Feb. 16, 1960 E. A. CRAWFORD 2,925,036

WEB FEEDING AND PRINTING MECHANISM FOR MULTIPLE UNIT ROLLER TYPE PRINTING MACHINE

Original Filed April 29, 1953 9 Sheets-Sheet 1

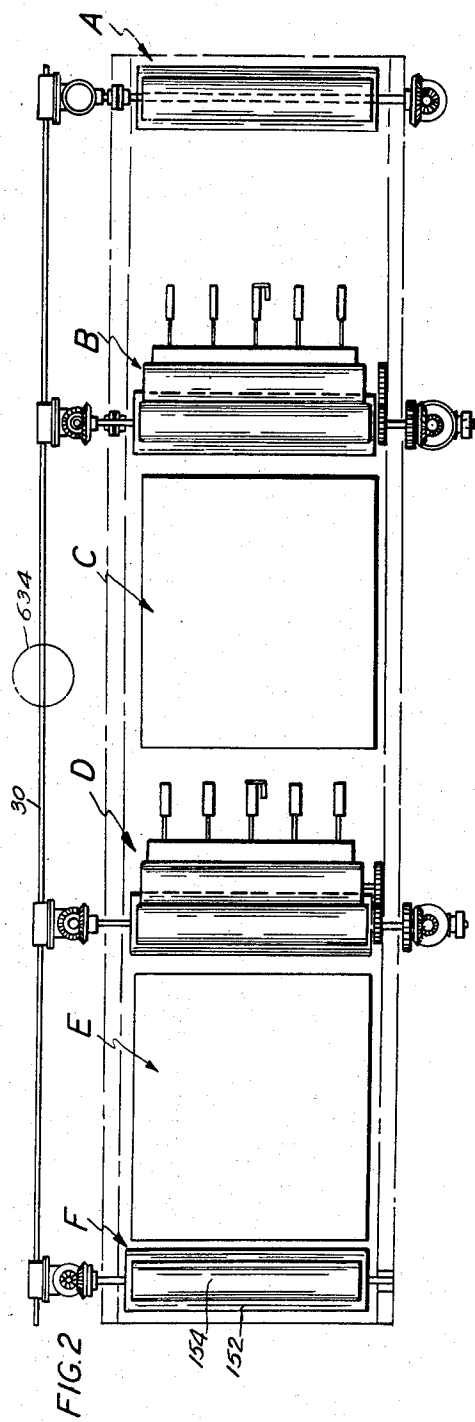


FIG. 2

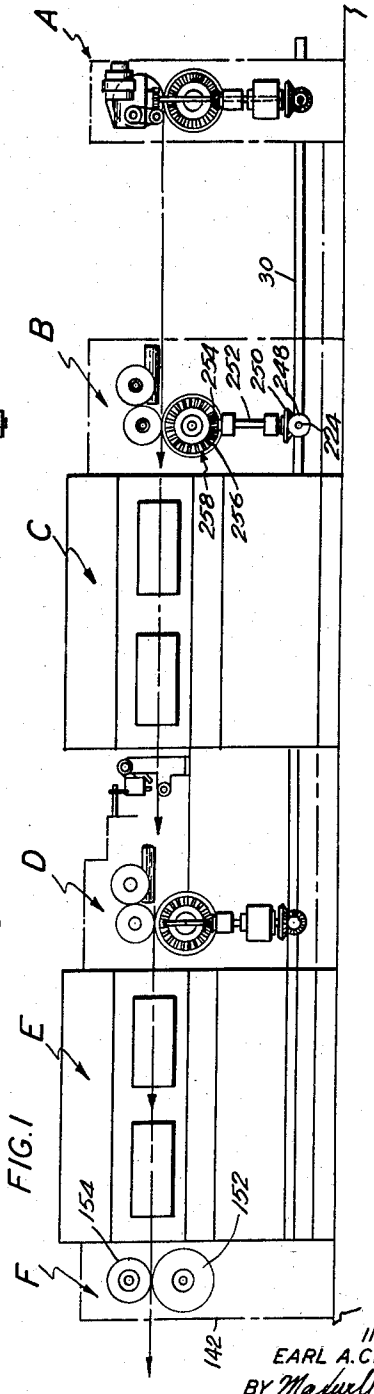


FIG. 1

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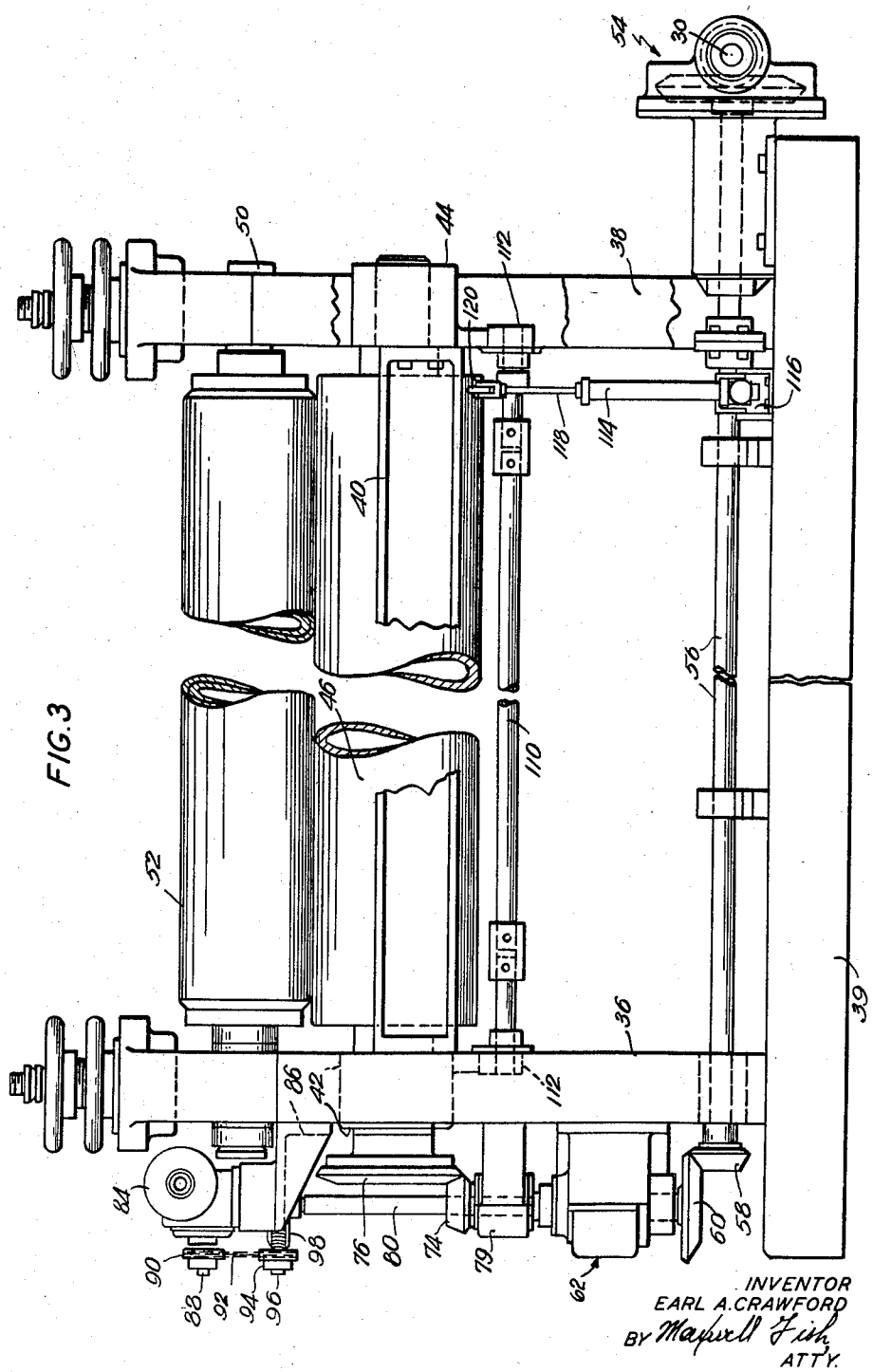


FIG. 3

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WEB FEEDING AND PRINTING MECHANISM FOR MULTIPLE UNIT ROLLER TYPE PRINTING MACHINE
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FIG. 5

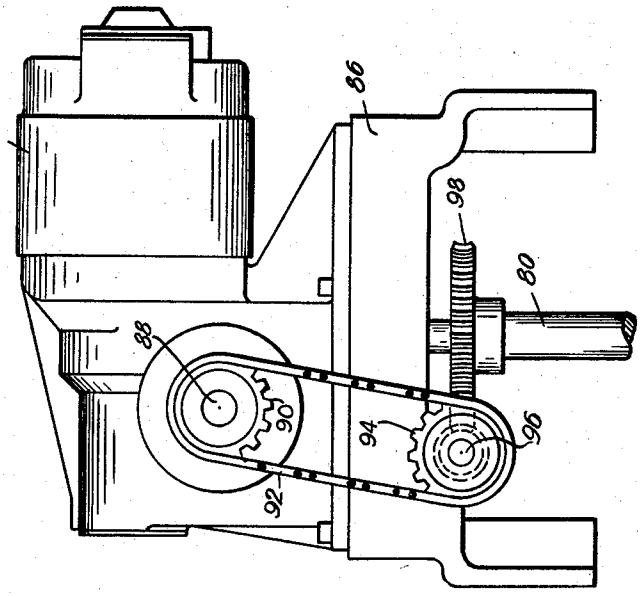
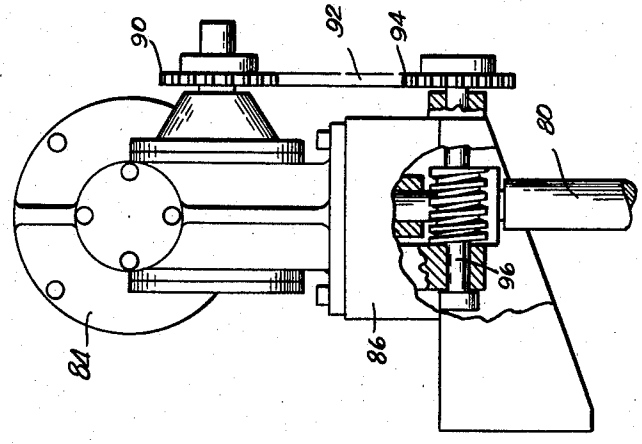


FIG. 4

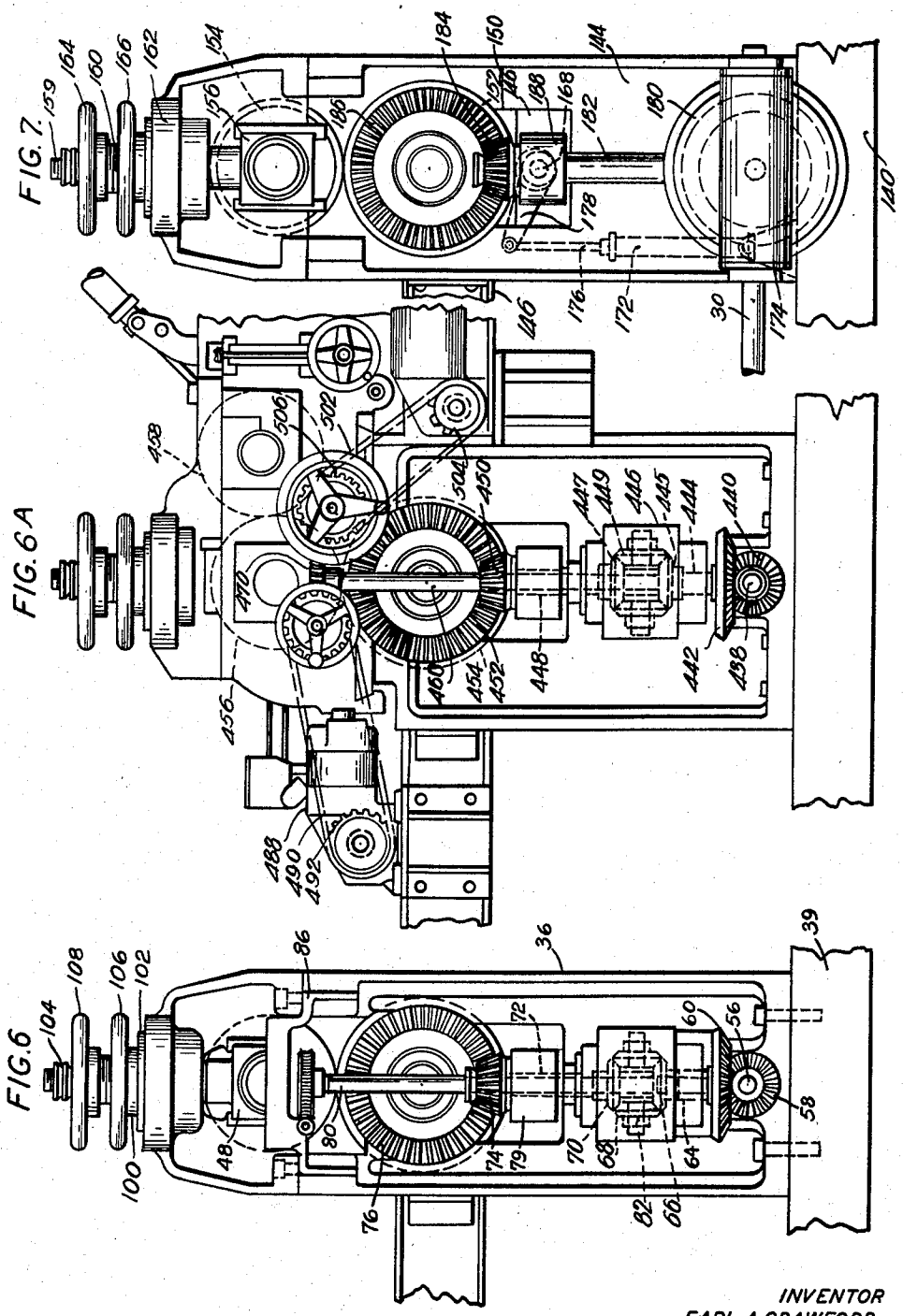


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Original Filed April 29, 1953 9 Sheets-Sheet 4



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WEB FEEDING AND PRINTING MECHANISM FOR MULTIPLE UNIT ROLLER TYPE PRINTING MACHINE

Original Filed April 29, 1953 9 Sheets-Sheet 5

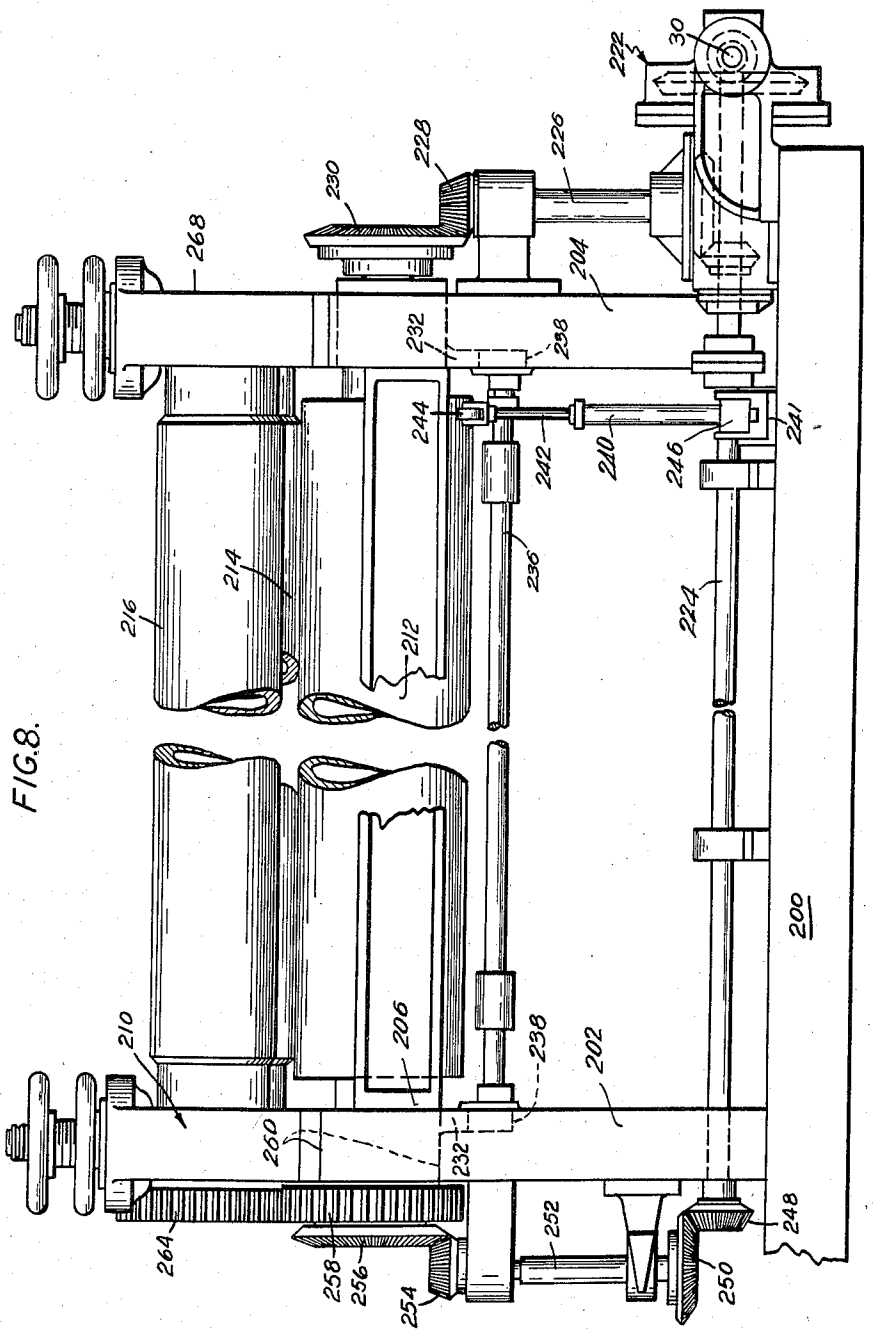


FIG. 8.

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WEB FEEDING AND PRINTING MECHANISM FOR MULTIPLE UNIT ROLLER TYPE PRINTING MACHINE

Original Filed April 29, 1953 9 Sheets-Sheet 6

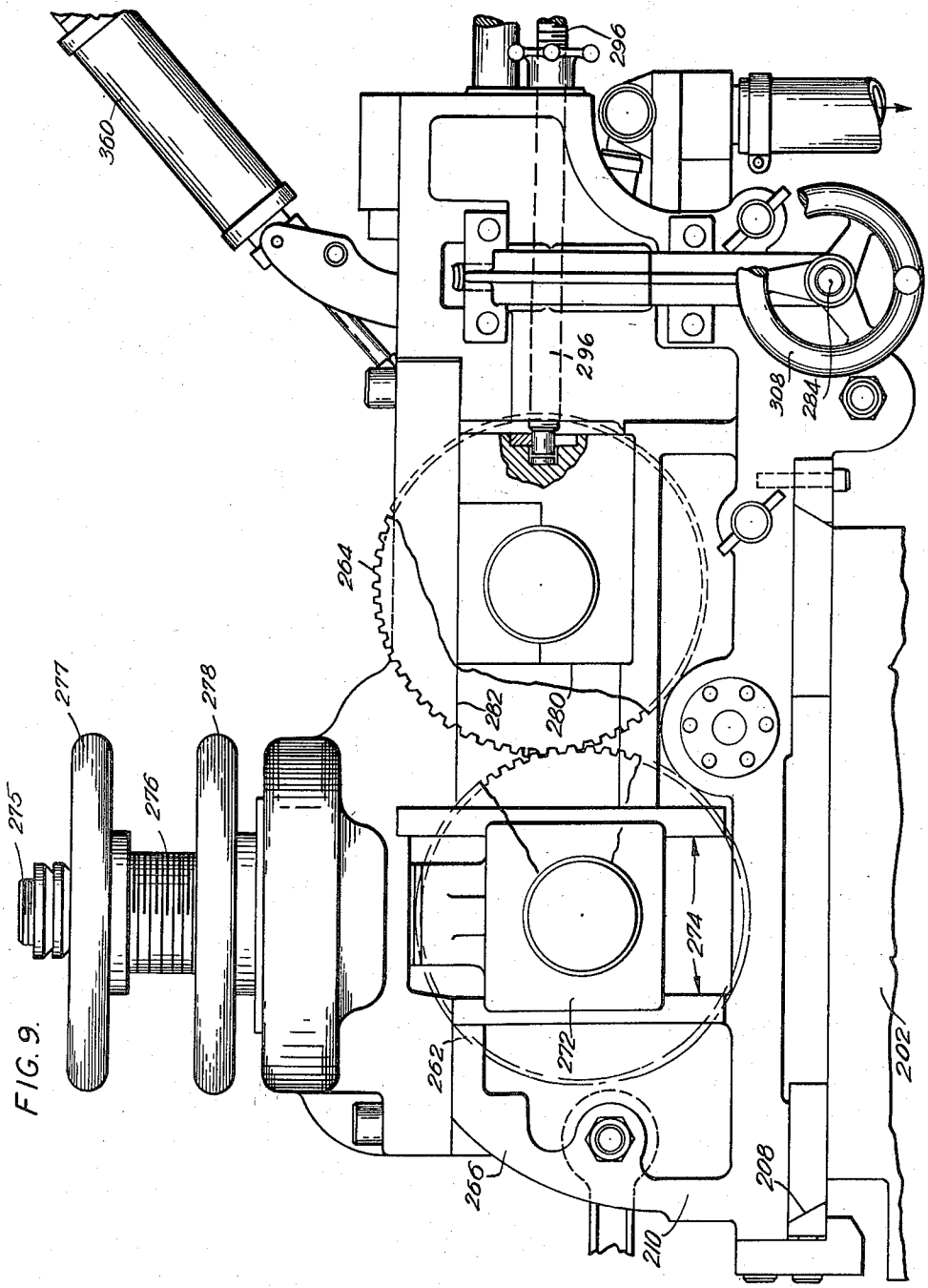


FIG. 9.

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WEB FEEDING AND PRINTING MECHANISM FOR MULTIPLE UNIT ROLLER TYPE PRINTING MACHINE

Original Filed April 29, 1953 9 Sheets-Sheet 7

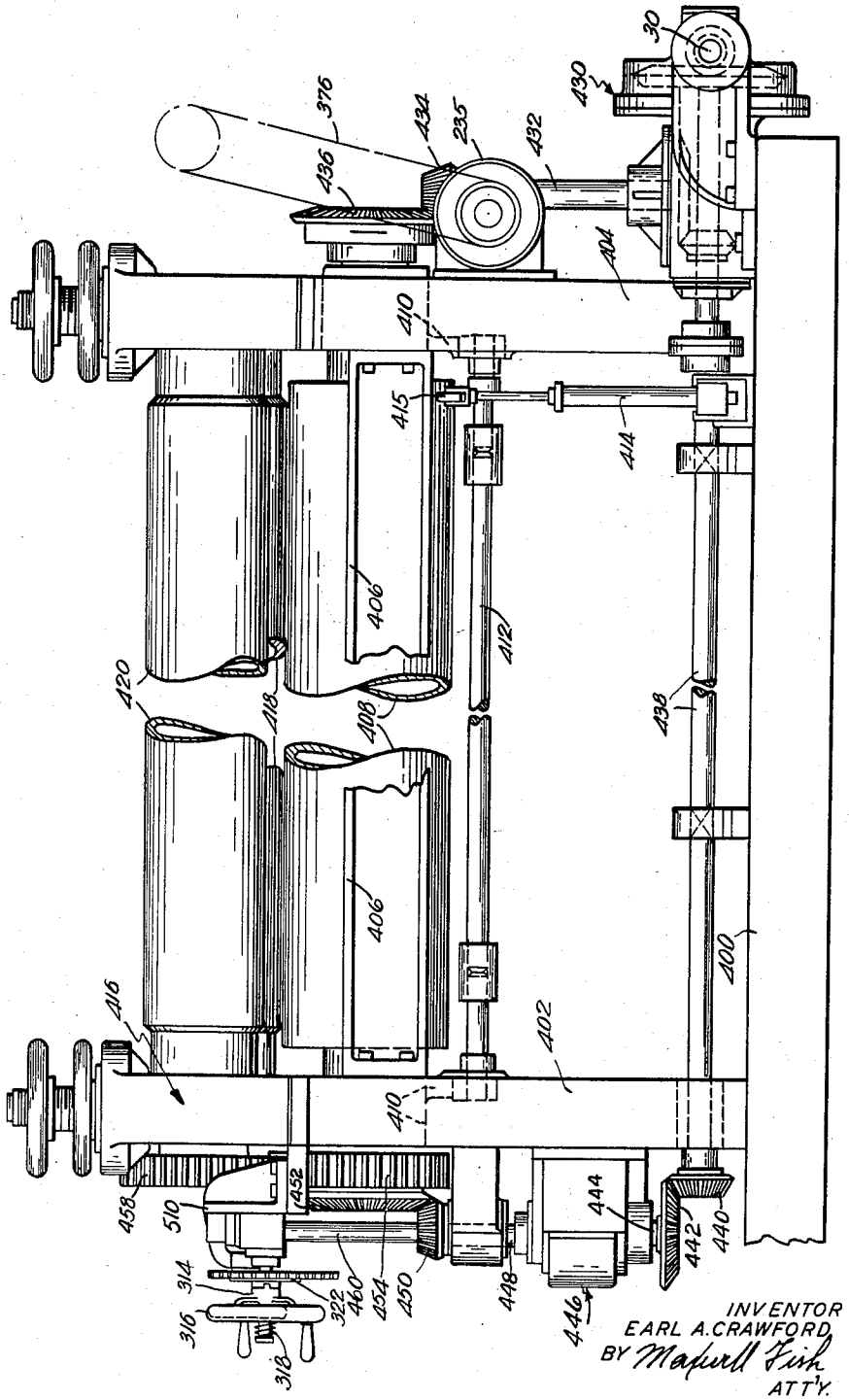


FIG. 10.

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WEB FEEDING AND PRINTING MECHANISM FOR MULTIPLE UNIT ROLLER TYPE PRINTING MACHINE
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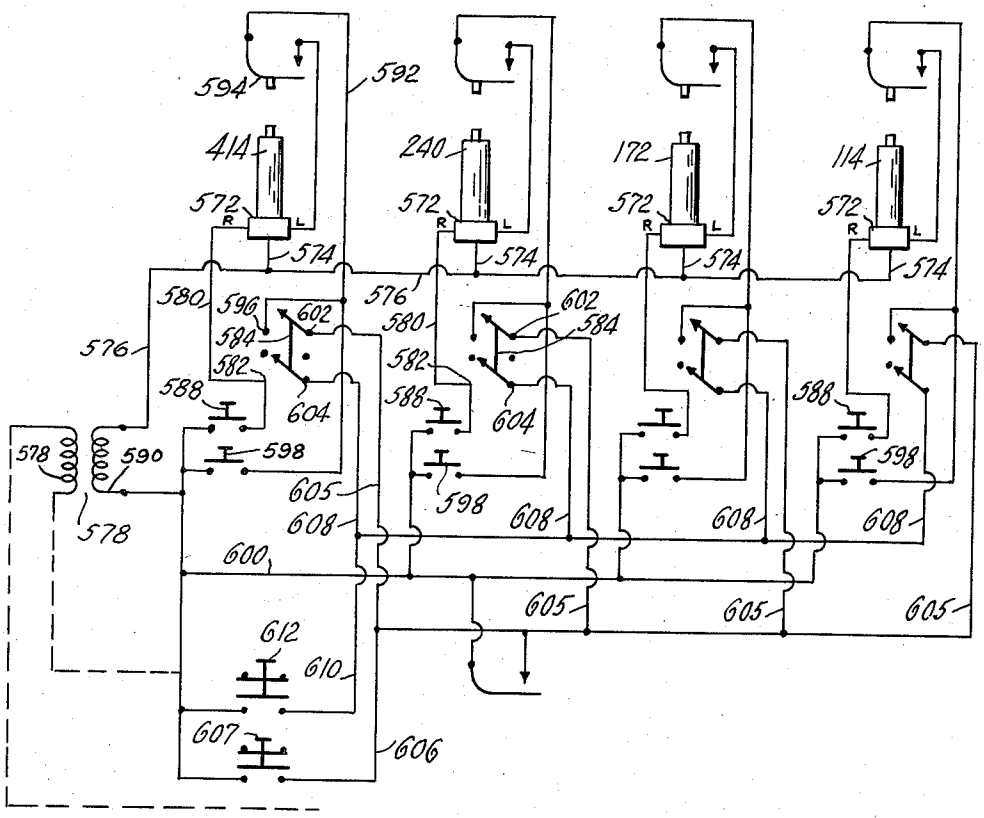


FIG. 11

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WEB FEEDING AND PRINTING MECHANISM FOR MULTIPLE UNIT ROLLER TYPE PRINTING MACHINE

Original Filed April 29, 1953 9 Sheets-Sheet 9

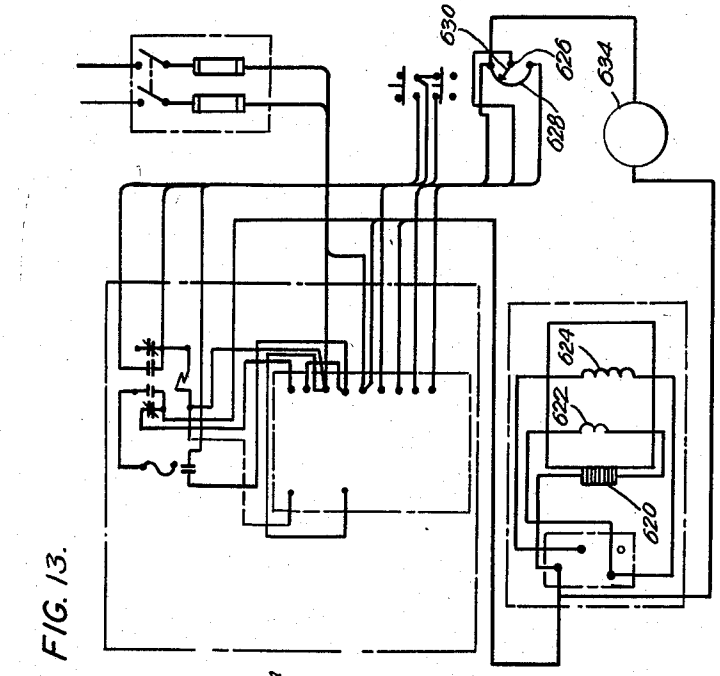


FIG. 13.

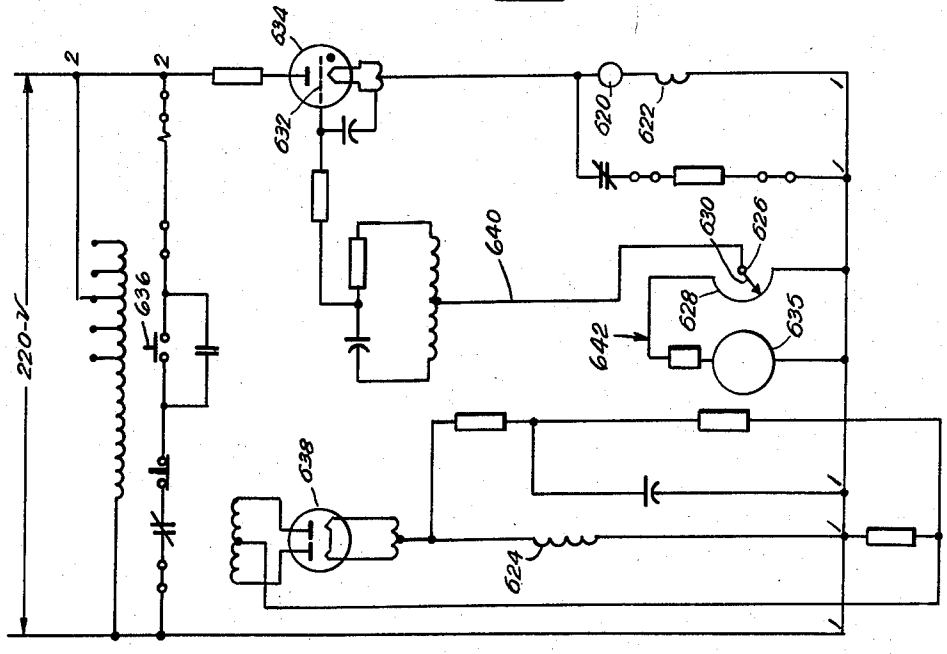


FIG. 12.

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United States Patent Office 2,925,036 Patented Feb. 16, 1960

2,925,036

WEB FEEDING AND PRINTING MECHANISM FOR MULTIPLE UNIT ROLLER TYPE PRINTING MACHINE

Earl A. Crawford, Warwick, R.I., assignor to Bird & Son, Inc., East Walpole, Mass., a corporation of Massachusetts

Original application April 29, 1953, Serial No. 351,970, now Patent No. 2,809,582, dated October 15, 1957. Divided and this application December 21, 1956, Serial No. 629,926

2 Claims. (Cl. 101—182)

The present invention relates to improvements in a multiple unit roller type printing machine, and more particularly to a web feeding and printing mechanism for the machine.

The invention is hereinafter disclosed in a preferred form as embodied in a multiple unit roller type printing machine for roller printing, coating or otherwise processing a webbed material suitable for use as floor and wall coverings and the like, which is formed from a paper base or similar fibrous web material which may be impregnated with asphalt or other material and having a limited stretch characteristic.

It is a principal object of the invention to provide a novel and improved web feeding and printing control mechanism for a machine of the general type herein disclosed which may be readily controlled by the operator to disengage any selected one or more of the roller printing units, or alternatively to disengage all of the roller feed elements of the machine to arrest the feed of the web without stopping or otherwise interfering with the operation of the several printing units.

In a machine of the general type disclosed in which rapidly drying inks are applied to a web traveling at speeds which may be in the vicinity of 200 or more feet per minute, it is of very considerable importance to avoid any interruption of the flow of ink to and the removal of excess ink from, the gravure roller.

The present application is a division of applicant's copending application Serial No. 351,970, filed April 29, 1953, and issued as Patent No. 2,809,582, dated October 15, 1957, for Machine and Method for Processing Webs of Paper Base and Similar Materials.

With the above and other objects in view as may hereinafter appear, the several features of the invention consist also in the devices, combinations and arrangement of parts hereinafter described and claimed, which, together with the advantages to be obtained thereby, will be readily understood by one skilled in the art from the following description taken in connection with the accompanying drawings, in which—

Fig. 1 is a front side view of a printing machine embodying in a preferred form several features of the invention;

Fig. 2 is a plan view of the printing machine shown in Fig. 1;

Fig. 3 is a view in elevation of the draw-in unit looking from the right hand end of the machine;

Fig. 4 is a detail view in elevation of the torque motor drive for producing a drag on the feeding web, shown in Fig. 3, looking from the front of the machine;

Fig. 5 is a view of the torque motor drive, shown in Fig. 4, looking from the left;

Fig. 6 is a view in elevation of the draw-in unit looking from the front side of the machine, but with the torque motor, for driving the differential tensioning device, omitted;

Fig. 6A is a view in elevation of the second printing unit looking from the front side of the machine;

Fig. 7 is a view in elevation of the draw-off unit looking from the rear side of the machine;

Fig. 8 is a view in elevation of the first printing unit looking from the right hand end of the machine;

Fig. 9 is an enlarged detailed view in elevation looking from the front of the machine of the carriage associated with the first printing unit;

Fig. 10 is a view in elevation looking from the right hand end of the machine of a second printing unit;

Fig. 11 is a diagrammatic view of the electrical connections for controlling the solenoid operated air valves by means of which the drive support rollers associated with the several units of the machine are moved into and out of operative position;

Fig. 12 is a single line diagram of the torque motor drive for producing a drag on the web extending through the draw-in and draw-off units; and

Fig. 13 is a supplementary diagram view of the electrical controls for the torque motor.

Referring to the drawings the multiple impression printing machine herein disclosed as embodying in a preferred form the several features of the invention comprises a web draw-in unit generally designated at A in Fig. 1 having a drive support roller and a cooperating pressure roller, a first roller printing unit designated at B, an associated drying oven C, a second roller printing unit D, an associated drying oven E, and a web draw-out unit, generally indicated at F, comprising a drive support roller and a cooperating pressure draw-off roller. These units are constructed and arranged to cause a web of material to be processed, which in the preferred form of the invention is floor covering material, to pass through the several units in a straight line run.

The several operating units of the machine referred to are driven in synchronism with one another by means of a torque shaft **30** which runs along the full length of the machine at the rear side adjacent the floor level, and is connected through individual reduction gear boxes with each of the separate units. The torque shaft **30** is continuously driven from any convenient source of power which may be an electric motor not shown.

Draw-in unit

The web draw-in unit A, above referred to, as best shown in Figs. 3 and 6 comprises a front standard **36**, and a rear standard **38** supported on a base member **39** and rigidly connected by a spacer member **40**. The standards provide support for two vertically slidable bearing blocks **42**, **44** for a drive support roller **46**. The standards also provide support for two bearing blocks, **48**, **50** (Figs. 3 and 6) for a pressure roller **52** which forms the upper roller of the pair. The drive support roller **46** is driven from the torque shaft **30** through a gear box **54**, and a drive shaft **56** which extends from the rear to the front side of the machine slightly above the level of the base member **39**. At its forward end the shaft **56** is provided with a bevel gear **58** which meshes with a bevel gear **60** forming the driving element of a differential gear unit generally indicated **62**, and is secured to a vertically disposed drive shaft **64** of said unit. The elements of the differential unit also include a bevel gear **66** which is secured to the shaft **64** and is connected by two idler bevel gears **68** with a driven bevel gear **70** mounted on a driven sleeve **72** in vertical alignment with the drive shaft **64**. A bevel gear **74** keyed to turn with and slidable axially on the sleeve **72** meshes with a large bevel gear **76** which is mounted to turn as a unit with the drive support roller **46**. A lug **79** formed integrally with bearing block **42** engages beneath and supports the bevel **74** in mesh with

gear 76 for any vertical adjustment of the bearing blocks 42, 44 and driving support roller 46. The control element of the differential gear unit comprises an upwardly extending control shaft 80 which is mounted above and in axial alignment with the drive shaft 64 and which extends upwardly through an axial bore in the driven bevel gear 70 and sleeve member 72. At its lower end the shaft 80 is provided with a transverse bearing pin 82 on opposite ends of which are mounted the idler bevel gears 68 of the differential unit. With this arrangement it will be understood that rotation of the control shaft 80, causing the idler bevel gears 69 to rotate about the axis of the driving and driven bevels 66 and 70 has the effect of changing the angular relation of the driving roller 46 to the main driving connections including torque shaft 30. Thus a continuous rotation of the control shaft 80 of the differential gear unit in one direction will cause the driving roller 46 and associated pressure roller 52 to be continuously driven at a slower rate than that which would normally be imposed thereon by the main driving connections including torque shaft 30.

In accordance with the invention a torque driving motor is employed in combination with the differential driving connection above described to produce a regulated retarding tension, or drag upon that portion of the webbed material, passing between the draw-in rollers 46, 52 and the draw-off rollers 152, 154. The amount of drag, which is in effect a braking force exerted on the traveling web is readily controlled by well known electrical means for adjusting the driving torque of the torque motor unit. The mechanism for producing a tensioning drag on the webbed materials specifically shown in Figs. 3, 4, and 5 comprises an electric torque motor 84 mounted on a bracket 86 on the front standard 36 of the draw-in unit A. The motor unit includes a transversely extending jack shaft 88 which is driven by means of reduction gearing from the armature shaft of the motor 84. A sprocket 90 on the shaft 88 is connected by a sprocket chain 92 with a sprocket 94 on a work shaft 96 which is in turn connected through a worm and gear connection 98 with the upper end of the differential gear unit control shaft 80. The torque motor unit operating through the differential gear unit as above described is employed to impose a drag on the webbed material being drawn through the printing machine.

An individual manual adjustment is provided for each of the bearing blocks 48, 50 to control the position of the pressure roller 52 with relation to the drive support roller 46. Vertical adjustment of each of the blocks 48, 50 is effected by means of a rotatable sleeve element 100 which is externally threaded to a nut 102 fixedly supported on the respective front and rear standards. The sleeve element 100 is supported to turn on an upwardly extending shaft 104 secured at its lower end to the bearing block. A manually adjustable hand wheel 106 is secured to the upper end of the sleeve. A locking nut in the form of a second hand wheel 108 is threaded to the sleeve above the nut 102.

In accordance with the invention the drive support roller 46 together with the drive support rollers for each of the draw-off units and the two printing units hereinafter to be described are arranged and supported to be dropped downwardly out of engagement with the cooperating rollers at the upper side of the traveling strip in order to arrest the feed of the strip without interfering with the continued drive of the several rollers including the elements of the printing units. The mechanism provided for controlling the position of the drive support roller 46 comprises a rock shaft 110 (Fig. 3) which extends parallel to and beneath the drive support roller and which is supported in bearing the respective standards 36, 38. Adjacent each end, the rock shaft 110 carries a cam member 112 which acts when the shaft is rocked in a counterclockwise direction as viewed from the front of the machine, to engage against and raise the respective bearing blocks 42, 44 and thereby to raise and to lock the drive support roller 46. For controlling this rocking movement of the rock shaft 110, a pneumatic cylinder 114 is provided which is supported at its lower end on a bracket 116 on the base 39. A piston element 118 extending from the upper end of the cylinder is connected with a lever arm 120 secured to the rock shaft 110. As indicated in Figs. 3 said cylinder 114 is provided at its lower end with an electric solenoid operated valve which controls the admission and exhaust of air to and from the cylinder.

Draw-off unit

The strip draw-off unit F, above referred to, as best shown in Figs. 1, 2 and 7, comprises a base 140 on which is mounted a front standard 142 (see Fig. 1) a rear standard 144 (see Fig. 7), and a spacer member, not specifically shown, by means of which the standards are rigidly secured together. Each standard is provided with a vertically slidable bearing block, not specifically illustrated, for a web draw-off roller 152. A cooperating pressure draw-off roller 154 is similarly mounted for vertical adjustment in the standards 142, 144 in bearing blocks 156, supported for vertical movement in guideways formed in the upper part of the respective standards For effecting this adjustment each bearing block 156 is provided with an upwardly extending shaft 159 providing support against axial movement relative thereto for a rotatable sleeve element 160 which is externally threaded to a nut 162 fixedly supported on the standard. A manually adjustable hand wheel 164 is secured to the upper end of the sleeve, and a lock nut 166 similarly formed with a hand wheel is threaded to the sleeve above the nut 162.

The web draw-off drive support roller 152 is normally maintained in a relatively raised operating position in engagement with the cooperating pressure roller 154 and is further adapted to be moved from engagement therewith to release the web from feeding engagement therewith by a pneumatically operated device identical with that shown in Fig. 3 for the draw-in unit, and which, as shown in Fig. 7, includes a rock shaft 168 which extends parallel to and beneath the drive support roller and which is supported in bearings in the respective standards 142, 144. Adjacent each end the rock shaft 168 carries a cam member 170 which acts, when the shaft is rocked in a clockwise direction as viewed from the rear of the machine, to engage against and to raise the respective bearing blocks for drive support roller 152, and thereby to raise and to lock the drive support roller 152 in its raised operative position. For controlling this rocking movement of the rock shaft 168 a pneumatic cylinder 172 is provided which is pivotally supported at its lower end on a bracket 174 on the base 140. A piston element 176 extending from the upper end of the cylinder is connected with a lever arm 178 secured to the rock shaft 168. As indicated in Fig. 11 the cylinder 172 is provided at its lower end with an electric solenoid operated valve 572 which controls the admission and exhaust of air to and from the cylinder.

The draw-off driving and pressure rollers 152, 154 are driven from the torque shaft 30 of the machine through operating connections (see Fig. 7) which include a reduction gear unit 180 having a vertically disposed output shaft 182 to the upper portion of which is keyed a bevel gear 184 which meshes with a bevel gear 186 secured to the rear end of the web draw-off driving roller 152. A supporting lug 188 on the bearing block 150 is arranged to maintain the bevel gear 184 in mesh with the gear 186 for any adjustment of the blocks 148, 150.

First roller printing unit

The two roller printing units indicated at B and D in Fig. 1 which are supported and arranged to impart successive impressions registered with relation to one an-

other to the webbed material during the run between the draw-in roller unit A and the draw-out unit F are with only slight differences, hereinafter specifically pointed out, identical in construction. Referring specifically to Figs. 8 and 9 inclusive, the first printing unit designated at B comprises generally a fixed base assembly (see Fig. 8) including a base **200**, a front standard **202**, a rear standard **204**, and a spacer member **206**, and a relatively movable upper assembly in the form of a carriage **210** which is supported for forward and back movement transversely of the feeding web on guideways **208** (see Fig. 9) formed in the upper ends of the respective standards **202**, **204**. The operating parts of the first printing unit include specifically a driving support roller **212** which is mounted beneath the traveling web in the standards **202**, **204** and a roller printing mechanism which is supported above the traveling web on the carriage **210**. This mechanism comprises a transfer roller **214** mounted on the carriage directly above the driving roller **212**, a cooperating gravure roller **216** which is mounted at that side of the transfer roller with the draw-in unit A and slightly above the transfer roller. The transfer roller **214** and gravure roller **216** are maintained at all times in continuous rolling contact in the carriage. An ink reservoir and a doctor blade **220**, not specifically shown, also are mounted on the carriage **210**.

The drive for the transfer and gravure rollers **214**, **216** of the first printing unit A is taken from the torque shaft **30** through a reduction gear box **222** onto a driving shaft **224** which extends between the rear and front standards **202**, **204** slightly above the level of the base **200**. A vertically disposed power output shaft **226** from the gear box **222** at the rear side of the machine has splined thereto adjacent its upper end a bevel gear **228** which meshes with a bevel gear **230** secured to the rear end of the driving support roller **212**.

A control mechanism is provided, similar to that described in connection with the driving support rollers for the draw-in and draw-out units, which is operative to move the drive support roller **212** vertically between a raised operative and a low inoperative position. To this end the support roller **212** is supported at each end in bearing blocks **232**, which are vertically movable in guideways formed in the respective front and rear standards **202**, **204**. Vertical movements of the bearing blocks **232** and driving support roller **212** is effected by means of a rock shaft **236** which is mounted from the standards **202**, **204** beneath and parallel to the support roller **212**. Toward each end, the shaft **236** has secured thereto a cam **238** which engages beneath the respective bearing blocks **232**. Movement of the rock shaft in a counterclockwise direction as viewed from the front of the machine causes the bearing blocks to be engaged by high portions of the respective cams to raise the support driving roller **212** to its driving position. For rocking the shaft **236** there is provided a pneumatic cylinder **240** which is pivotally connected at its lower end to a bracket **241** on the base **200**.

A piston **242** extending from the upper end of the cylinder is connected to a laterally extending lever arm **244** secured to the rock shaft **236** for controlling the admission and exhaust of air from the piston. One of several identical solenoid controlled air valves **572**, as shown in Fig. 11, controls the admission and exhaust of air from the cylinder.

The transfer roller **214** and the gravure roller **216** are positively driven at the same linear rate with the drive support roller **212**. The drive is taken from the torque shaft **30** and reduction gear box **222** through driving shaft **224** to the front side of the machine, thence through bevel gears **248**, **250** onto a vertical drive shaft **252**. At its upper end the shaft **252** is fitted with a bevel gear **254** which meshes with a bevel gear **256** formed integrally with a large spur gear **258** which is supported to turn in a fixed bearing **260** provided in the upper portion of the front standard **202**. A gear **262** (see Fig. 9) secured to the forward end of the transfer roller **214** meshes with the spur gear **258** and also with a gear **264** secured to the forward end of the gravure roller **216**. The spur gear **258** is of substantial width so that the transfer roller drive gear **262** will always be meshed with the spur gear **258** irrespective of the transverse adjustment of the carriage **210**.

Second printing unit

The second printing unit designated at D in Fig. 1, and more specifically shown in Fig. 10 is substantially identical with the printing unit B, previously described, except for the provision of a novel means for securing an accurate register of the impression produced thereby on the traveling sheet of webbing longitudinally as well as laterally with relation to the impression produced on the sheet by the first printing unit B. The second printing unit comprises a base assembly including a base **400**, a front standard **402**, and a rear standard **404**, and an additional spacer member **406** for maintaining these parts rigidly in position. A driving support roller **408** is mounted in the base assembly of the printing unit, being supported in bearing blocks **410** mounted for vertical adjustment in the respective front and rear standards. A control mechanism is provided for shifting the driving support roller **408** between a high operating and a low inoperative position which is similar to that previously described for effecting a similar shift between high and low positions of the first printing unit drive support roller **212**. This mechanism includes a rock shaft **412** having at each end cams for engagement beneath the bearing blocks **410**, and a solenoid controlled pneumatic cylinder **414** for controlling the position of the rock shaft.

The second printing unit D further comprises a carriage **416** mounted on guideways on the respective standards for movement transversely of the feeding strip. The carriage provides support for a transfer roller **418** mounted directly above the driving support roller **408** and a gravure roller **420** mounted at that side of the transfer roller with the draw-in unit A and at a level slightly above that of the transfer roller. The second printing unit is also provided with a doctor blade assembly including a doctor blade, and an ink supply system, not specifically shown.

The drive support roller **408** for the second printing unit is driven from the torque shaft **30**, through a gear box **430** and vertical output shaft **432**, having a bevel gear **434** splined thereto for engagement with a bevel gear **436** mounted from the rear end of the drive support roller **408**.

The drive for the transfer roller **418** and gravure roller **420** of the second printing unit is taken from the gear box **430** through a horizontally disposed drive shaft **438** to the front side of the machine, and through bevel gears **440**, **442** to the input shaft **444** of a vertically disposed differential gear unit **446**. The output sleeve member **448**, from the unit aligned with the input shaft **444**, carries a bevel gear **450** which meshes with a bevel gear **452** formed internally with a large spur gear **454** which in turn meshes with a driving gear **456** secured to the forward end of the transfer roller **418**. The gear **456** meshes also with a driving gear **458** on the gravure roller **420**.

The differential unit above described is employed to effect an angular adjustment of the second printing unit transfer roller **418** and gravure roller **420** with relation to the driving mechanism for the machine, and thereby to obtain an adjustment of the impression imparted to the feeding web longitudinally thereof.

The illustrated machine is provided with electrical devices under the control of the operator for controlling the operation of the air cylinders above described, by

means of which the several drive support rollers are lowered and raised.

In accordance with the invention control devices are provided which enable the operator to move the drive support rollers, associated with the several operating units of the machine either as a group or individually, between raised operating and lowered inoperative positions in which they are separated from the cooperating pressure and impression transfer rollers.

The electrical devices provided for controlling the operation of the several air cylinders by means of which the respective driving support rollers are raised and lowered comprise a series of solenoid operated air valves **572** mounted integrally with each of the driving support roller raising and lowering air cylinders **114**, **172**, **240** and **414**. Each solenoid air valve **572** is provided with raise and lower control leads marked respectively as R and L, and an intermediate terminal **574**. Each of the terminals **574** is connected to a wire **576** which is connected to a power supply transformer **578**. The R terminals are connected respectively by identical wire **580** with one terminal of a manual-automatic control switch **584**. An extension of the R line **580** is connected with a normally opened push button control switch **588** which is in turn connected by a wire **590** with the power supply transformer **578**. The drive support roller drop control terminal L, from each of the solenoid actuated valves **572**, is connected by means of a wire **592** through a micro-switch **594** with a second terminal **596** of the manual-automatic switch **584**, and also with a normally opened lower button control switch **598** which is connected by the wire **590** with the power supply solenoid **578**. Since the electrical connections to each of the solenoid operated air valves **572** are identical, the same reference characters have been used for the designation of these identical parts. Each of the several raise control switches **588** and lower control switches **598** are connected with the power supply transformer by a wire **600** and wire **590**. Of two remaining terminals **602**, **604** associated with each manual-automatic switch **584**, the terminals **602** are connected by wires **605** and **606** to a stop switch **607** which is connected to the power supply line **590** and transformer **578**. The terminals **604** are connected by means of wires **608** and **610**, and a forward switch **612** to the power line **590** from the power supply transformer **578**.

The operation of the control devices for moving the several driving support rollers between operative and inoperative positions is as follows:

Assuming that all of the manual-automatic switches **584** are closed so that the several solenoid controlled air valves are directly controlled by the automatic Forward and Stop switches **612**, **607**, the pressing of the Forward automatic switch button **612** causes all the R solenoid contacts to be energized shifting the air valves **572** to the raise position in which air is admitted to the several air cylinders **114**, **172**, **240** and **414** thus raising the several driving support rollers to operative position to feed the web through the machine. The several cylinder pistons, upon reaching the limit of their upward movement, engage with and close the respective micro-switches **594** so that the electrical circuit including the drive support roller drop control terminals may be energized by the actuation of either the automatic manual stop switch **607** or the individual stop switch **598**.

In order to stop the feed of the web the operator presses the Stop button **607** causing the L contacts of the several solenoid controlled air valves **572** to be energized to condition the respective air valves to exhaust air from the respective air cylinders **114**, **172**, **240**, **414**. The downward movement of the pistons causes each of the driving support rollers to be lowered to its inoperative position to arrest the feeding and printing operations without interference with the continued drive of the drive support rollers, and printing unit rollers.

The arrangement above described for stopping the feed of the web provides a convenient means available to the operator for stopping the machine with a minimum of disruption to the machine operation. The continued drive of the gravure and transfer rollers of the printing units, although the advance of the web is stopped, has the advantage that a continuous circulation and flow of ink through the printing unit is maintained which avoids any possibility that the ink will tend to dry or harden on the rollers.

Whenever one of the manual-automatic switches **584** is shifted to its open position the associated solenoid control air valve **572** is operatively disconnected from the automatic switch control buttons **612**, **616** and remains under the individual control of the manual forward and reverse buttons **588**, **598** which will now control the movement of the drive support roller of said machine unit to and from its operative position. In the event that one of the printing units, as for example the first printing unit B, is to be rendered inoperative in this manner while a printing or lacquering operation is being carried on only by the second printing unit D, the manual-automatic switch **584** associated with the first printing unit is moved to the open position as shown, and the reverse button **598** associated with the first unit is pressed causing the L contact of the solenoid air valve **572** to be energized thereby exhausting air from the air cylinder **240** and causing the drive support roller **212** to be moved downwardly to its inoperative position.

The individual controls for moving the respective drive support rollers between raised operative and lowered inoperative positions have been found useful also to condition the machine for various operations, as for the adjustment of the several rollers of the respective machine units when the machine is stopped, and for straightening any portion of the web which may have gotten out of line. The printing units may be rendered inoperative individually to avoid printing over defective or uneven portions of the web which might cause injury to the transfer roller surface.

The operation of the torque motor unit **84** to retard the rotation of the draw-in pressure and drive support rollers in order to tension the feeding web will be readily understood from an inspection of the electrical diagram of Figs. 12 and 13, of which Fig. 12 is a single line diagram of the electrical operating connections and Fig. 13 is a complementary diagram showing the positions of the several elements including the control switches and the supporting panels. Referring to Figs. 12 and 13 the torque motor **84** is shown having an armature **620**, a commutator field **622** and a shunt field **624**. The speed or torque of the motor is determined by the adjustment of a speed control **626** having a rheostat **628** and an adjustable arm **630** which is connected to the grid **632** of a thyratron tube **634** through which direct current is supplied to the armature and the commutator field winding of the motor. A further adjustment of the power input is effected by means of a variable speed generator **635** supported in series with the rheostat **628** of the speed control and arranged to be driven from the torque shaft **30** of the machine. There is also provided on the same panel with the speed control a start and stop switch **636** for the torque motor **84**.

From an inspection of the single line diagram of Fig. 12, it will be noted that a direct current is supplied to the armature **620** and commutator field winding **622** through the thyratron rectifier tube **634** and that direct current is supplied to the shunt field **624** through a rectifier tube **638**. The arm **630** of the speed control unit is connected with the control element on grid **632** of the tube **634** by means of a wire **640** and resistance elements of ordinary construction.

The rheostat **628** of the speed control **626** is connected to the variable speed generator **635** by a wire **642** and a suitable resistance unit. The generator **635** is also con-

nected with one of the two line wires indicated at 1. The arrangement of the several elements of the torque motor electrical circuit are such that the power output of the torque motor is held to a constant value which is determined by the setting of the control arm 630, and is further controlled by the rate of drive of the main torque shaft 30 which in turn controls the rate of drive of the generator 635. It is the function of the generator 635 to vary the power output of the torque motor in proportion as the rate of feed of the web through the printing machine is increased or decreased, so that the amount of stretch imposed on the web in accordance with the setting of control arm 630 will remain constant regardless of the speed at which the machine is driven.

The amount of drag exerted on the traveling web by the torque motor 84 and differential connection in the drive to the draw-in rollers 46, 52 is readily adjusted during machine operation by manual adjustment of the speed regulator hand 630. As the torque is gradually increased any tendency of the web to weave will disappear and the web will be found to be running true along the entire length of the run to the draw-off station. Under these conditions, in which a floor covering material may be an asphalt impregnated felt or paper is passing through the machine a stretch of about ⅛" per linear yard may be present. If the torque is increased beyond the elastic limit of the material it may be noted that the web tends to ripple, followed by separation and breakage of the web.

The invention having been described what is claimed is:

1. In a machine for roller printing webs of paper base and similar fibrous web materials having a limited stretch characteristic, the combination of a web conveyor constructed and arranged to draw the web along a run lying substantially in a horizontal plane between draw-in and draw-off stations, a driving support roller supported from the machine for engagement with the underside of the web, and a cooperating pressure roller supported from the machine for engagement against the upper side of the web at each of said stations, at least one printing unit for printing a portion of the web on said run comprising a driving support roller supported from the machine for engagement with the underside of the web, and printing devices including a cooperating impression transfer roller engaging the upper side of the web, means for driving each of said driving support and impression rollers at predetermined linear rates to feed the web, individual bearing supports for the several driving support rollers shiftable between raised web feeding and low inoperative positions, bearing support raising and lowering cams disposed beneath and engaging with said individual bearing supports for each of the several driving support rollers, a rock shaft disposed parallel to each driving support roller and connected at its opposite ends to the associated bearing support cams at the two ends of the associated driving support roller, a laterally extending arm secured to each said rock shaft, and pneumatic cam shift cylinders associated with the several driving support rollers, mounted on the machine and attached to the respective laterally extending arms and means under the control of the operator for selectively operating said pneumatic devices to raise and lower the associated driving support rollers.

2. In a machine for roller printing webs of paper base and similar fibrous web materials having a limited stretch characteristic, the combination of a web conveyor constructed and arranged to draw the web along a run lying substantially in a horizontal plane between draw-in and draw-off stations, a driving support roller supported from the machine for engagement with the underside of the web, and a cooperating pressure roller supported from the machine for engagement with the upper side of the web at each of said stations, at least one printing unit for printing a portion of the web on said run comprising a driving support roller supported from the machine for engagement with the underside of the web, and printing devices including a cooperating impression transfer roller engaging the upper side of the web, bearing supports for the individual driving support rollers shiftable toward and away from the underside of the web, a bearing support raising and lowering cam disposed beneath each of said bearing supports, a rock shaft extending parallel to the driving support roller and connected to each of said bearing support raising and lowering cams, individual fluid actuated devices connected to rock each said rock shaft and associated cams for shifting said bearing supports, automatic electrical means under the control of the operator for actuating said fluid actuated devices to simultaneously shift the several driving support rollers from one to the other position, means under the control of the operator for rendering said automatic means operative and inoperative to shift said driving support rollers, and electrically operated devices under the control of the operator for shifting each drive support roller selectively between its raised web engaging position and its low inoperative position.

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