

Nov. 7, 1961

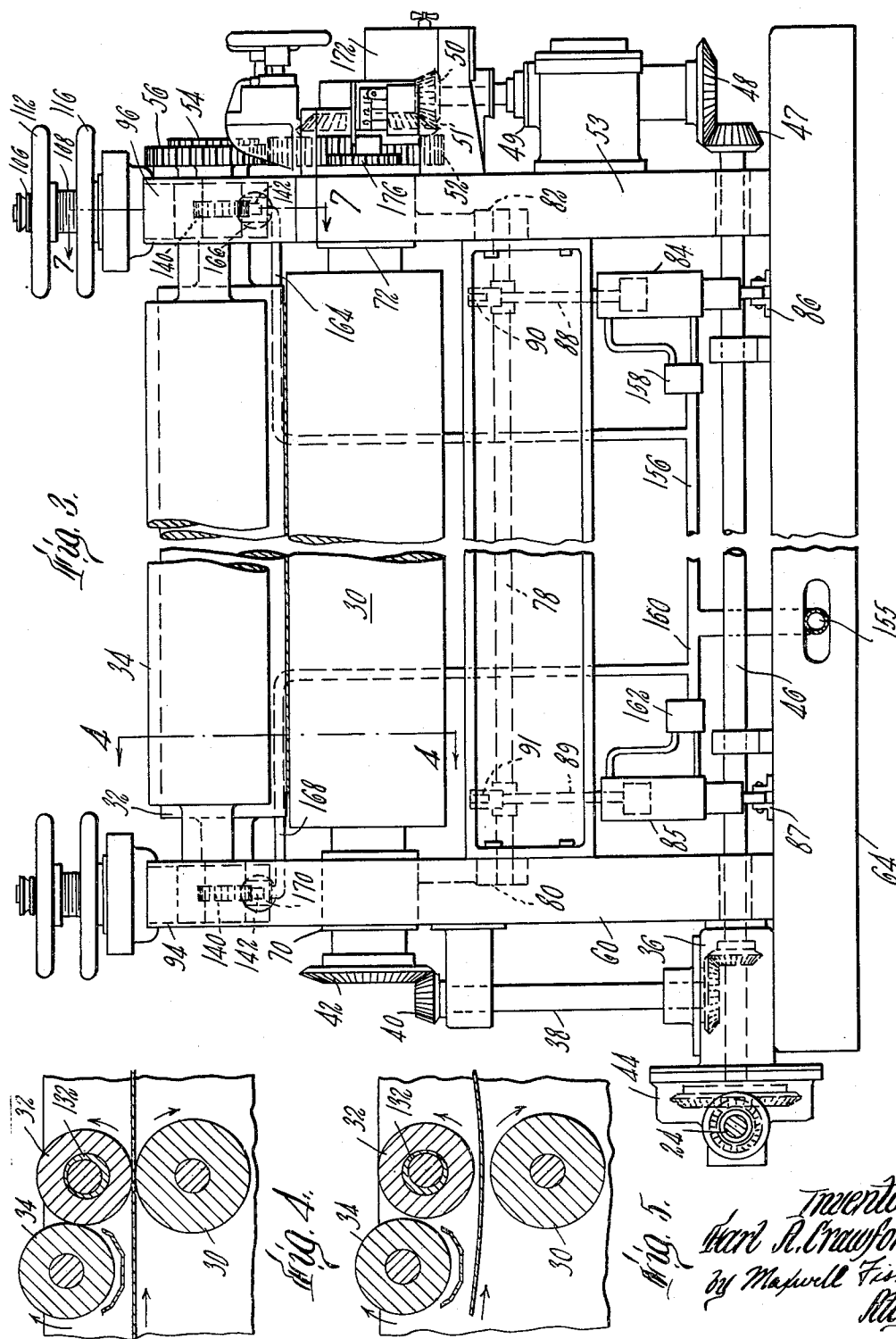
E. A. CRAWFORD

3,007,404

OFFSET INTAGLIO PRINTING

Filed Sept. 15, 1959

6 Sheets-Sheet 2



Nov. 7, 1961

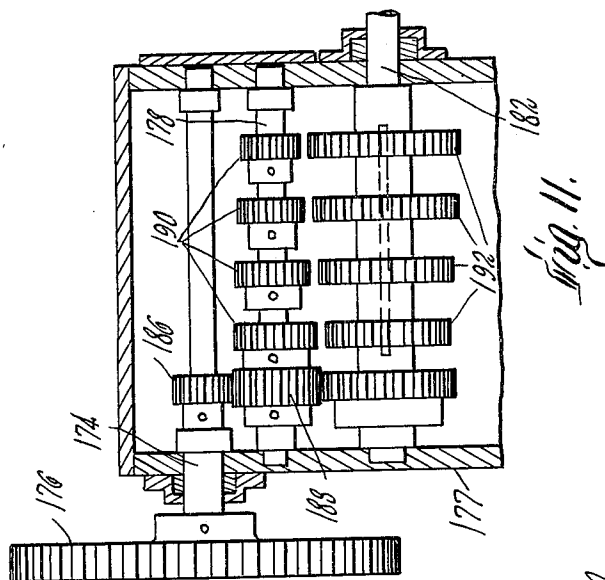
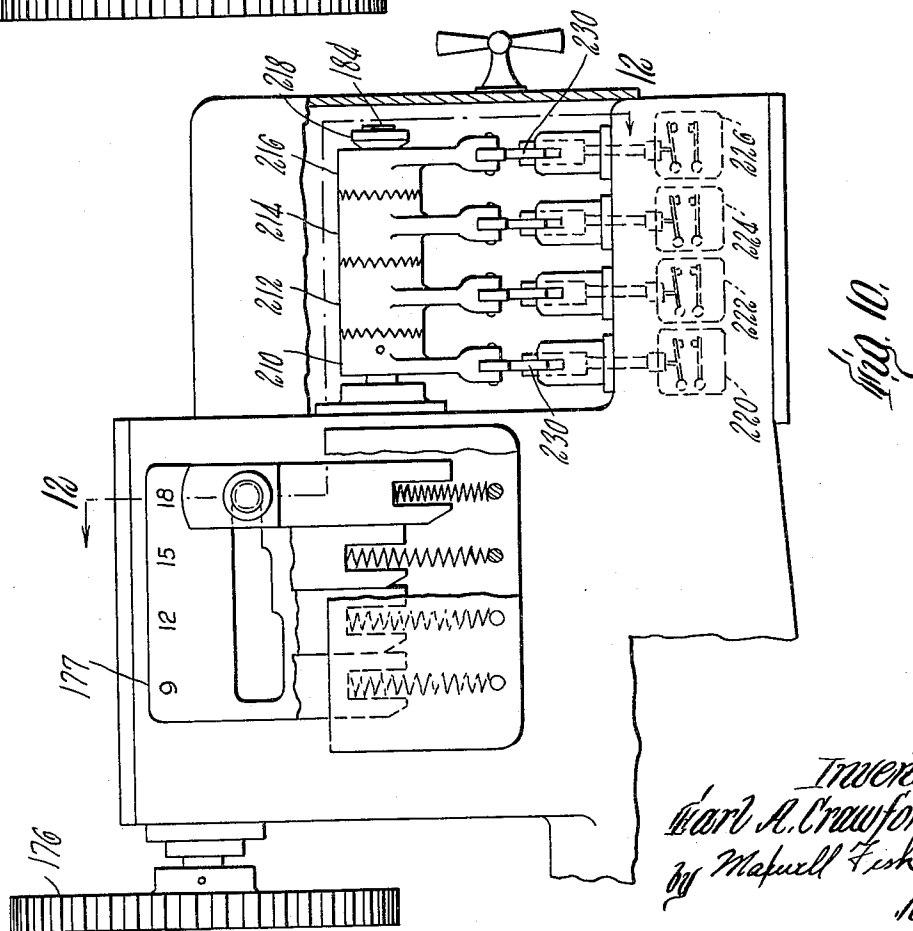
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OFFSET INTAGLIO PRINTING

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6 Sheets-Sheet 4



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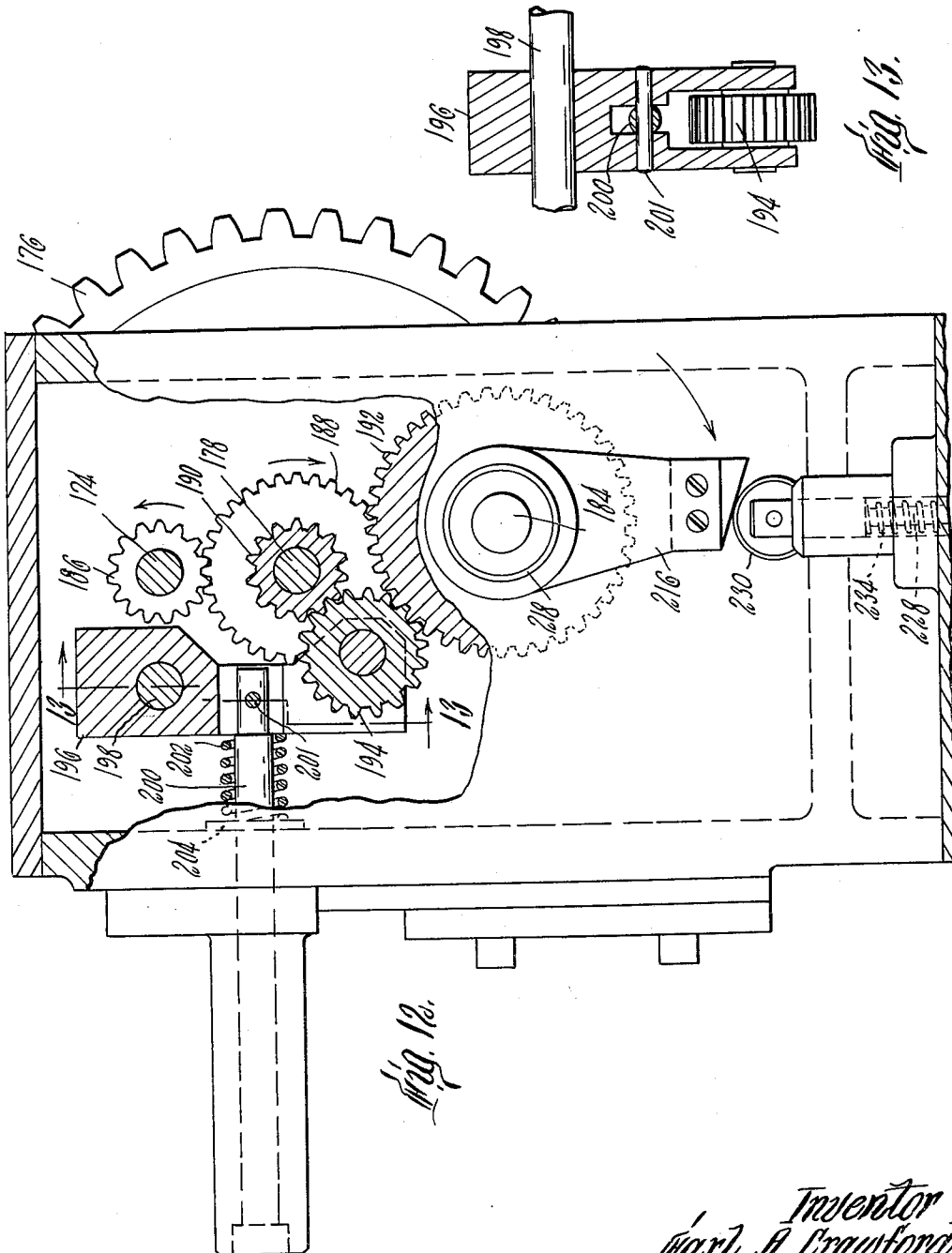
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OFFSET INTAGLIO PRINTING

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6 Sheets-Sheet 5



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OFFSET INTAGLIO PRINTING

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6 Sheets-Sheet 6

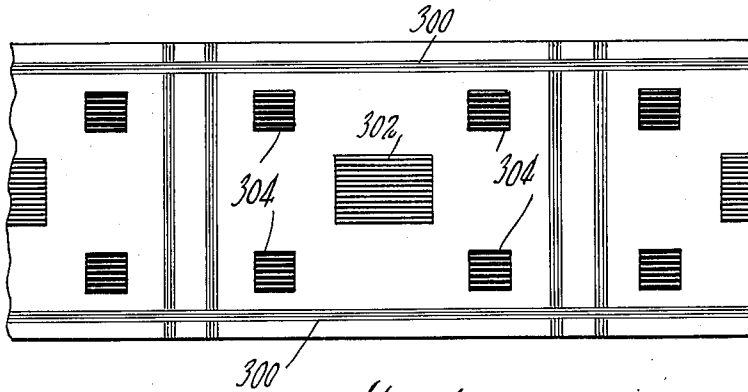


Fig. 14.

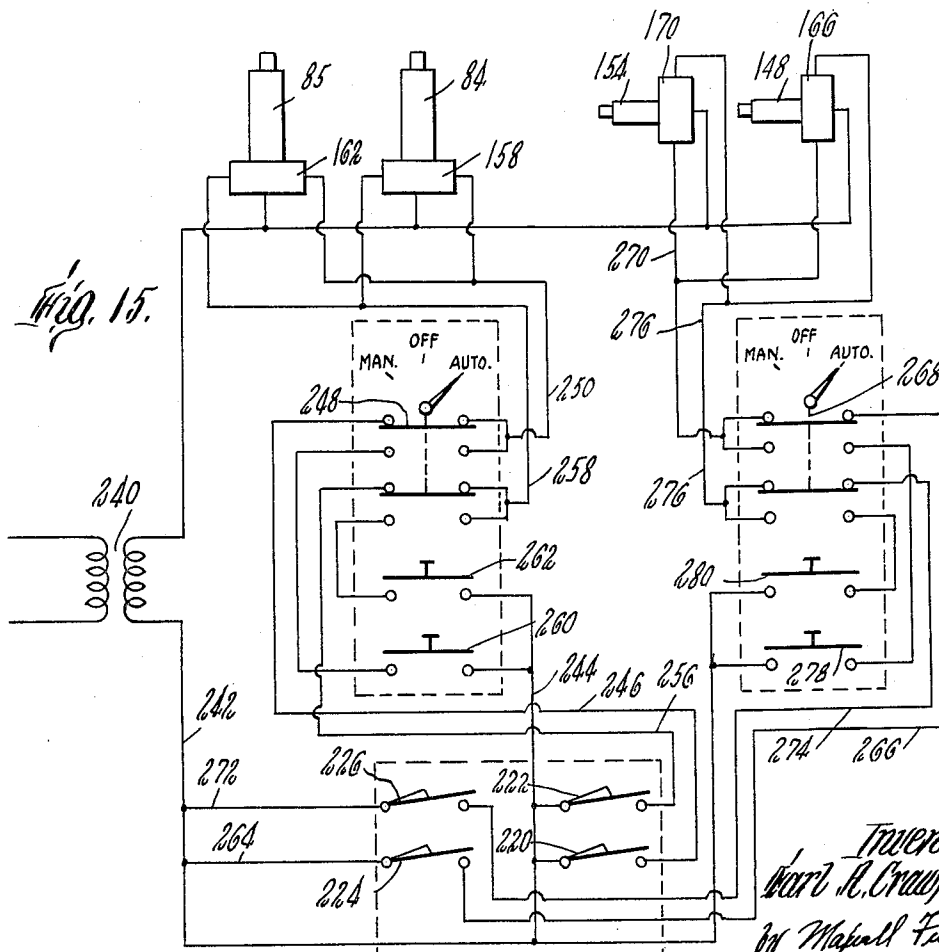


Fig. 15.

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3,007,404

OFFSET INTAGLIO PRINTING

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Filed Sept. 15, 1959, Ser. No. 840,180

11 Claims. (Cl. 101—154)

The present invention relates to improvements in offset intaglio printing on a roller press and more particularly to a method and apparatus for printing diverse colors and shades of colors on subject material passing through the press.

More particularly the invention is herein disclosed as embodied in a roller printing press of the general type in which the material to be printed is advanced along a substantially horizontal path from a feed-in to a draw-off station through one or more offset intaglio printing units, each comprising a support roller over which the material passes, a rubber surfaced offset ink transfer roller cooperating therewith located above the material to be printed, and an engraved intaglio roller to which ink is applied and which transfers said ink by contact to the printing roller in any desired pattern.

The illustrated printing unit is provided with means for moving the support roller downwardly away from the offset ink transfer roller to disengage the subject material advancing through the press and thereby to arrest the printing of the subject material, and additional means for moving the offset ink transfer roller away from the engraved intaglio roller in order to arrest the transfer of ink onto the offset ink transfer roller.

It will be understood that in intaglio or rotogravure printing the small cells formed in the peripheral surface of the engraved intaglio roller are filled with ink which is deposited on the surface to be inked on small individual droplets. Once the cells have been filled, all excess ink is removed from the surface of the engraved intaglio roller by the doctor blade before printing so that a uniform unvarying weight of ink is transferred by the engraved intaglio roller to the surface to be inked regardless of the amount of inking to which said roller may be subjected. The present invention relates more particularly to an offset type of press which is constructed and arranged to permit either one or a series of deposits of said ink to be placed in succession on the offset ink transfer roller to build up a desired weight and density of ink which is thereafter transferred to the subject material passing through the press.

It is a principal object of the invention to provide control means for controlling the relative movements of the support roller to its inoperative position, and in timed relation therewith the movements of the impression transfer roller out of inking contact in accordance with a recurring pattern.

More particularly, it is an object of the invention to control the said movements of the support roller and of the offset ink transfer roller of at least one printing unit of a series into and out of operative position in such timed relation as to provide for the printing of different weights or volumes of ink on specified portions of the material for the production of shaded printing and of so-called profile printing.

Other objects of the invention are to provide for the improved construction and arrangement of the printing unit and of the support and control mechanisms therefor.

In accordance with the invention I have provided in an offset intaglio roller printing unit of the type referred to having means for shifting the support roller to and from printing position and additional means for shifting the offset ink transfer roller into and out of inking contact with the engraved intaglio roller of the unit the combina-

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tion of automatically acting control means for correlating these roller shifting operations in such a manner as to control the density and weight of ink transferred by the offset ink transfer roller to the subject material for each printing impression of the printing unit.

This improvement is employed preferably in a roller printing press having a plurality of successively operating printing units for the purpose of controlling the density and shading of the ink applied by the particular unit referred to, as compared with the printing impressions by other printing units of the series.

In an end border printing operation, for example, in which the printing unit adapted for printing the end border is out of operation for one or more successive revolutions of the offset ink transfer roller, the roller shifting mechanism above referred to functions to prevent the inking of the offset ink transfer roller except during the last idle revolution of the unit preceding the printing of the end border in order to match the shade of ink in the side border applied by a second continuously operating printing unit. Alternatively for the printing of designs which may recur only intermittently following a number of nonprinting revolutions of the ink transfer roller, shading effects may be secured by a controlled variation in the number of inkings applied to the offset ink transfer roller during the intervening nonprinting revolutions of the printing unit.

The details of the invention 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 plan view of a printing machine embodying in a preferred form the several features of the invention;

FIG. 2 is a view looking from the near side of the machine shown in FIG. 1 along which runs the main drive shaft connecting the several draw-in, draw-out and printing units;

FIG. 3 is a view looking from the right of one of the printing units and is taken on a line 3—3 of FIG. 2 to illustrate particularly the printing unit marked as "C" in FIGS. 1 and 2;

FIGS. 4 and 5 are diagrammatic views illustrating alternative printing and disengaged positions of both the support roller 30 and the ink transfer impression roller 32;

FIG. 6 is a view of the printing unit shown in FIG. 3 looking from the right of FIG. 3;

FIG. 7 is a detailed sectional view on a somewhat enlarged scale taken on a line 7—7 of FIG. 3, illustrating particularly the mechanism for controlling the positions of the engraved intaglio and offset ink transfer rollers;

FIG. 8 is a detailed sectional view taken on a line 8—8 of FIG. 7 illustrating particularly the eccentric bearing shift device for the offset ink transfer roller shown also in FIG. 7;

FIG. 9 is an enlarged detail sectional plan view taken on a line 9—9 of FIG. 7;

FIG. 10 is an enlarged detailed view of the selector cam and follower mechanism, and of the change speed driving connections therefor;

FIG. 11 is a detailed view, partly in section, taken on a line 11—11 of FIG. 6 illustrating particularly the change-speed mechanism for driving the selector cam shaft;

FIG. 12 is a view looking from the right taken on a line 12—12 of FIG. 10 illustrating the change-speed mechanism, the selector cam shaft, and one of the selector cam and follower connections associated therewith;

FIG. 13 is a detailed sectional view of the change-speed shift gear and of the manual control therefor taken on a line 13—13 of FIG. 12;

FIG. 14 is a diagrammatic view of a rug pattern constructed in accordance with the invention; and

FIG. 15 is a diagrammatic view of the electrical con-

trol devices for controlling the operation of the several hydraulic valves.

The invention is herein disclosed as embodied in an offset roller printing press adapted for printing floor coverings and similar materials and is of the general type illustrated in my prior Patent No. 2,809,582 dated Oct. 15, 1957, for Machine and Method for Processing Webs of Paper Base and Similar Materials comprising a draw-in station, a draw-out station and a plurality of printing units and associated driers disposed at intervals along the run of the web between the draw-in and draw-out stations.

The illustrated machine, as indicated in the somewhat diagrammatic FIGS. 1 and 2, comprises a draw-in station A, a series of six printing units designated at B, C, D, E, F and G, and a draw-out station H. Since all of the printing units of the series may be identical with each other, only one of the printing units, for example, that designated by the letter C will be described and illustrated in detail.

The web is drawn into the printing press through a pair of nip rollers which form part of the draw-in unit A, consisting of a nether support roller 20 and a cooperating top roller 22, said rollers being positively driven from a main drive shaft 24 extending along the near side of the machine, through connections which form specifically no part of the present invention. The web is drawn out from the printing press through a pair of nip rollers including a nether support roller 26 and a cooperating top roller 28 which are positively driven from the main drive shaft 24. In accordance with the disclosure of my above-noted prior patent, the draw-in and draw-out roller units are driven at a differential rate adapted to stretch that portion of the web extending between the draw-in and draw-out stations to substantially its elastic limit, so that the web is caused to travel along a true path from one to the other of said stations without any tendency to distortion or weaving.

The printing unit designated at C comprises a nether support roller 30, a cooperating upper offset ink transfer roller 32, and an engraved intaglio roller 34, together with suitable driving connections from the main drive shaft 24 adapted for driving the three rollers at the same peripheral rate. As best shown in FIGS. 1, 2 and 3, the nether support roller 30 is driven from the shaft 24 through connections which include a gear box 36 having an input connection from the drive shaft 24, an output connection in the form of a vertical shaft 38 and bevelled gears 40, 42 connecting the shaft 38 with the support roller 30.

The driving connections for the offset ink transfer roller 32 and engraved intaglio roller 34 comprise a gear box 44 having an input connection with the main drive shaft 24, and an output connection in the form of a shaft 46 which extends from the near side to the operator side of the machine. The shaft 46 is connected by bevel gears 47, 48 and adjustable driving connections generally designated at 49, a bevelled pinion 50 and a bevelled gear 51 with a driving pinion 52 carried on a column 53 forming a portion of the fixed understructure portion of the printing unit, and meshes with a pinion 54 fixed to turn with the offset ink transfer roller which meshes with a pinion 56 fixed to turn with the engraved intaglio roller 34.

The printing unit C comprises an understructure including the column 53, and a column 60, rigidly connected together by a base bar 64, and providing support for the axle of the nether support roller 30. The support roller 30 is mounted in bearing blocks 70, 72, which are vertically adjustable in guideways formed respectively in the columns 60 and 53 of the understructure.

A mechanism is provided for effecting a vertical shift of the support roller 30 between a raised web supporting position and an alternative low disengaged position which comprises a rock shaft 78 disposed beneath the support

roller 30 in parallel relation thereto having fixed thereto adjacent the two ends identical cams 80, 82 which engage beneath and support the respective bearing blocks 70, 72. A rocking movement is imparted to the shaft 78 and cams 80, 82 to raise and lower the support roller 30 by means of two identical pneumatic cylinders 84, 85 attached at their lower ends to brackets 86, 87 on the base bar 64, and having piston rods 88, 89 connected at their upper ends to rocker arms 90, 91 secured to the rock shaft 78.

The offset ink transfer roller 32 and gravure roller 34 are supported in a normally fixed relation to one another on a carriage 92, see FIGS. 3, 5 and 6, which is mounted in ways 93, 95 formed respectively in the two columns 60 and 53 of the understructure for movement transversely of the travelling web. The carriage comprises front and rear members 94, 96 overlying respectively the columns 60 and 53, and rigidly connected together into a single unit by means of a heavy connecting bar, not shown.

The offset ink transfer roller 32 is carried at each end in identical bearing blocks of which one is shown at 100 in FIG. 5 vertically adjustable on ways 104 formed in the member 96, a similar bearing block and ways, not shown, being provided on the member 94. The adjusting means (see FIGS. 3 and 7) comprises a central shaft 106 secured to each of the bearing blocks 100, an externally threaded sleeve 108 which is supported against axial movement relative to the shaft 106 and is mounted in a fixed nut 110 for vertical movement when rotated by means of a hand wheel 112. A locking nut 114 actuated by a locking hand wheel 116 serves to lock the parts in adjusted position.

The engraved intaglio roller 34 is supported for horizontal adjustment on bearing blocks of which one is shown at 120, adjustable on a horizontal guideway 124 formed in the member 96. The position of the block 120 is determined by means of a control rod 126 and connections not specifically shown since they form specifically no part of the present invention. The opposite end of the roller 34 is mounted in a block which is similar to the block 120 and is similarly adjustable.

It will be understood that the mechanisms above described for positioning the bearing axes of the impression transfer and gravure rollers on the carriage are utilized primarily for effecting a permanent adjustment of these centers which will not be disturbed during the subsequent operation of the machine upon any given class of work.

In the illustrated construction means are provided for automatically shifting the offset ink transfer roller with relation to the engraved intaglio roller between an engaged ink transfer position and an alternative out-of-engagement inoperative position in which no ink is transferred from the engraved intaglio roller to the offset ink transfer roller. Each end of the offset ink transfer roller 32 is formed with a reduced portion or trunnion 130 (see FIGS. 7 and 8) which is mounted to turn in an eccentric sleeve bearing 132 fixedly mounted within a rotatably adjustable sleeve 134 supported by means of ball bearings 136, 138 within a bore formed in the bearing block 100. A pinion 140 formed on the peripheral surface of the sleeve 134 meshes with a rack 142 which is connected at one end to a piston rod 144 and piston 146 of a pneumatic cylinder 148. The pneumatic cylinder 148 is fixedly mounted on the member 96 of the carriage. The rock 142 is mounted to slide in a guideway formed in the bearing block 100 and is subject to vertical adjustment with the block. A movable connection is, therefore, provided between the rock 142 and piston rod 144 to permit a corresponding change in the relative positions of these parts which comprises a plate 150 on the rock having formed therein a vertically disposed T-shaped slot which engages with the flanged end of a pin 152 extending axially from the adjacent end of the piston rod 144. It will be understood that the near end of the offset ink transfer roller 32

is similarly supported in an eccentric sleeve bearing which is rotated to shift the near end of the roller 32 by means of a rack and pinion and actuating air cylinder (designated at 154 in FIG. 15) which is identical in construction and operates simultaneously with the pneumatic cylinder 148 to move both ends of the offset ink transfer roller into and out of engraved intaglio roller 34 engaging position.

In FIG. 7 the parts including the offset ink transfer roller 32, rack 142 and air cylinder piston 146 are shown for the engaged printing position of the offset ink transfer roller 32. Movement of the piston 146 and rack 142, together with the similar parts associated with the near end of the roller 32 to the left will rotate the eccentric sleeve bearing assembly including sleeves 132, 134 supported on a bearing block 100 carried by frame member 96 clockwise at the same time that the similar sleeve assembly above described but not specifically illustrated for supporting the other end of the offset ink transfer roller 32 on a similar bearing block on frame member 94, is similarly rotated clockwise, so that the roller 32 is moved away and downwardly from the engraved intaglio roller 34 a few thousandths of an inch to prevent further inking of the offset ink transfer roller 32.

In accordance with the invention, a control mechanism is provided for automatically controlling the operation of the several pneumatic valves above described for moving the support roller 30 and the ink transfer roller 32 into and out of operating position. The movements of the two rollers into and out of operating position are carefully correlated to cause printing to be suspended on the particular printing unit during any one or a series of selected revolutions of the ink transfer roller, and at the same time to control the position of the ink transfer roller to determine the number of layers of ink which will be applied to the ink transfer roller before the support roller 30 is again moved to its raised printing position. It will be understood that there is a separate control mechanism of the type hereinafter described associated with each of the printing units B through G inclusive as shown in FIGS. 1 and 2. Inasmuch as these mechanisms may be identical, only that mechanism which is associated with the printing unit C will be disclosed herewith.

Compressed air is supplied to the pneumatic cylinders 84, 85 for moving the support roller 30 from and to its engaged printing position, and to the pneumatic cylinders 148, 154 for moving the offset ink transfer roller 32 to and from engagement with the engraved intaglio roller 34, through pipe connections which include a supply source generally indicated at 155 and branch pipe connections therefrom including a pipe 156 which connects with an electrically actuated reversing valve 158 associated with the pneumatic cylinder 84, a branch pipe 160 which connects with an electrically actuated reversing valve 162 associated with the pneumatic cylinder 85, a third branch pipe 164 which connects with an electrically actuated reversing valve 166 associated with the pneumatic cylinder 148, and a branch pipe 168 which connects with an electrically actuated reversing valve 170 associated with the pneumatic cylinder 154.

The operation of the several reversing valves above described to shift the support roller 30 and the offset ink transfer roller 32 respectively between operative and disengaged positions is controlled by means of a control unit which is carried in a housing 172 (see FIGS. 3 and 6) which is mounted on the machine column 53 forming part of the understructure of the machine. This unit comprises a change gear unit, a cam shaft driven therefrom and adjustable cam and follower connections by means of which the pneumatic cylinder reversing valves 158, 162, 166 and 170 are controlled. The control unit is provided with an input shaft 174 and a gear 176 which is continuously meshed with the main driving gear at 52 from which the offset ink transfer roller 32 and the engraved intaglio roller 34 are driven.

The input shaft 174 forms part of a conventional change

gear unit 177 (see FIGS. 10-13 inclusive) which includes an intermediate shaft 178 and an output shaft 182 which is rigidly connected with an axially aligned cam shaft 184. In general, the gearing provided within the change gear unit comprises a gear 186 secured to the input shaft 174 which meshes with a gear 188 on the intermediate shaft 178. A series of successively smaller gear 190 on the intermediate shaft 178 are adapted to be alternatively connected with a corresponding series of successively larger gears 192 on the output shaft 182. A pinion 194 mounted on a depending rocker arm 196 carried on a guide shaft 198 for rocking movement is arranged to be shifted axially and into position for connecting any selected pair of gears.

The position of the pinion 194 is controlled by means which is generally indicated as including a manually operable shift rod 200 having a pivotal connection 201 with the rocker arm 196. For shifting the position of the pinion 194, the shift rod 200 is pulled outwardly to disengage the pinion 194 and is then shifted transversely to move the rocker arm 196 and pinion 194 along the guide shaft 198. A spring 202 coiled about the rod 200 and seated at one end against a washer 204 which bears against the housing 172 and at its other end against the rocker arm 196, acts to maintain the pinion 194 normally in engaging position with the selected pair of change gears.

The cam shaft 184 is adapted to be driven from the main driving pinion 52 through the change gear mechanism above described at any one of a plurality of speeds, each of which is accurately synchronized with the rate of rotation of the offset ink transfer roller 32. The cam shaft 184 has mounted thereon four angularly adjustable segmental cam members indicated respectively at 210, 212, 214 and 216. Each of these segmental cam members comprises a hub and an arm extending therefrom which supports at the end thereof a segmental cam. As noted in FIG. 10, the hub of the cam member 210 is keyed to the cam shaft 184, the several hubs being then held with relation to one another by means of corrugated end faces which are held together by means of a nut 218 threaded to the end of the cam shaft 184. The several cam members 210-216 are shown for purposes of illustration as being in alignment. It will be understood, however, that the angular positions of the cam members 212, 214, 216 will be determined in accordance with the requirements of the printing operation the printing unit is called upon to perform. The several cam members are arranged to cooperate with switch assemblies which include a support roller Raise control switch 220 arranged to be acted upon by the cam member 210, a support roller Lower switch 222 which cooperates with the cam member 212, an ink transfer roller On switch 224 which is actuated by the cam member 214, and an ink transfer roller Off switch 226 adapted to be engaged by the cam member 216. Inasmuch as the cam actuated switches 220, 222, 224 and 226 are identical in construction and operation, only one of these will be described in connection with the disclosure of FIGS. 10 and 12. The switch assembly comprises a switch actuating plunger 228 having mounted at its upper end a cam follower roller 230. The lower end of the switch actuating plunger 228 is arranged, when depressed, to engage with and close the contact element of the switch. A spring 234 coiled about the plunger 228 is arranged to support the plunger 228 and cam follower roller 230 in a raised position in which the associated switch is retained in its open position.

The electrical circuits actuated by the cam and follower devices of the control unit above set forth as shown in the diagrammatic FIG. 14 comprise a power source in the form of a transformer 240. Current is drawn from one side of the transformer through a wire 242 and a branch wire 244 to one side of the support roller Lower switch 222 and to the support roller Raise switch 220. Current passes from the support roller Lower switch 222 through a wire 246, a manual-automatic switch 248 and wire 250

to the lowering side of the electrically operated control valves 158 and 162 for the respective support roller lowering and raising pneumatic cylinders 84, 85. The support roller Raise switch 220 is similarly connected through wire 256 and the manual automatic switch 248 with a wire 258 which connects with the raise side of each of the two electrically operated valves 158, 162. From an inspection of FIG. 14, it will be noted that if the manual switch 248 is moved from the automatic position shown to the manual position that the branch wire 244 may then be connected either through a manual Lower switch 260 or a manual Raise switch 262.

For shifting the ink transfer impression roller to the Off or disengaged position, the current passes from the wire 242 through wire 264 through the offset ink transfer roller cam actuated switch 224 and wire 266 to a manual-automatic switch 268 whence the current passes through a wire 270 to the off side of the electrically operated valves 166, 170 for the two offset ink transfer roller actuating pneumatic cylinders 148, 154. For shifting the offset ink transfer roller 32 to the On or engaged position the cam actuated switch 226 is closed causing current to pass from the supply line 242 through wire 272, switch 226, and wire 274 to the manual-automatic switch 268 whence the current passes through a wire 276 to the On or engaged side of the electrically operated valves 166, 170 associated with the offset ink transfer roller positioning cylinders 148, 154. It will be understood that when the manual-automatic switch 268 is shifted to the manual position, the automatic connections above described are disconnected and current is provided for energizing alternatively the On and Off sides of the electrically operated valves for the cylinders 148, 154 by pressing downwardly respectively on the manual Off button 278 or upon the manual On button 280 as desired.

The operation of my improved printing machine for the printing of end borders, shaded profile designs and the like will be briefly described as follows.

Referring particularly to FIG. 14 and to the rug pattern there shown by way of example, it is assumed that the machine is set up for printing a series of identical 12 foot rug patterns each having a border 300 extending along the sides and across the ends of the rug, a center block 302 printed a somewhat darker shade of the same color as the border and four identical blocks 304 printed a still darker shade of the same color. One of the printing units of the machine which may be that designated at D is set up to print continuously the two side borders. Another of the identical printing units, which may be the unit C, is set up for printing the end borders in the following manner. The engraved intaglio roller 34 has formed thereon two end border designs in back-to-back position for printing the adjacent end borders of two adjoining rugs. The engraved intaglio roller 34 and offset ink transfer roller 32 are assumed to have a 3 foot circumference so that for a 12 foot rug the unit should print only once for each four revolutions of the rollers 32, 34. The change speed gear unit 177 is, therefore, set to cause the cam shaft 184 of the control unit to turn through one revolution for each four revolutions of the offset ink transfer roller 32. The support roller Lower cam 212 on cam shaft 184 is now set to actuate the support roller 30 Lower automatic switch 222 immediately after the completion of the printing of an end border design and thus to move the support roller downwardly to the inoperative nonprinting position shown in FIG. 5. The support roller Raise cam 210 is then set to actuate the support roller Raise automatic switch 220 toward the end of a full revolution of the cam shaft 184 and after the printing rollers 32 and 34 have completed three full revolutions during which the printing unit C is inoperative. With this arrangement it will readily be seen that the support roller 30 is moved into printing relation to permit the transfer of ink from the offset ink transfer roller 32 onto the web during each fourth revolution only of the printing rollers 32, 34,

The offset ink transfer roller of the printing unit C is at the same time moved away from the engraved intaglio roller 34 to avoid the building up of an excessive weight of ink on the offset ink transfer roller 32 during the three idle revolutions of the printing roller. I have found that the transfer of a single ink impression from the engraved intaglio roller 34 to the offset ink transfer roller 32 at the same time that the support roller is returned to its active printing position will produce a printed end border impression on the rug which accurately matches the density and color shade of the side border ink impression continuously printed on the web by the printing unit D. To this end the offset ink transfer roller Off cam 216 is adjustably positioned on the cam shaft 184 to actuate the offset ink transfer roller Off switch 226 immediately following the actuation of the support roller Lower switch 222, so that the offset ink transfer roller 32 is moved to the inoperative position illustrated, for example, in FIG. 5. The offset ink transfer roller On cam 214 is then adjusted on the cam shaft 184 to engage the offset ink transfer roller On switch 224 toward the end of one revolution of the cam shaft 184, and following the completion of three full revolutions of the printing rollers 32, 34. With this setting of the machine, it will be appreciated that the support roller 30 and the offset ink transfer roller 32 are moved from the inoperative position of FIG. 5 to their operative positions of FIG. 4 during only each fourth revolution of the printing rollers 32, 34; first, to insure that printing will take place only during each fourth revolution of said printing rollers, and secondly, to control the weight of ink transferred from the engraved intaglio roller 34 to the ink transfer roller 32 in order to cause the end border printing to match accurately the weight and color of the ink applied by the printing unit D in printing the side borders.

The printing of the darkest shade blocks 304 of the rug pattern is effected by the use of two additional printing units which may, for example, be B and E, each of which is caused to print one pair of said blocks 304 which are in lateral alignment and thereafter to be rendered inoperative during three revolutions of the printing rollers by a downward movement of the support roller to its inoperative position, while the offset ink transfer roller is moved to its inoperative position for one revolution only of the printing rollers and is then returned to its operative position, so that it receives three successive loads of ink from the engraved intaglio roller which, when the support roller is again raised to its operative position effects the transfer of a relatively great weight of ink to the travelling web to produce a dark shade of the color employed. It is assumed that the printing unit B is employed to print the right hand pair of color blocks 304 shown in FIG. 14 which appear at 12 foot intervals in each successively printed rug. The printing unit E may be utilized to print the left hand pair of color blocks 304 shown in FIG. 14 which appear at 12 foot intervals in each successive rug.

For this operation the control unit of each of these printing units B and E will be set to produce one revolution of the cam shaft 184 for each four revolutions of the printing rollers. The impression roller Lower and Raise cams corresponding to the cams 212 and 210 of FIG. 10 will have the same setting as that used for the printing unit C above described so that the support roller is lowered immediately following a printing operation and is then raised after the completion of three idle revolutions of the printing rollers. The ink transfer impression roller cams 216 and 214 are set to cause the offset ink transfer rollers for the printing units B and E to be moved to the inoperative position immediately following the printing of an impression on the web and to be returned to the operative or on position by the engagement of the On cam 214 with the On cam switch 224 after the cam shaft 184 has turned through approximately 1/4 of a revolution, so that these rollers will receive three

applications of ink for the transfer of a dark color impression to the web.

The center block 302 of the rug pattern shown in FIG. 14 is produced by the use of a printing unit which, for example, may be the printing unit F. In this instance the unit is set up to print on the web once during each fourth revolution, and the offset ink transfer roller is moved to its inoperative position during two out of three idle revolutions of the printing rollers and is thereafter returned to its operative position so that the offset ink transfer roller receives two successive applications of ink which are then transferred to the travelling web to produce an intermediate shade of the color in the center block.

The setting of the control unit for the printing unit F will be identical to that previously described for unit C except that a different setting will be required for the offset ink transfer roller On and Off cams 214 and 216. The cam 216 will be set as above described to actuate the offset ink transfer roller Off switch 226 immediately upon completion of a printing operation. The offset ink transfer roller On switch 214 will be set to engage the On switch 224 after two full idle revolutions of the printing rollers at a position which corresponds to approximately $\frac{1}{2}$ revolution of the cam shaft 184, so that the offset ink transfer rollers for the printing unit F will receive two applications of ink for the transfer of an intermediate shade of color impression to the web.

The invention having been described what is claimed is:

1. The method of producing shaded and profile printing on a roller printing press for printing subject material passing continuously along a run between draw-in and draw-out stations through at least one printing unit stationed along said run having a support roller mounted at one side of said subject material, an engraved intaglio roller and an off-set ink transfer roller of a size to turn through a plurality of revolutions for each repeat of the pattern printed on the subject material; disposed at the other side of said subject material, which comprises the steps of shifting the support roller from a support printing position to a disengaged position during selected successive revolutions of the offset ink transfer roller to arrest the printing of the subject material and thereafter shifting said support roller to the printing position, and relatively shifting the offset ink transfer roller and engraved intaglio roller from an ink transfer contact position to an out-of-contact position with relation to one another during a selected number of said revolutions of the offset ink transfer roller when the support roller is in said disengaged position and thereby to control a selected repetitive number of inkings and density of ink on the offset ink transfer roller deposited upon the subject material upon shifting said support roller to printing position.

2. A method for producing shaded and profile printing on a printing press for printing subject material passing continuously along a run between draw-in and draw-out stations in accordance with the steps set forth in claim 1 in which the offset ink transfer roller is moved away from the engraved intaglio roller supported to rotate on a relatively fixed axis only when the support roller is shifted to said disengaged position, and is returned to the engraved intaglio roller engaging position not later than the return of the support roller to said printing position.

3. The method of producing shaded profile printing in accordance with a repeat pattern on a roller printing press for printing subject material passing continuously along a run between draw-in and draw-out stations through a plurality of printing units stationed along said run, each of said units having a support roller mounted at one side of said subject material, a continuously inked engraved intaglio roller and an off-set ink transfer roller of a size to turn through a plurality of revolutions for each repeat of the pattern printed on the subject ma-

terial disposed at the other side of said subject material, which comprises the steps of shifting one or more of the support rollers of said printing units to a withdrawn disengaged position during at least one of a series of revolutions of the offset ink transfer roller to arrest the printing of the subject material and thereafter returning said support roller to the printing position, relatively shifting the offset ink transfer roller and engraved intaglio roller associated with said shifted support roller between an ink transfer and an out-of-contact position during selected revolutions of said offset ink transfer roller in which said support roller is in said withdrawn disengaged position to effect a selected number of inkings of the offset ink transfer roller to be transferred in repetitive cycles to the web upon the return of the support roller to the printing position, shifting the support roller of another of said printing units to a withdrawn disengaged position during at least one of a series of revolutions of the offset ink transfer roller and thereafter returning said support roller to the printing position, and controlling the relative ink transfer contact position of the offset ink transfer roller and engraved intaglio roller of said latter unit while said support roller is in said withdrawn disengaged position to effect a selected number of inkings of the offset ink transfer roller to be transferred to the web upon the return of the associated support roller to the printing position, and thereby to control the shades of color impression transferred to the forward moving web by each individual printing unit, said color impressions being in synchronized registered relation, one with another.

4. In an offset intaglio roller printing press for printing repeat patterns on subject material passing continuously along a run between draw-in and draw-out stations past and synchronized with a plurality of printing units adapted for intermittent printing each comprising a support roller mounted in said unit at one side of the subject material, and printing rollers including an offset ink transfer roller, and an engraved intaglio roller engaging said offset ink transfer roller mounted in said unit at the other side of said subject material, said off-set ink transfer roller being of a size to turn through a plurality of revolutions for each repeat of the pattern printed on the subject material, and driving connections for driving the support roller, the offset ink transfer roller and the engraved intaglio roller continuously at the same peripheral rate, the combination of means to relatively move the printing and support rollers between a subject material printing position and a withdrawn non-printing position to effect intermittent printing, means to relatively move the offset ink transfer roller and engraved intaglio roller between an ink transfer contact position and an out-of-contact position, and control means operable in accordance with a recurring pattern and timed with relation to the rotation of said offset ink transfer roller to relatively move said printing and support rollers of each said printing unit between said subject material engaging printing position and a withdrawn nonprinting position to effect intermittent printing of the forward moving web, said control means being further operable to relatively move said offset ink transfer and engraved intaglio rollers of each said printing unit between said ink transfer contact position and out-of-contact position, and pattern means for said control means operable to control the number of inkings and density of ink on the offset ink transfer roller deposited upon the subject material at each said intermittent printing.

5. In an offset intaglio roller printing press for printing a repeat pattern on subject material passing continuously along a run between draw-in and draw-out stations through and in synchronized relation with a plurality of printing units adapted for intermittent printing each comprising a support roller mounted in said unit at one side of the subject material, an offset ink transfer roller and an engraved intaglio roller engaging said offset ink transfer roller mounted in said unit at the other side of said

subject material, said off-set ink transfer roller being of a size to turn through a plurality of revolutions for each repeat of the pattern printed on the subject material and driving connections for driving the support roller, the offset ink transfer roller and the engraved intaglio roller continuously at the same peripheral rate, the combination of a first shifting means operative to move the support roller between an advanced printing position and a withdrawn disengaged position in which printing of the subject material is interrupted, a second shifting means operative to relatively move the offset ink transfer roller and engraved intaglio roller between an ink transfer contact position and an out-of-contact position, means for applying ink continuously to each said engraved intaglio roller, and control means operable in accordance with a recurring pattern and timed with relation to the rotation of said offset ink transfer roller of each said printing unit for actuating said first shifting means to move said support roller to said disengaged position during at least one revolution of said offset ink transfer roller in a recurring series of said revolutions and thereby to arrest the printing of said subject material while said support roller is disengaged, said control means being further operable to actuate said shifting means to relatively shift said offset ink transfer and engraved intaglio rollers of each said printing unit to said out-of-contact position during a selected number of said revolutions of said offset ink transfer roller when said support roller is in said disengaged position, and pattern means for said control means operable to control the number of inkings and density of ink on the offset ink transfer roller deposited upon the subject material upon the shifting of said support roller to the printing position.

6. In an offset intaglio roller printing press for printing subject material passing continuously along a run between draw-in and draw-out stations through at least one printing unit adapted for intermittent printing comprising a support roller mounted in said unit at one side of the subject material, an offset ink transfer roller and an engraved intaglio roller engaging said offset ink transfer roller mounted in said unit at the other side of said subject material, and driving connections for driving the support roller, the offset ink transfer roller and the engraved intaglio roller continuously at the same peripheral rate, the combination of means operative to shift the support roller between an advanced printing position and a withdrawn disengaged position in which printing of the subject material is interrupted, means operative to shift the offset ink transfer roller between an ink transfer contact position and an out-of-contact position with relation to the engraved intaglio roller, and means for applying ink continuously to said engraved intaglio roller, and a pattern mechanism timed with relation to the rotation of said offset ink transfer roller including a control unit, and means actuated thereby for causing said shifting means to move said support roller to said disengaged position during selected successive revolutions of said offset ink transfer roller to arrest the printing of said subject material during said successive revolutions, and additional means actuated by said control unit for further actuating said shifting means to shift said offset ink transfer roller between said ink contact transfer and out-of-contact positions, and thereby to control the number of applications of ink to the offset ink transfer roller while said support roller is in said disengaged position.

7. In an offset intaglio roller printing press for printing subject material passing continuously along a run between draw-in and draw-out stations through at least one printing unit adapted for intermittent printing comprising a support roller mounted in said unit at one side of the subject material, an offset ink transfer roller and an engraved intaglio roller engaging said offset ink transfer roller mounted in said unit at the other side of said subject material, and driving connections for driving the support roller, the offset ink transfer roller and the en-

graved intaglio roller continuously at the same peripheral rate, the combination of means for effecting intermittent shaded color printing by said printing unit including a cam shaft, means including change speed gearing for driving said cam shaft in timed relation to said offset ink transfer roller, a cam actuated support roller shift device operable to shift said support roller between a subject material printing position and a withdrawn non-printing position, a cam actuated offset ink transfer roller shift device operable to shift the offset ink transfer roller between an ink transfer contact position and an out-of-contact position with relation to the engraved intaglio roller, a support roller printing shift cam and a nonprinting shift cam adjustably supported on said cam shaft for actuating said support roller shift device, and an offset ink transfer roller contact shift cam and an out-of-contact shift cam adjustable on said cam shaft for actuating said offset ink transfer roller shift device.

8. In an offset intaglio roller printing press for printing subject material passing along a substantially horizontal run between draw-in and draw-out stations having a plurality of printing units stationed along said run, each of said printing units being adapted for intermittent printing comprising a frame, a support roller over which the subject material passes shiftable on said frame between a raised printing position and a low disengaged position in which printing of said subject material is interrupted, an offset ink transfer roller supported from said frame for engagement with the upper side of said subject material opposite the associated support roller, and an engraved intaglio roller supported from said frame at one side of and somewhat above said offset ink transfer roller for engagement therewith, said offset ink transfer roller and engraved intaglio roller being relatively shiftable between an ink transfer contact position and an out-of-contact position with relation to one another, a means for applying ink continuously to said engraved intaglio roller, and driving connections continuously driving each said support roller, the offset ink transfer roller and the engraved intaglio roller at the same peripheral rate, the combination of means for producing a recurring printing pattern comprising means for shifting each said support roller from one to the other of said printing and disengaged positions and for relatively shifting the associated offset ink transfer and engraved intaglio rollers between said contact and disengaged positions, and a pattern device associated with each printing unit including cam means timed with relation to the rotation of said offset ink transfer roller for actuating said shifting means associated with each printing unit to move each of said support rollers between said printing and disengaged positions to effect intermittent printing by the respective units, said cam means being further timed to move the offset ink transfer roller associated with the respective printing unit between said ink transfer contact position and said out-of-contact position when the associated support roller is in the disengaged position and thereby to control the number of inkings and density of ink on the offset ink transfer roller deposited upon the subject material during said intermittent printing by each of said printing units.

9. In an offset intaglio roller printing press for printing subject material passing continuously along a substantially horizontal run between draw-in and draw-out stations through at least one printing unit adapted for intermittent printing comprising a support roller mounted on said unit beneath the subject material, an offset ink transfer roller and an engraved intaglio roller engaging said offset ink transfer roller mounted in said unit above said subject material, and driving connections for driving all of said rollers continuously at the same peripheral rate, the combination of vertically adjustable bearing supports for the support roller, actuating means including pneumatic devices for shifting said support bearings

and the support roller between a raised printing and a lowered nonprinting position, rotatably adjustable eccentric bearing supports for the offset ink impression roller, and pneumatic devices for rotating said rotatable bearing supports to shift said offset ink impression roller between an engraved intaglio ink transfer contact position and a disengaged position, and control means for effecting said roller shifting movements comprising electrically operated solenoids for operating each of said pneumatic devices, support roller raise and lower switches and offset ink transfer roller On contact and Off contact switches, and cam means acting in timed relation to the peripheral movement of said rollers for controlling said support roller raise printing switch and lower nonprinting switch to effect intermittent printing of said subject material and for controlling said offset ink transfer roller On contact switch and Off contact switch to control the number of inkings and the density of ink deposited by the offset ink transfer roller on the subject material with each said intermittent printing.

10. In an offset intaglio roller printing press for printing repeat patterns on subject material passing continuously along a run lying substantially in a horizontal plane between draw-in and draw-out stations through and in synchronized relation to a plurality of printing units adapted for intaglio printing, the combination for each printing unit of a support roller supported from the machine for engagement with the underside of the subject material, and printing rollers including an offset ink transfer roller, and an engraved intaglio roller engaging said offset ink transfer roller mounted in said unit at the upper side of said subject material, said offset ink transfer roller being of a size to turn through a plurality of revolutions for each repeat of the pattern printed on the subject material, driving means for driving the support roller, the offset ink transfer roller and the engraved intaglio roller of each printing unit continuously at the same peripheral rate, means for moving any selected said support roller intermittently from printing position downwardly away from said offset ink transfer roller and away from the subject material to effect intermittent printing of the subject material, and means acting when rendered operative to relatively move the offset ink transfer roller and engraved intaglio roller associated with said selected support roller between an ink transfer contact position and an out-of-contact posi-

tion, and pattern means for controlling each said moving means to control the number of inkings and density of ink on the off-set ink transfer roller deposited upon the subject material at each said intermittent printing.

11. In an offset intaglio roller printing press for printing repeat patterns on subject material passing continuously along a substantially horizontal run between draw-in and draw-out stations past at least one printing unit adapted for intermittent printing, the combination of a support roller mounted on said unit beneath the subject material, an offset ink transfer roller and an engraved intaglio roller engaging said offset ink transfer roller mounted in said unit above said subject material, and driving connections for driving all of said rollers continuously at the same peripheral rate, vertically adjustable bearing supports for the support roller, actuating means for shifting said support bearings and the support roller between a raised printing position and a lowered nonprinting position, adjustable bearing supports for the offset ink transfer roller, and pattern mechanism controlled from the machine, means actuated by the pattern mechanism for shifting said offset ink transfer roller bearing supports and the offset ink transfer roller supported thereby between an engraved intaglio ink transfer contact position and a disengaged position, and control means actuated by said pattern mechanism for effecting said vertical movements of the support roller between said printing and lowered nonprinting positions to effect intermittent printing of said subject material, said control means acting further to effect movement of said offset ink transfer roller from the engaged position only when said support roller has been shifted to the nonprinting position, thereby to control the number of inkings and the density of ink deposited by the offset ink transfer roller on the subject material with each said intermittent printing.

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