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Vines

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[54] **PRINTING MACHINE**

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[52] **U.S. Cl.** **101/228,** 101/232, 226/52, 226/58, 226/143

[51] **Int. Cl.** **B41f 13/04**

[58] **Field of Search** 226/58, 59, 167, 226/52, 55, 143, 62, 67; 101/178, 181, 228, 224, 225, 227, 232

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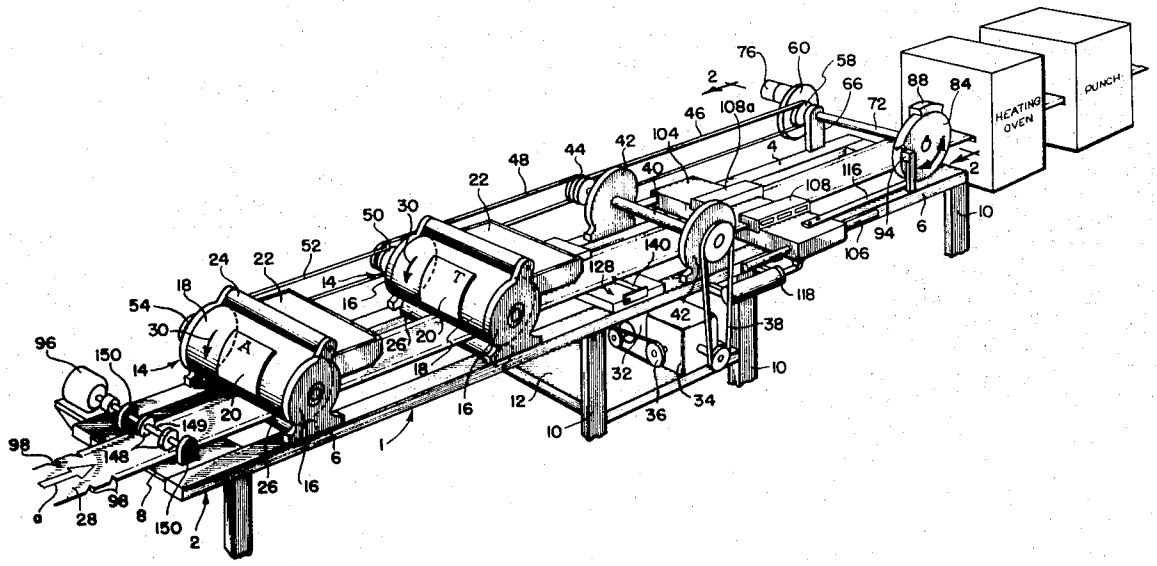
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[57] **ABSTRACT**

A machine for imprinting on a strip or sheet comprises multiple printing cylinders in tandem and revolving continuously at the same speeds for imprinting successive impressions on the strip. The strip is intermittently fed at a linear speed that is the same as the peripheral speed of the impression surfaces of the printing plates on the printing cylinders. The mechanism for intermittent feed comprises a carrier having spring fingers that engage notches at the sides of the strip to feed the strip a predetermined amount after which the carrier is returned to an initial or starting position for again feeding the strip.

10 Claims, 9 Drawing Figures



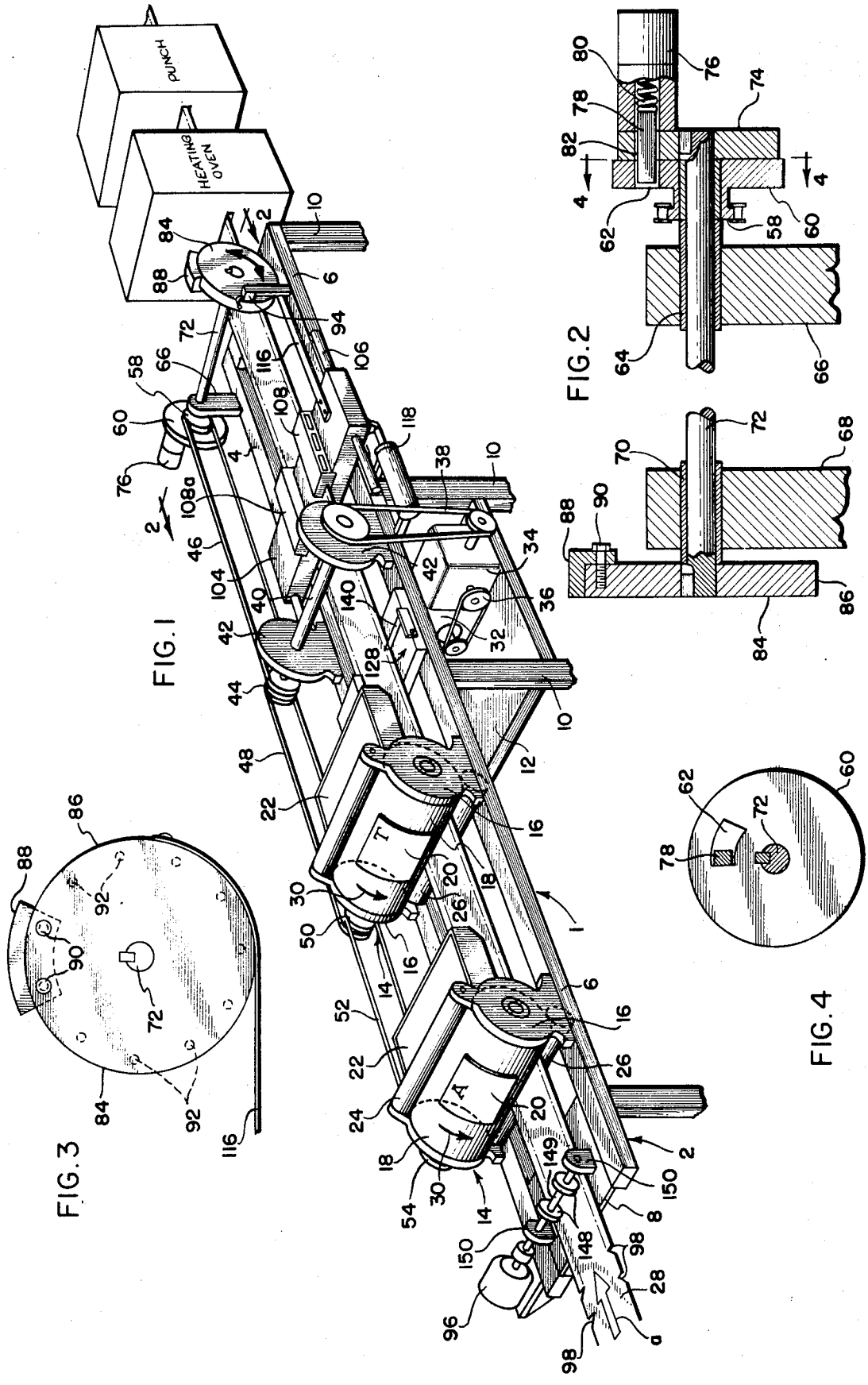

PUNCH
HEATING OVEN
FIG. 1
FIG. 2
FIG. 3
FIG. 4

FIG. 5

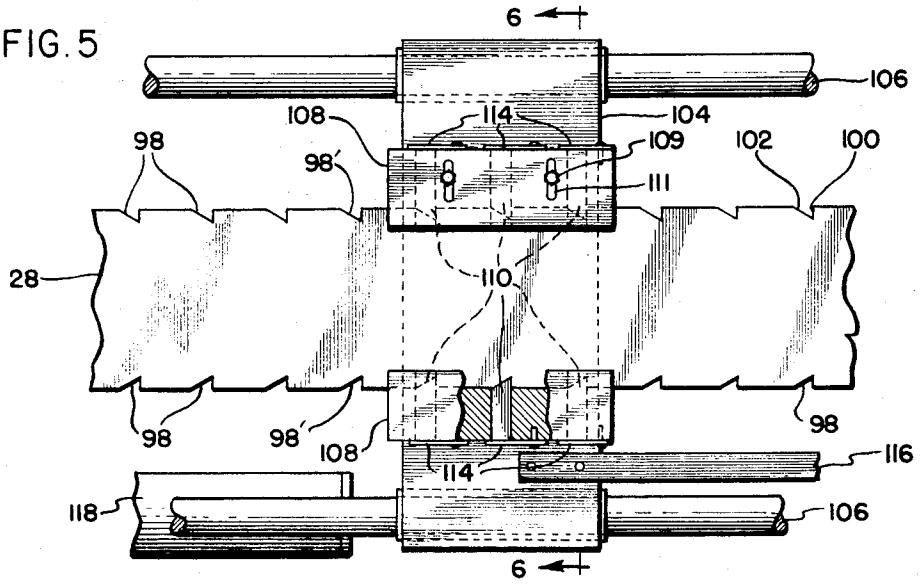


FIG. 6

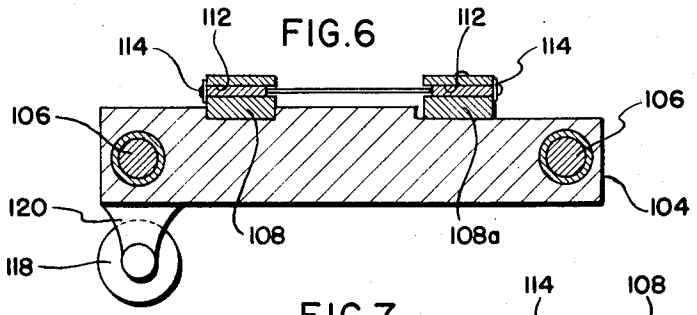


FIG. 7

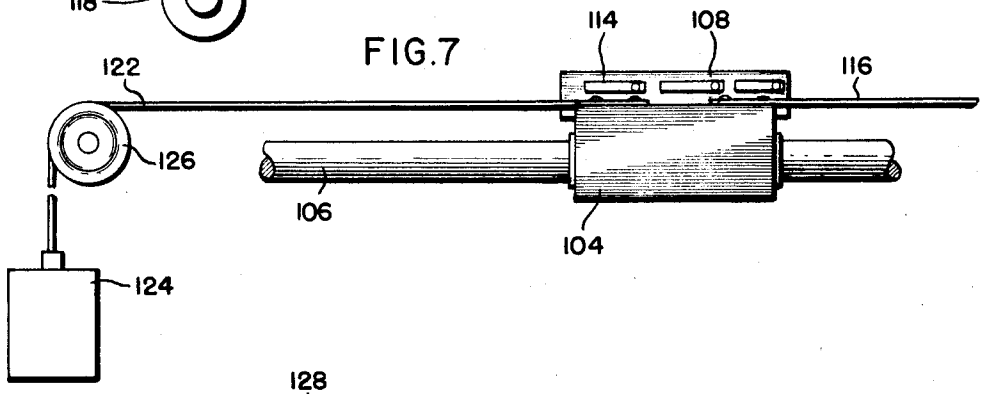


FIG. 8

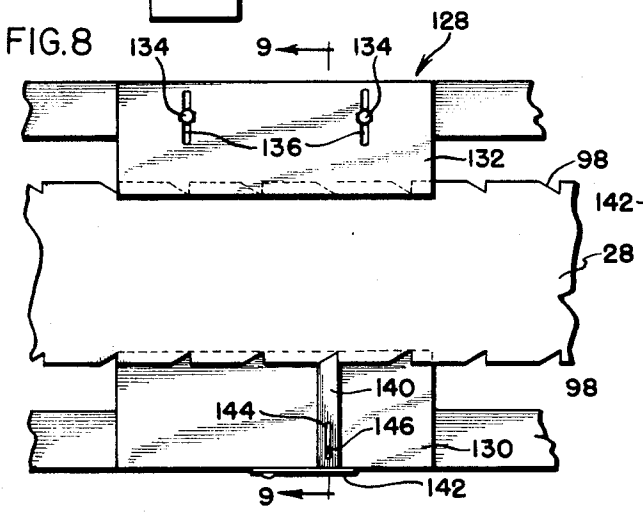
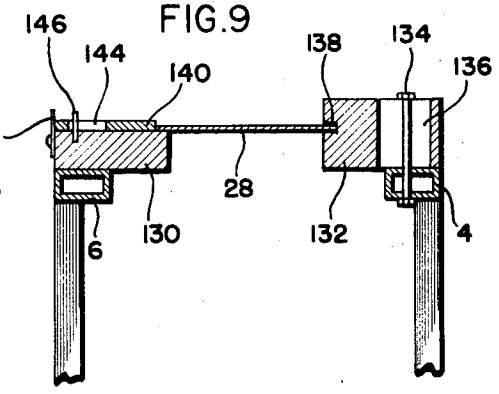


FIG. 9



PRINTING MACHINE

BACKGROUND OF THE INVENTION

This invention relates to improvements in printing machines, and more particularly to machines for imprinting multiple impressions on a web or sheet fed therethrough.

In the production of name plates, escutcheon plates, and the like, the run to be printed is usually of such low volume that it is uneconomical to install or set up multicolor rotary presses of the type used for imprinting metal cans and the like. As a result, the usual practice is to run the metal sheet through the press to make a monochrome impression, and then place the sheet in a baking oven to dry the ink. For each subsequent color, the press is set up and the sheet passed therethrough and then dried in the oven. Such a procedure is costly. Moreover, since the sheet is of metal it is not possible to use metal type, and the common practice is to use offset lithography, all of which further adds to the cost of the finished article.

OBJECTS AND SUMMARY OF THE INVENTION

An object of this invention is to provide a machine for imprinting a sheet or web with multiple impressions, the sheet being continuously fed from a supply roll and advanced along the press and through the printing heads in succession, following which the sheet may be advanced through a drying oven and then to a punch press where the sheet is cut to form the individual articles.

A further object of this invention is to provide a machine of the type stated in which the printing cylinders are continuously revolving and wherein the sheet is fed intermittently through the printing heads at a linear speed which is the same as the peripheral speed of the impression-forming surface on the printing cylinder.

A still further object of this invention is to provide a machine of the type stated in which the sheet is advanced intermittently by a reciprocating carrier that engages notched margins of the sheet so as to insure accurate and uniform advancement of the sheet during each successive step of its travel.

Another object of this invention is to provide a machine of the type stated which utilizes rubber printing plates for direct impression on the sheet, thereby eliminating the need for offset printing equipment.

In accordance with the foregoing objects the machine comprises a frame for supporting a plurality of printing cylinders spaced in tandem along the frame, each printing cylinder including a printing plate and a cooperating impression roller for imprinting successive impressions of different colors on the sheet. The printing cylinders revolve continuously at the same peripheral speed, and intermittent feeding means including a carrier are provided for engaging the notches at the margins of the sheet so as to feed the sheet intermittently at the same linear speed as the peripheral speed of the printing plates, thereby to assure clean impressions and proper retistry of successive impressions.

In the form of the invention to be described, the intermittent feeding means further includes a rotatable disc with a flexible band trained thereover and connected to the carrier, first means including a drive member and an electrically operated clutch for effecting the drive of said disc in one direction. The disc may be returned by a second means. This second means

may be a hydraulically operated mechanism similar to a conventional door closer or by a flexible band having a weight on one end and connected to the carrier at its other end. A third means is provided to declutch the drive to the disc when the disc has rotated its predetermined amount. This third means preferably comprises a switch that is operated by a cam on the disc.

An anti-backup or index device is also provided on the machine. When the carrier has advanced the sheet the desired amount and then undergoes retraction to its initial position, a spring finger engages one of the notches in the sheet to retain the sheet in a position of registry preparatory to the next cycle of operation of the carrier. A motor driven roller assembly applies retrograde force to the sheet to keep it biased against the spring finger.

BRIEF DESCRIPTION OF THE FIGURES

FIG. 1 is a perspective view of a printing machine constructed in accordance with and embodying the present invention;

FIG. 2 is a fragmentary sectional view, on an enlarged scale, taken along line 2—2 of FIG. 1;

FIG. 3 is a fragmentary side elevational view of the carrier drive disc and switch-actuating cam that form part of the present invention;

FIG. 4 is a fragmentary sectional view taken along line 4—4 of FIG. 2;

FIG. 5 is a fragmentary top plan view, on an enlarged scale and partly broken away and in section, of the carrier and parts adjacent thereto;

FIG. 6 is a fragmentary sectional view taken along line 6—6 of FIG. 5;

FIG. 7 is a fragmentary side elevational view of the carrier and parts adjacent thereto but showing a modified form of carrier return mechanism;

FIG. 8 is a fragmentary top plan view of the anti-backup or index device that forms part of the present invention; and

FIG. 9 is a fragmentary sectional view taken along line 9—9 of FIG. 8.

DETAILED DESCRIPTION

Referring now in more detail to the drawings, there is illustrated a printing machine 1 comprising a frame 2, of any suitable configuration and including longitudinally extending members 4, 6 that are joined by transverse plates 8, the latter being in any suitable number to impart the necessary rigidity to the frame 2. Also included in the frame 2 is a sub-structure comprising a series of legs 10 and a power-drive support 12.

Mounted on top of the frame 2 and supported by the longitudinal members 4, 6 are printing heads 14 which are spaced apart along the length of the frame 2. For simplicity of illustration there are two printing heads 14 shown in the drawing; however, it will be understood that it is within the scope of this invention to provide any number of printing heads 14 on the frame 2. The printing heads 14 are of generally conventional construction. Suffice it to say, however, that each printing head 14 includes opposed, upstanding plates 16, 16 which serve to journal a printing cylinder 18. Each printing cylinder 18 has suitable conventional means for removably mounting a printing plate 20. In addition, each printing cylinder has an inking attachment 22 that includes inking rollers 24. Since the inking attachment and inking roller arrangement is known,

these features are shown somewhat diagramatically in FIG. 1.

Also provided on each printing head 14 and below the printing cylinder 18 is an impression roller 26 which cooperates with the printing plate 20 to form an impression on a continuous web or sheet 28 that is fed therethrough in a manner presently to be described. Thus, when the printing cylinders 18 are driven in the directions shown by the arrows 30, the printing plates 20 will pass under the inking rollers 24 so that the relief portions of the plates 20 (shown as A and T by way of example) will be inked following which the impressions will be applied to the sheet 28 at the region where the sheet 28 is backed or supported by the respective impression rollers 26. Generally speaking, the printing or impressions made by the several printing heads 14 will be of different color and/or of different configuration. This will, of course, depend upon the nature of the final product desired. Moreover, each printing plate 20 may contain a multiple of impressions so that when the sheet has passed through all of the printing heads 14, the sheet will contain a multiplicity of like multicolor patterns which may thereafter be cut or punched out from the sheet to form a number of finished products.

The printing plate 20 is preferably a molded rubber or rubber-like structure in which the configuration of the impression is raised. The printing plates 20 may be molded in accordance with known techniques. Rubber or rubber-like printing plates are often particularly suitable where the sheet of material 28 is of aluminum or other metal.

Mounted on the support 12 is a power-drive arrangement that includes an electric motor 32 in driving connection with a speed reducer 34 through a chain and sprocket system 36. The output from the speed reducer 34 drives through chain and sprocket assembly 38 to a main drive cross shaft 40. It will be noted that the cross shaft 40 is journaled in plates 42, 42, which are similar to the plates 16, previously described. Thus, the cross shaft 40 may be, in effect, the printing cylinder shaft of an unused or partially constructed printing cylinder. Moreover, in the interest of reducing the overall length of the machine, a fully assembled printing head may be provided in lieu of the partial form thereof at the plates 42, 42 and cross shaft 40. Such a printing head 14 may be used or left unused, as the case may be, in which latter case a printing plate would not be mounted thereon.

The cross shaft 40 drives two sprockets 44 around which drive chains 46, 48 are trained. Drive chain 48 drives the printing cylinder of the adjacent printing head 14 through one sprocket portion of a dual sprocket 50 on or in driving connection with the printing cylinder shaft thereof. The other sprocket portion of the dual sprocket 50 drives through an additional drive chain 52 to a sprocket 54 on or in driving connection with the printing cylinder shaft of the next adjacent head 14. The several sprockets 44, 50, 54 are all of the same diameter and so the cross shaft 40 and the several printing cylinders 18 are all driven at the same speed of rotation.

The drive chain 46 is trained around a sprocket 58 that is downstream from the cross shaft 40, the sprocket 58 including an enlarged hub 60 with a short arcuate slot 62 therein. The sprocket 58 is likewise of the same diameter as the sprocket 44. The sprocket 58 is freely rotatable on a sleeve bearing 64 which is fitted into an upstanding journal post 66. The journal post 66 and a like journal post 68 are supported by and extend upwardly from respective longitudinal members 4, 6. The journal post 68 also has a sleeve bearing 70, and the sleeve bearings 64, 70 rotatably support a transverse or disc shaft 72. The shaft 72 has a clutch member 74 rigidly keyed on one end and adjacent to the hub 60. This clutch member 74 includes a solenoid 76 having a pin or plunger 78 and a spring 80. The plunger 78 passes through a hole 82 in the clutch member 74 and is adapted also to project into the slot 62 when the solenoid is deenergized, which is the condition shown in FIG. 2. Therefore, with the solenoid deenergized the continuously rotating sprocket 68 drives the shaft 72 due to the clutching effect of the solenoid plunger 78 with the sprocket hub 60. On the other hand, when the solenoid 76 is energized in a manner to be described, the plunger 78 is retracted from the slot 62 whereby the shaft 72 is no longer driven by the sprocket 58.

Adjacent to the journal post 68 and keyed to the shaft 72 for rotation therwith is a disc 84 having an outer circular, cylindrical surface 86. For reasons hereinafter more fully appearing, the diameter of the surface 86 is the same as the diameter of the impression surface of each printing plate 20. Mounted on the periphery of the disc 84 is an actuator or cam 88 which is held in position by bolts 90 that are threaded into selected holes 92 in the disc 84. The cam 88 may, therefore, be adjustably positioned on the disc 84 by threading the bolts 90 into any two selected adjacent holes 92, for purposes presently more fully appearing. For the present, however, it should be noted that the purpose of the cam 88 is to actuate a switch assembly 94 that physically includes two separate switches in different electrical circuits. The two switches are operated together. One switch is closed to energize the solenoid 76 and retract the plunger 78. The other switch energizes an electric motor 96 (FIG. 1) at the same time the solenoid 76 is energized. Likewise, when the cam 88 retracts from the switch assembly 94 the solenoid plunger 78 reengages the slot 62 and at the same time current to the motor 96 is interrupted. The purpose of such arrangement will be presently described. Furthermore, the switches in the switch assembly 94 are simply in series with the respective electrical components (solenoid 76 and motor 96) and thus the circuit configuration will be apparent without diagram.

It will be noted that the sheet 28 is formed with opposed notches 98, 98 at the opposite longitudinal margins thereof. As indicated in FIG. 5, the notches have a forward edge 100 that is at right angles to the path of travel (arrow *a*, FIG. 1) of the web and a trailing edge 102 that is at an acute angle to the edge 100. The notches 98 are equally spaced along the respective longitudinal edges of the sheet 28. The sheet 28 is, furthermore, intermittently fed by a carrier 104 that reciprocates on guide rods 106, 106, the latter being on opposite sides of the frame 2. The carrier 104 includes opposed blocks 108, 108*a* on opposite sides of the sheet 28 and which are slotted, as shown in FIG. 6, for receiving the notched margins of the sheets 28. The block 108*a* is adjustable on the carrier 104 for various widths of sheet, and for this purpose the block 108*a* has slots 111 for receiving bolts 109 that thread into the carrier.

The blocks 108, 108*a* are adapted to retain fingers 110, that being shown three such fingers in each block in the present form of the invention. The fingers 110 are spaced apart the same distance as the spacing be-

tween the notches **98.** Furthermore, it will be noted that the tips of the fingers **110** are shaped to fit conformably in the notches **98.** The fingers **110** are mounted for sliding movement in slots **112** of block **108** and are biased toward the respective notches **98** by leaf springs **114.** The leaf springs **114** are screwed or otherwise secured to the side faces of the blocks **108.** It will be apparent then that as the carrier **108** is moved to the right (FIG. **5**) to advance the sheet **28,** the spring fingers **110** will be in gripping engagement with the sheet **28** to insure positive advance of the sheet. On the other hand, when the carrier **104** moves to the left, the carrier will move relative to the sheet **28** since the spring fingers **110** will ride out of the notches **98** until the spring fingers **110** again reach a position such that they will be biased into the notches **98.** Consequently, upon retraction of the carrier **104** to the left, the left hand fingers **110** will be shifted from the positions shown so as to engage notches **98'.** The remaining fingers will, of course, engage their respective adjacent notches **98.** As a result, the sheet **28** advances a distance equal to the distance between two adjacent notches **98** each time the sheet is intermittently fed by the carrier **104.** The spacing of the notches **98** and the spacing of the spring fingers **110** will, of course, be determined by the amount of displacement required for the sheet **28** for each step of its travel through the machine. The sheet **28** will ordinarily be prepunched with the notches **98** prior to being rolled into a supply coil for subsequent use with the machine of the present invention. The spacing of the notches **98** will depend upon the nature of the product, the spacing of the printing heads, and other parameters which will be apparent to those skilled in the art. For different notch spacings the blocks **108** could be replaced so as to house spring fingers **110** with the required spacing. As a practical matter, however, the spacing of the notches will generally be somewhat standardized in order to simplify setup of the machine.

The drive for the carrier **104** is provided through a flexible band **116** which is secured at one end to the carrier **104** and at its other end to the disc surface **86** and is trained around such surface **86.** When the disc **3** rotates counterclockwise (FIG. **3**) the carrier **104** will be advanced. This advance will continue until the cam **88** strikes the switch assembly **94,** which energizes the solenoid **76** to retract the plunger **78.** The carrier **104** is returned to its initial position by a return mechanism **118** that has a piston rod connected to a depending ear **120** of the carrier and a cylinder rigidly mounted relative to the spring **2.** This return mechanism **118** operates similar to conventional door-closing or check member and, therefore, need not be described in detail.

FIG. **7,** however, shows a modified form of carrier return mechanism which is simply a flexible strap **122** connected at one end to the carrier **104** and at its other end to a weight **124.** Therefore, when the plunger **78** is retracted causing the shaft **72** and disc **84** to be free of driving engagement from the sprocket **58,** the weight **124** simply pulls the carrier **104** back to its initial position, namely through a distance equal to the distance between two adjacent notches **98** in the sheet **28.** For convenience, the strap **22** may be trained over a pulley **126** that is rotatably mounted at a convenient place on the side of frame **2.**

It will be apparent that when the carrier **104** is being retracted to its initial position, the sheet **28** might tend to back up somewhat and get out of registry. Accordingly, an anti-backup arrangement **128** is provided to prevent this from happening. As best seen in FIGS. **8** and **9,** this arrangement includes a pair of opposed blocks **130, 132** that are secured on opposite sides of the sheet **28** and rearwardly of the carrier **104.** The block **132** is secured to the frame member **4** by bolt and nut assemblies **134** which projects through slots **136, 136** whereby the position of the block **132** relative to the edge of the sheet **28** may be adjusted. The inwardly presented face of the block **132** has a groove **138** (FIG. **9**) that receives and guides the edge of the sheet **28.** The block **130** is suitably secured to the frame member **6** and includes a spring finger **140** with a tip shaped to fit conformably in a notch **98.** The spring finger **140** is slidable on the block **130** and is biased toward the sheet **28** by a flat leaf spring **142** which engages the flat rear end of the finger **140.** The spring finger **140** has a slot **144** that receives a retaining pin **146** to hold the finger **140** against the block **130.**

The arrangement **128** operates in conjunction with rollers **148, 148** (FIG. **1**) that are driven by the motor **96.** These rollers **148, 148** are preferably lined with rubber on their peripheries and are mounted on the common shaft **149** that is driven by the motor **96** and is journaled in bearings **150, 150** on a support member **8** at the rear or beginning end of the machine. When the motor **96** is not in operation the rollers **148** and motor shaft are freely rotatable by the movement or feed of the sheet **28.** However, when the motor **96** is energized by engagement of the cam **88** with the switch assembly **94,** the rollers **148** rotate clockwise (FIG. **1**) to apply retrograde force to the sheet **28** so as to pull the sheet **28** firmly against the spring finger **140.** As a result, the sheet **28** is indexed or positioned in precise registration preparatory to the next forward advance of the carrier **104.**

In use and with the printing cylinders continuously revolving, it will be assumed that the carrier **104** is in its initial position about to be advanced so as to move the sheet **28** through an increment of its travel. In this condition the solenoid **76** is deenergized and the plunger **78** is held within the slot **62** by the spring **80.** The disc **84** is positioned as shown in FIGS. **1** and **3.** The drive through the sprocket **58** turns the shaft **72** and disc **84** whereby the flexible band **116** pulls the carrier **104** the required increment of travel, namely a distance equal to the distance between adjacent notches **98.** As soon as that distance has been reached, the cam **88** strikes a switch assembly **94,** energizing the solenoid **76,** immediately retracting the plunger **78,** and allowing the disc **84** and shaft **72** to be freely rotatable. Now, the return mechanism **118** (or **122, 124, 126**) returns the carrier **104** back to its initial position. The disc **84** is also rotated clockwise back to its initial position. Since the current to the solenoid **176** is interrupted as soon as the disc **84** begins to rotate back to its initial position, when such initial position is reached, the spring **80** urges the plunger **78** back into the slot **62** preparatory to another cycle of operation of the carrier **104.**

The cam **88** must be positioned on the disc **84** so that the cam engages the switch assembly **94** when the carrier **104** has completed its intended stroke. The various threaded holes **92** through which the cam bolts **90** may be positioned allows the cam **88** to be adjustably mounted depending upon the stroke of the carrier

which, in turn, depends upon the spacing of the notches **98.**

It is also significant that the diameter of the disc surface **86** is the same as the diameter of the impression surface of each printing plate **20.** The flexible band **116** is exceedingly thin and can be said to increase only negligably the effective diameter of the disc **84** as the band **116** wraps partially therearound upon movement of the disc **84** in a counterclockwise direction. Consequently, upon rotation of the disc **84** to advance the carrier, as aforesaid, the carrier and, hence the sheet **28,** is advanced at the same linear speed as the peripheral speed of the printing or impression surface of each plate **20.**

Following the printing operations, the sheet is fed through a heating oven to dry the ink, and then to a punch, both diagramatically illustrated in FIG. **1.** The structural detail of the heating oven and punch are known. Suffice it to say that the punch may serve to trim or cut up the sheet into a number of finished products. In any event, the intermittent feed of the machine can operate in conjunction with the operation of the punch to insure registry of the punch with respect to the printed regions of the sheet.

The invention is claimed as follows:

1. A machine for imprinting on a sheet of material, said machine comprising a frame, a plurality of printing cylinders spaced along said frame, each printing cylinder mounting a printing plate and an impression roller for imprinting successive impressions on said sheet as the sheet moves between each printing plate and its associated impression roller, means for revolving said printing cylinders continuously and at the same peripheral speed, and means for intermittently feeding said sheet such that when a printing plate is in printing contact with said sheet, the peripheral speed of the printing plate is the same as the speed of travel of the sheet; said intermittent feeding means comprising a carrier for engaging said sheet at predetermined regions thereof, and means for moving said carrier a predetermined amount to advance said sheet a predetermined distance to maintain the register of the printing plates on the sheet; said intermittent feeding means further including a rotatable member, a flexible structure trained over said rotatable member and connected to said carrier and to said rotatable member, first means for rotating said member in one direction an amount sufficient to advance said carrier said predetermined amount from an initial position of the carrier, and second means for rotating said member a like amount in the opposite direction to return said carrier to its initial position.

2. A machine according to claim **1** including third means actuated upon rotation of said member said amount for rendering ineffective the operation of said first means so that said second means then operates to return said carrier.

3. A machine according to claim **2** in which said first means includes a drive member and an electrically operated clutch, and said third means is a switch for controlling the current to said clutch.

4. A machine according to claim **1** in which the peripheral speed of rotation of said rotatable member is the same as the peripheral speed of said printing cylinders.

5. A machine according to claim **1** in which said rotatable member has a peripheral surface over which said flexible structure is trained, said peripheral surface having a diameter that is the same as the diameter of impression surfaces of the printing plates.

6. A machine according to claim **1** having means for returning said carrier to an initial position, and means for locating said sheet in a predetermined position of registry preparatory to the next advance of the sheet.

7. A machine according to claim **6** in which said locating means comprises means for applying retrograde force to said sheet and cooperating means for engaging said sheet at a predetermined region thereof.

8. A machine for imprinting on a sheet of material said machine comprising a frame, a plurality of printing cylinders spaced along said frame, each printing cylinder mounting a printing plate and an impression roller for imprinting successive impressions on said sheet as the sheet moves between each printing plate and its associated impression roller, means for revolving said printing cylinders continuously and at the same peripheral speed, and means for intermittently feeding said sheet such that when a printing plate it in printing contact with said sheet, the peripheral speed of the printing plate is the same as the speed of travel of the sheet; said intermittent feeding means comprising a carrier, and means for moving said carrier a predetermined amount to advance said sheet a predetermined distance to maintain the register of the printing plates on the sheet, said intermittent feeding means further including a rotatable member, means trained over said rotatable member and connected to said carrier and to said rotatable member, first means for rotating said member in one direction an amount sufficient to advance said carrier said predetermined amount for an initial position of the carrier, and second means for rotating said member a like amount in the opposite direction to return said carrier to its initial position.

9. A machine for imprinting on an elongated sheet of material, said machine comprising a frame, a plurality of printing cylinders spaced along said frame, each printing cylinder mounting a printing plate and an impression roller for imprinting successive impressions on said sheet as the sheet moves between each printing plate and its associated impression roller, means for revolving said printing cylinders continuously and at the same peripheral speed, and means for intermittently feeding said sheet such that when a printing plate is in printing contact with said sheet, the peripheral speed of the printing plate is the same as the speed of travel of the sheet; said intermittent feeding means comprising a carrier in driving connection with the opposed longitudinal margins of the sheet, means for moving said carrier a predetermined amount from an initial position to advance said sheet a predetermined distance to maintain the register of the printing plates on the sheet, means for returning said carrier to said initial position, and means for locating said sheet in a predetermined position of registry preparatory to the next advance of the sheet; said last-named means comprising means for applying a retrograde force to said sheet and cooperating means for engaging said sheet at a predetermined region thereof.

10. A machine according to claim **9** in which said carrier has spring biased fingers engaging notches at margins of the sheet.

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