or both sides of the web. Additionally, the invention is intended, as applied to multiple webs, for use with or without carbon. The invention is capable of use on as many multiple part forms as are desired for com-

mercial use but, for purposes of illustration, and within the limits of the drawings, I have shown in FIG. 1 two paper webs indicated at A and B, respectively, as being withdrawn from rolls A-1 and B-1 which may be journaled at A-2 and B-2 respectively upon a frame 10. It is to be understood, however, that my invention is capable of use with a larger number of webs, and that additional supply rolls and printing units may be added, as desired.

Each web is passed through a withdrawing apparatus, indicated in general (FIG. 1) at 11, for web A, and at 12 for web B. The web A then falls in a festoon indicated at A-3 while the web B falls in a festoon indicated at B-3, from which each passes into a widthwise guiding apparatus indicated in general at 13 and 14 respectively, and thence into a printing press indicated in general at 15 and 16 respectively.

The present invention is concerned with a method and apparatus for controlling the movement of one or more webs continuously through a rotary printing or processing unit, while holding the web or webs in exact lengths and in exact register. Additionally, the invention contemplates such accomplishment, without the need for checking an observation of length or register, and without making either manual or automatic adjustments to compensate for variations in length or register.

The foregoing is accomplished by withdrawing the webs from supply rolls and by allowing the webs to fall in a loop or festoon before performing the printing or processing operation. Thus, the printing or processing unit is not required to exert force to withdraw any web from a supply roll. The invention further contemplates the performance of the printing or processing operation upon the web, either singly, or in multiple, while a pulling force is exerted upon the web only after it has passed through the printing or processing couple. Such pulling force is exerted in a plane.

The preferred form of pulling force illustrated comprises the punching of a row of holes along either one or both marginal edges of the web or webs after it has left the printing or processing unit, and then immediately engaging some of such holes and exerting force against the walls thereof to pull the web, or webs, in a plane, and thereby hold it, or them, against slippage during the performance of any subsequent operation such as perforating, numbering, binding, or file hole punching. Thus, the printing or processing unit performs no function except to imprint or process the web. The web pulling unit is indicated as being a pinned belt 18 which is mounted within a frame 20, and is suitably carried by an endless chain 60, which is driven in timed relationship to the web withdrawal rolls and the printing couples.

Each web withdrawal unit is illustrated in FIGS. 4, 9 and 10 as comprising a drive roll 21 which is mounted on the shaft 22 and is journaled in the front and back plates 23 and 24 respectively of the press frame 19. Pressure rolls 25 and 26 are adapted to engage the web as it passes over the roll 21 and to exert the desired degree of pressure thereagainst to assure a uniform withdrawal of the web from the supply roll. As shown, the pressure rolls may be journaled in arms 27 and 28 respectively, the latter of which are mounted on a cross bar 29, supported for angular adjustment in the frame plates 23 and 24 respectively. The pressure rolls may be suitably adjusted and then locked in any desirable position, as by a hand clamp 30. The drive for the roll 21 is obtained through suitable gearing and chain connections by an electric motor M, in timed relationship to the pulling and printing or processing equipment, as will be hereinafter set forth.

In FIG. 4, the web A-3 falls in a festoon, then extends upwardly past a first guide bar 31, thence over a second guide bar 32, and around a third guide bar or tube 33, at which point drag pressure may be exerted against the web by means of a brush 34 which is mounted for angular adjustment upon a cross bar 35. If longitudinally extending perforations are desired in the web, they may be

applied thereto by a perforating roll 36, as the web passes over an anvil roll 37.

From the perforator 36 the web passes downwardly around the impression roll 40 of a printing couple, the blanket roll of which is indicated at 41. The impression roll is journaled at 42 in a suitable printing couple frame indicated at 38 in FIG. 4, while the blanket roll 41 is mounted on a shaft 43, which is also journaled in the printing couple frame. The customary plate cylinder is indicated at 44 as being journaled on shaft 45.

After the web leaves the impression roll 40, it travels to the left, as viewed in FIG. 4 and passes along the line indicated at 50 and into the pulling unit. In FIG. 3 the pulling unit is shown as an endless pinned belt 18, which is driven by suitable driving connections to the motor M, as will hereinafter be more fully described. The pins on the belt project outwardly therefrom for engagement with holes that are punched in the web after it has left the printing couple and in close proximity thereto. A suitable punching unit includes a roll 51 having uniformly spaced punches or male dies 52 therein and a roll 53 having coacting openings or female dies 54 therein. It is understood that the openings 54 are in registration with the punches 52 so as to form a row of holes in the paper as it passes therebetween. The roll 51 is mounted on shaft 55, while the roll 53 is mounted on shaft 56, each of which is journaled for rotation in the front and back plates 57 and 58 of the frame 20. Thus, as shown in FIG. 3, the webs are pulled in a plane which is at a right angle to the axis of the coacting dies.

In FIG. 2 I have shown one punch roll 51 for punching one row of holes along one edge of a web of paper and an additional punch 51a also affixed to the shaft 55 for punching a second row of holes along the opposite edge of the paper web. It is to be understood that there is a die roll also affixed to the shaft 56 for coacting with the second punch roll 51a. The rolls may be axially adjustable along their respective shafts to accommodate various widths of paper webs.

To actuate and maintain movement of a web through the printing couple, a pulling force may be exerted upon the web by means of pins 59 (FIG. 15) which project outwardly from the endless belt 18. The pins engage openings 61, which are made in the webs by the coacting punch and die rolls. Thus, in FIG. 15 two webs A and B are shown with an interleaved carbon web C, with the forward edge 62 of each pin pushing against the forward edge of the hole in each web. Where a single row of holes is desired along one edge, then only one belt 18 need be used for pulling the webs. Where, however, a row of holes is desired along opposite edges, then two such belts 18 are utilized, one for each row of holes.

In FIG. 6, the chain 60 for the belt 18 is shown as being mounted on upper end sprockets 63 and 64 and on lower sprockets 65 and 66, respectively. To take up any slack in the chain, I have shown an idler sprocket 67 which may be mounted on a shaft 68, which is shown as being journaled in a plate 69, one end of which is pivotally mounted at 70 to one of the frame plates. A slot 71 in the plate 69 enables the plate to be swung about the pivot 70 for taking up any slack in the chain. The plate, in turn, may be locked in any desired position by means of a clamping bolt indicated in general at 72. Suitable guide sprockets 73 and 74 engage the upper reach of the chain and cooperate with the sprockets 63 and 64 to support it in a plane. It is to be understood that the web 50 bridges the gap between the guide sprockets 73 and 74, but that the pins re-engage holes in the web as the chain passes over the guide sprockets 74 and moves to the left, as shown by the arrow 75 in FIG. 6.

To assist in holding the web or webs upon the pins of the belt 18 reference may be had to FIGS. 6 and 8 which illustrate a bar 80 which is supported above the line of movement of the webs and is provided with a channel-shaped recess 81 through which the pins may pass when

the bar is lowered to contact the webs. In FIG. 8 the bar is shown in raised position but it is adapted to be swung downwardly after the webs have been placed over the pins on the belt. For accomplishing such purpose the bar is shown as being supported by two links 82 and 83 (FIG. 6), each of which is pivotally connected as at 84 and 85 respectively to the bar 80 and each of which is pivotally connected as at 86 and 87 respectively to the frame. A handle 88 attached to the bar facilitates movement of it from the upper full line position of the links shown in FIG. 6 to the lower dotted line position 82a and 83a respectively.

In FIG. 1 I have indicated various units for processing the web or webs after passage through the line hole punching unit. Such operating structures may comprise a numbering unit 90, a file hole punching unit 91, a longitudinal perforating unit 92, a crimp locking unit 93, a cross perforating or cut-off unit 94, a folder 95, and a delivery belt 96. If desired, a second pinned belt 97 may be disposed between the cross perforator and the folder and may be driven in timed relation to the belt 18, thereby maintaining contact with the webs until the time of the final operation thereon.

Where it is desired to use an interleaved carbon, then provision is made (FIG. 4) for supporting a roll of carbon paper 100 on a shaft 101 which is journaled in the press frame. A friction roll 102 bears against the upper portion of the carbon roll and drives it so as to remove the web therefrom. The web falls in a loop, as indicated at 103, and then passes upwardly to the right, as shown in FIG. 4, around a guide bar 104 thence vertically around a guide roller 105, thence over a guide bar 106 and thence to the left along the paper line 50. The friction roller 102 is driven in timed relation to the other operating mechanism, so as to maintain the loop in the carbon web while the press is in operation.

To rotate the various shafts for the web withdrawal, the printing, the punching and the pulling operations, I have shown an electric motor M which is connected in any suitable manner to the various units for effecting a positive driving connection and thus assuring a timed relationship in the operation thereof. Thus, in FIG. 2 the motor M may be connected by a belt 110 to a driven pulley 111, which is fixed to a line shaft 112 at the rear of the press. The line shaft has various take-off points, such as 113, 114, 115 and 116, each of which may include a gear box for transmitting power to the respective driven units. Suitable spaced flexible couplings 117 provide a universal joint type of movement and assure alignment of the various operating sections of the line shaft.

Any conventional form of printing unit or inking unit and/or color unit, may be utilized in carrying out the present invention. The printing unit shown is merely illustrative of one form of operation which may be performed upon the web. In FIG. 2 the drive for such unit is indicated in general at 120, as embodying suitable interconnected gears and chain drives for effecting a desired speed of rotation of the impression roll 40 and of the coacting blanket roll and plate cylinder.

The drive for the roll 21 may be taken from the unit 120 as by means of a sprocket chain 121 (FIGS. 4 and 5), which is driven by a sprocket on shaft 122, the latter of which is directly geared to the shaft 112. The chain 121 may drive a sprocket wheel 123, which is mounted on shaft 124. A second sprocket wheel 125, also mounted on shaft 124, drives a chain 126, the latter of which drives a sprocket 127 on shaft 128. The shaft 128 is geared to the shaft 22 and the tension on the chain 126 is adjustably controlled by means of an idler sprocket 129, which is supported on a bell crank 130, the latter of which is pivoted at 131 to the frame and to a manually adjustable rod 132.

To actuate the carbon drive roll 102, I have shown a pulley 135 on the shaft 124, which carries a belt 136

(FIGS. 5 and 12). The belt drives a pulley 137 on shaft 138 the latter of which carries a sprocket 139. A chain 140 passes around the sprocket 139 to drive a sprocket 141 on shaft 142, the latter of which carries the friction drive roll 102. The driving roll shaft is supported on a bracket which is in the form of a yoke designated 143 and is pivoted on the shaft 138. Thus the driving roll can follow down by gravity and remain in contact with the surface of the carbon roll. There may be a spring-loaded take-up on the belt 136, which is shown in general (FIG. 11) as a pulley 144 on a pin 145, the latter of which is carried in an arm 146 of a spring-loaded bracket which is pivoted at 147 to the frame.

The drive for the punch and die roll shafts 55 and 56 respectively may best be illustrated in FIGS. 2, 3 and 5 wherein a shaft 150 driven by the gear unit 115 carries a gear 151, which is connected by suitable gearing, as indicated in general at 152, to drive the shafts 55 and 56 in unison. As illustrated, the numbering unit 90 may be suitably operated by gearing, indicated in general at 153, while the file hole punch, indicated at 91, may likewise be driven from suitable gearing, indicated in general at 154. Such last mentioned gearing may be directly connected to the gear 151.

The driving arrangement for the additional units shown on FIGS. 1, 3 and 5 may embody gearing arrangements similar to those described. Thus, for example, the gearing, indicated in general at 155 in FIG. 2, may be operated by the gear box unit 114 for actuating the longitudinal perforator 92, the drive shaft 156 for the endless chain 60 and its associated pinned belt 18, and the crimp lock 93. Similarly, the take-off shaft 157 from the gear box 113 may be suitably geared to drive the cross perforator 94. Additional take-off drives (not shown) may be utilized from an extension of the shaft 112, to the left as viewed in FIG. 2, for driving the folder 95 (FIG. 1), the delivery belt 96 and the auxiliary pinned belt 97. It is to be understood that all of such units are operated in timed relationship so as to enable all operations to be performed while the webs are moving continuously through the machine. Thus, the line shaft 112 would be extended to accommodate any desired number of printing units, each with its own web withdrawal unit, and carbon supply roll, and each additional printing unit would have its own driving connections, as illustrated and described in connection with FIGS. 4 and 5.

In FIG. 16 I have illustrated, in greater detail, the construction of the pinned belt which is used for pulling the forms through the machine. In the form illustrated the endless chain 60 is driven by a sprocket wheel 160 which is fixed to the shaft 156. The links of the chain may carry angle plates 161 (FIG. 16) each having a leg 162 which extends parallel to the associated chain link and another leg 163 which carries the pin 59. The respective angle plates are guided along the upper reach of the belt by a table 164, and by an angle bar 165, which are fixed to the frame, and thereby provide a passage-way between which the pin carrying legs 163 are moved as the chain is operated. There is also shown in FIGS. 6 and 16 a pair of guide bars 166 which are fixed to the frame and extend along and above the upper reaches of the endless chain 60. They act as a guide to dampen any tendency of the chain to fly off the driving sprocket and guiding sprockets.

One of the features of the present invention is the use of a widthwise guiding and adjustment for the web immediately preceding the entry of it into the printing couple. Such guiding is accomplished in the apparatus illustrated in FIG. 13 by collars 170 and 171 between which the web passes as it leaves the upper end of the festoon. The collars are mounted for adjustment, either toward or from each other, so as to accommodate webs of different widths, and also for movement together as a unit with reference to the frame, so as to shift the position of a web and adjust it to suit operating conditions. To accom-

plish this purpose, the collar 170 is shown as being slidably mounted upon the tube 33, one end 173 of which extends into an opening 174, in the rear frame plate 24 of the printing unit frame. The other end of the tube extends through an opening 175 in the front frame plate 23, and also through an extension of the opening in a block 176 affixed to the front face of the frame. The tube extends beyond the block and has slidably mounted therein a bar 177 which terminates inside the tube, as designated at 178. The outer end of the bar is provided with a knob 179. The tube 33 may be locked to the frame, as by means of a wing bolt 180, while the bar 177 may be locked to the tube by means of a wing bolt 181. With such arrangement, the bar may be adjusted and locked in position with reference to the tube, while the tube may be adjusted and locked in position with reference to the frame. Additionally, the tube and bar may be rotated as a unit and then locked in any desired position with respect to the frame.

To facilitate a quick adjustment widthwise between the collars 170 and 171, the tube 33 may be provided with a slot 182 through which a wing bolt 183 extends. That portion of the bar 177 beneath the slot is provided with spaced threaded openings 184 into which the wing bolt 183 may be threaded for locking the collar 171 to the bar. The bar 32 (FIG. 17) has one end thereof rigidly connected to the collar 170, and has the other end thereof slidably extendable through an opening in the collar 171, the latter of which may be detachably connected to the tube 33, as by a set screw 185. Thus, the collar 171 may be positioned in any of the openings 184 for quick setting and then adjusted minutely by movement of the bar 177 axially with respect to the tube 33.

In addition to the tension or drag which may be exerted upon the web by the brush 34, I may utilize the bar 32, as shown in FIG. 17. Since the bar 32 is carried by the collars 170 and 171, and since the collars as a unit may be turned about the axis of the tube, then the position of the bar 32 may be varied angularly with respect to the axis of the tube, so as to adjust the tension on the web in accordance with the requirements in use. Thus, a web of relatively heavy paper would require a different position of the bar 32 than would be the case with a web of relative light paper. Moreover, such adjustment can be made quickly while the web is in motion, so as to maintain optimum printing conditions on the surface of the web. One position of the bar 32 is shown in FIG. 17 in full lines, while another position is shown in dotted lines at 32a. Thus, when the web A-3 is passing around the solid line position of the bar 32, there is a greater area of contact between the paper and the tube 33, thus placing greater tension on the web, than would be the case where the bar is in the position indicated at 32a.

In FIG. 14 I have shown a plan view of a multi-web assembly, wherein the webs are indicated at A, B and D, while interleaved carbon webs are indicated at C and C-1. Lines of longitudinally extending holes are shown at 190 and 191, cross perforations at 192, file holes at 193 and crimp interlock at 194. It is to be understood that other operations may be performed on the webs, such as numbering, stub removal perforation, adhesive connections and the like.

By performing a printing or other processing operation upon a web of paper as it is drawn into the printing couple, or processing unit, from a free falling festoon, and by applying a slight drag to the web in advance of its entry into the printing or processing unit, and by utilizing a pulling force on the web only after it has passed through the printing couple or processing unit, I have been able to overcome the problems of variations in tension on the paper and to overcome the resulting loss of register. As applied to numbered forms, or to color printing, the advantages of the invention are readily apparent, because I have eliminated the necessity for complex sensing and automatic tension control devices. Ad-

ditionally, I have eliminated the need for continuous adjustments to the tension and to the position of the supply roll, to compensate for varying friction effects incident to the movement of the web over the various guides and work performing cylinders. The importance of maintaining constant lengths and register, while enabling the press to operate at any speed within its range of movement, is important to those skilled in the art, particularly to operators who depend upon their skill and judgment in making manual adjustments constantly to the tension controls while the press is in operation. Thus, I have achieved optimum conditions at the point of printing and greatly simplified the press construction.

The terms and expressions which have been used herein are terms of description and not of limitation, and there is no intention in the use of such terms and expressions of excluding any equivalents of any of the features shown or described, or any portion thereof. It is the intention to include various modifications which are possible within the scope of the appended claims.

I claim:

1. A method of continuously printing multiple webs of material on a rotary printing press comprising, feeding each web from a supply roll by exerting a pulling force thereon, allowing each web to fall into a slack festoon between the feeding point and a printing unit, exerting a drag pressure on each web and guiding each web sideways immediately preceding the entrance thereof into the printing unit, printing each web, directing all webs in superimposed condition to a punch having cooperating male and female dies, and pulling all webs in superimposed condition in a plane which is at a right angle to the axis of said dies.

2. A method according to claim 1 wherein the punching operation is performed on all of the webs simultaneously after they have passed through their respective printing units.

3. A method according to claim 2 wherein the pulling force acting on the webs is exerted against the walls of some of the holes formed by the punching operation.

4. A method according to claim 1 wherein each web is subjected to a perforating operation before it has entered the printing unit to provide a row of snapout perforations extending longitudinally of the web.

5. A method according to claim 1 wherein each web is subjected to a perforating operation after the webs have passed through the printing units, to provide a row of stub-removal perforations.

6. A method according to claim 3 wherein an additional operation is performed on the webs after the punching operation and while the webs are moving under control of the pulling force.

7. A method according to claim 6 wherein the additional operation comprises a cross-perforation of the webs.

8. A method according to claim 6 wherein the additional operation comprises a consecutive numbering at spaced intervals on at least one of the webs.

9. A method according to claim 6 wherein the additional operation comprises the formation of file holes at spaced intervals on the webs.

10. A method according to claim 6 wherein the additional operation comprises cutting off the webs at spaced intervals.

11. A method according to claim 1, wherein a web of carbon paper is interposed between adjacent webs and is propelled simultaneously with the adjacent webs by the same pulling force which operates to move the webs through the printing unit.

12. An apparatus for continuously printing multiple webs of material comprising in combination, supply rolls for the multiple webs, means for feeding each web from its supply roll, means for forming a festoon in each web beyond the feed means, means exerting a predetermined drag pressure upon each web at the discharge end of each of said festoons, a plurality of rotary printing units, means for directing each web into one of said printing units, a punch having male and female dies, means for directing said webs in superimposed position through said punch, endless elongated pin means for engaging the punched holes in said webs for pulling said webs in a plane at a right angle to the axis of said dies, when the dies are in axial alignment, and power means for actuating each of said means in timed relationship.

13. Apparatus according to claim 12 wherein each printing unit is positioned between the drag exerting means and the punch.

14. Apparatus according to claim 12 wherein the means for directing each web into one of the printing units comprises members which engage the side edges of each web and are positioned between the point of application of drag pressure and the point at which the printing operation is performed.

15. Apparatus according to claim 12 wherein the punch comprises rotary members having the coating male and female dies thereon, and wherein the means for pulling the webs comprises an endless belt having spaced pins thereon which engage some of the punched holes in the webs and which operate thereby to pull the webs with a constant tension.

16. Apparatus according to claim 12 wherein two punches are provided and operate to form two rows of holes in the webs, one row being parallel to and adjacent one longitudinal edge of the webs and the other row being parallel to and adjacent the other longitudinal edge of the webs.

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