July 27, 1965 C. L. HORNBERGER ETAL 3,196,786

ROTARY PRINTING PRESS WITH MOVABLE TRANSFER CYLINDER

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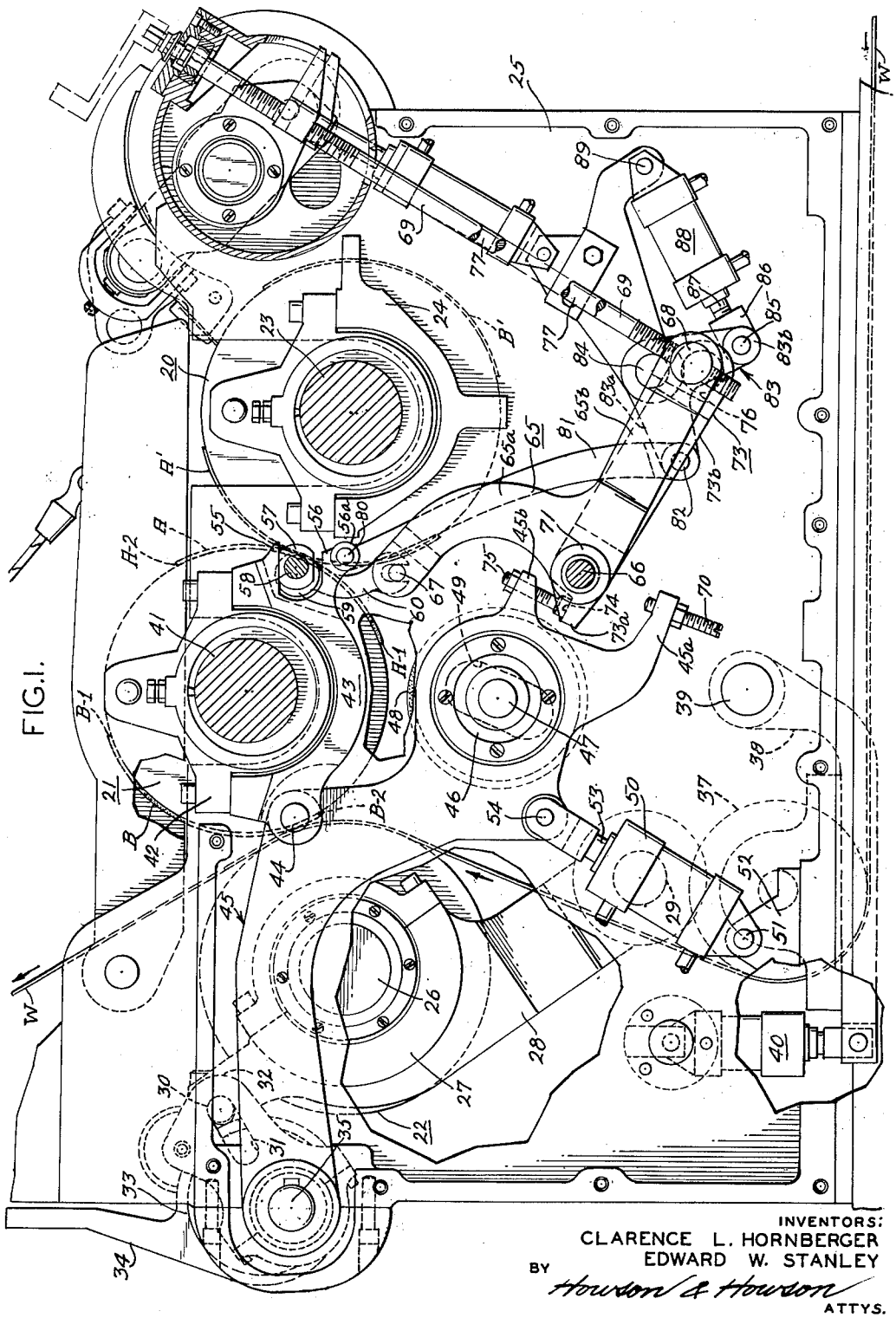


FIG. 1.

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FIG. 2.

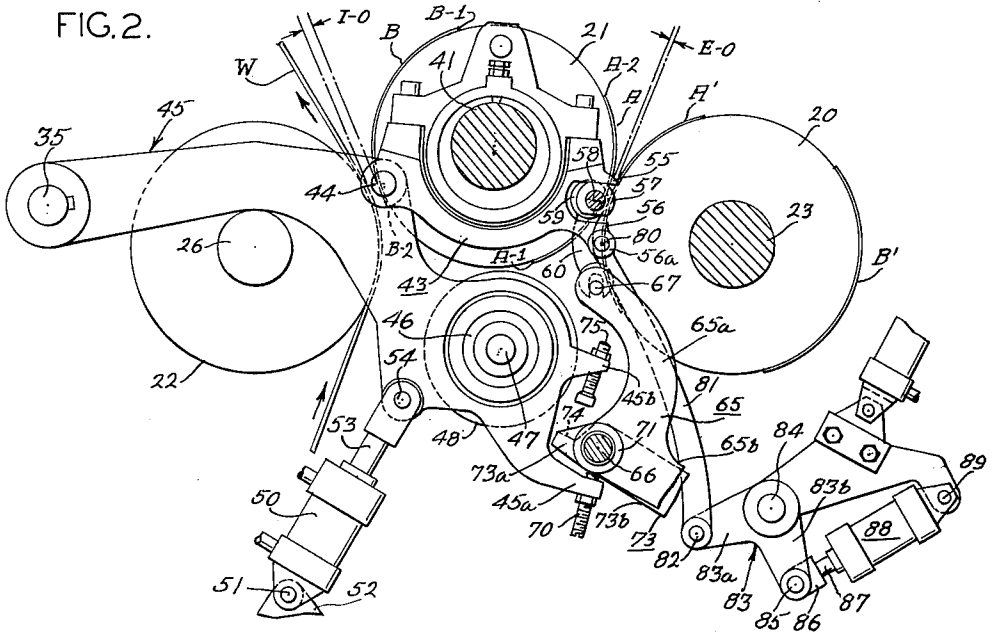
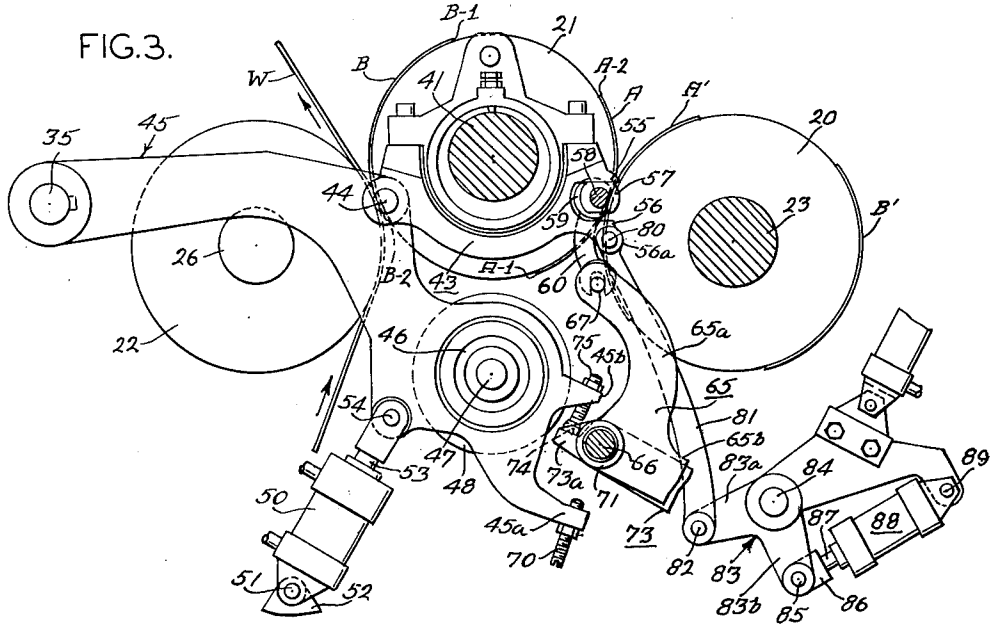


FIG. 3.



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FIG. 4.

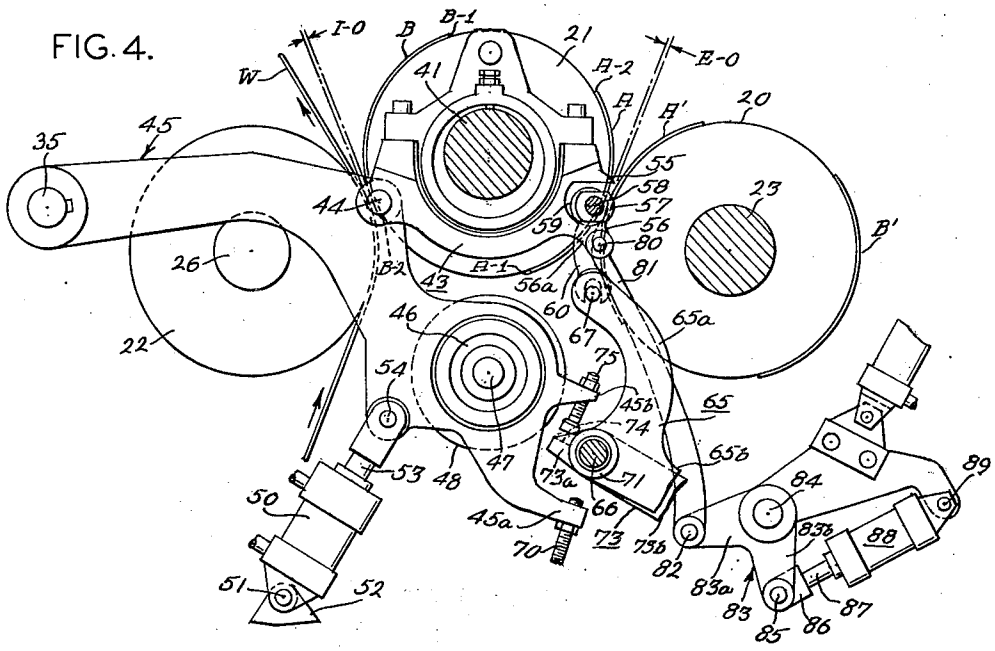
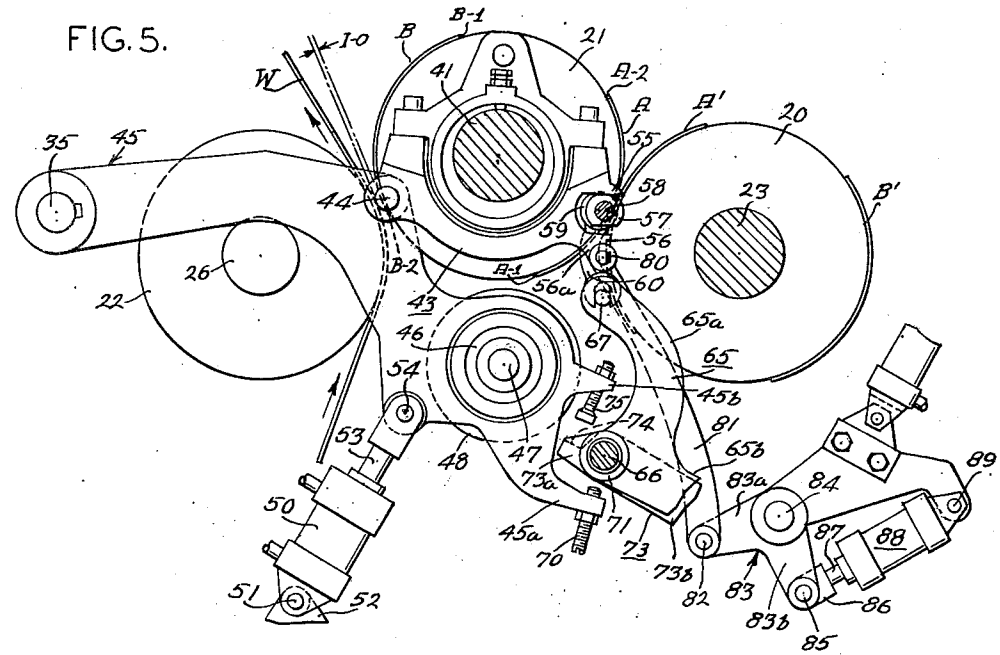


FIG. 5.



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FIG.6.

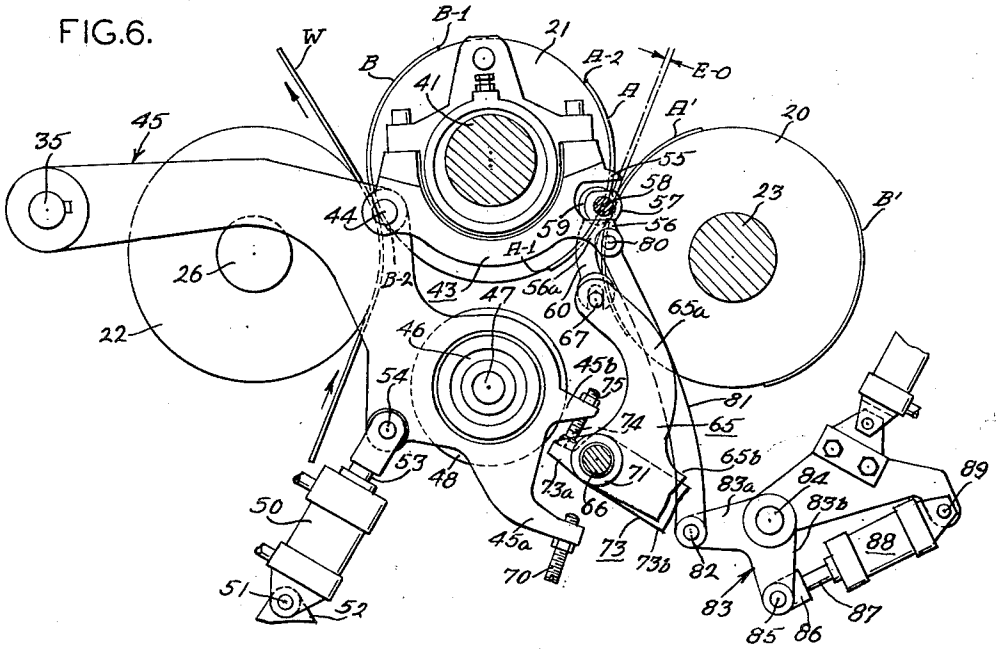
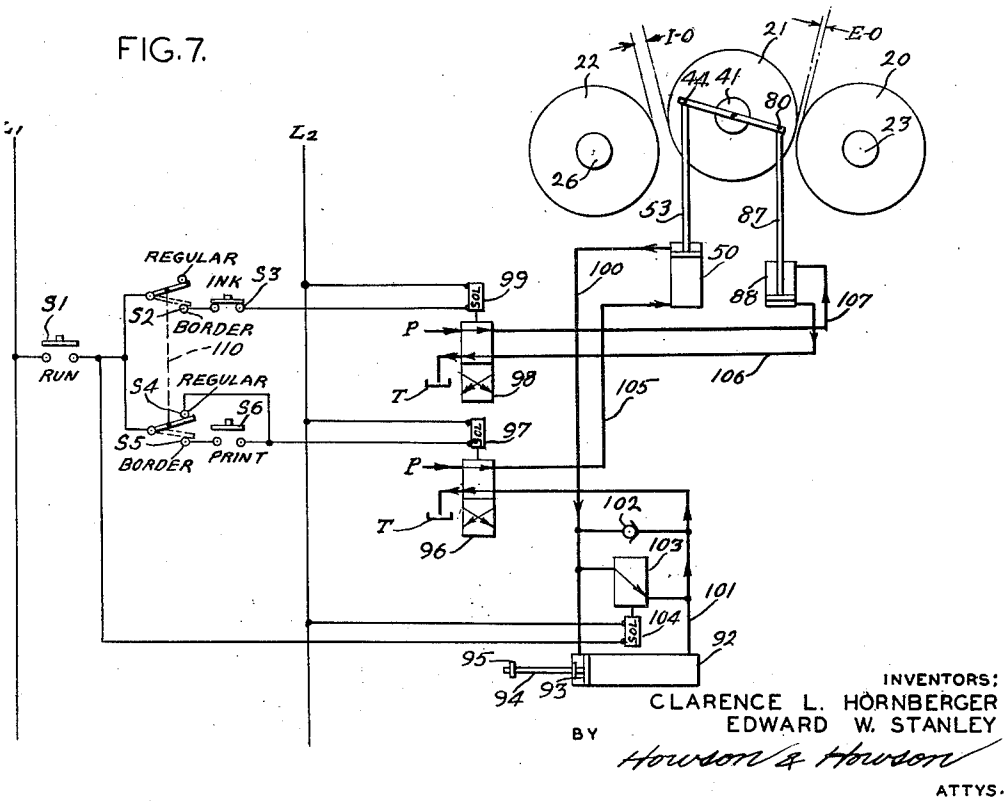


FIG.7.



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ROTARY PRINTING PRESS WITH MOVABLE TRANSFER CYLINDER

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FIG.8.

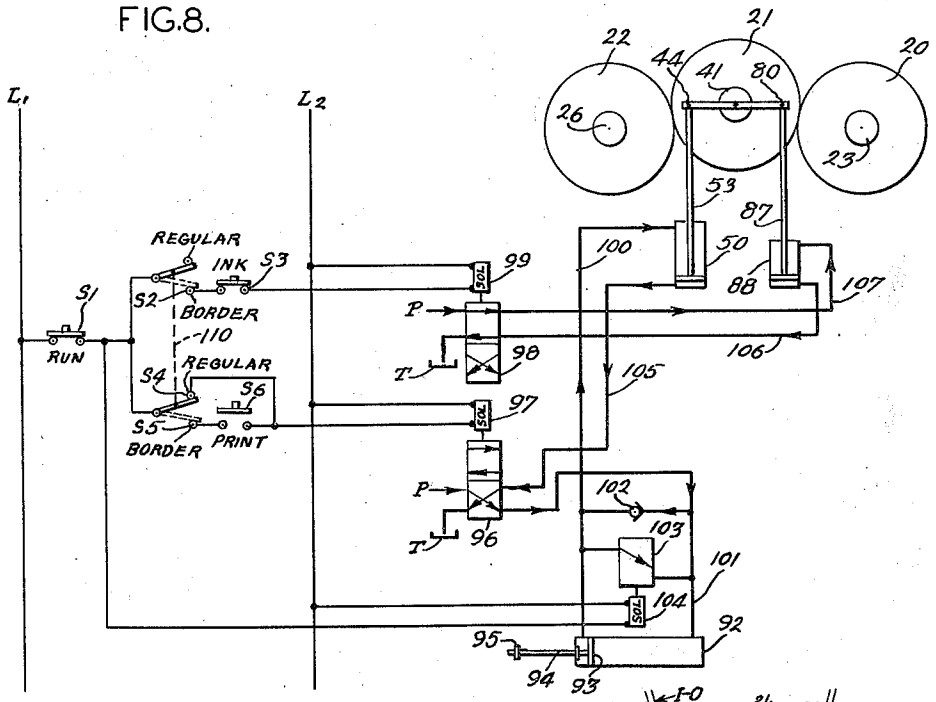
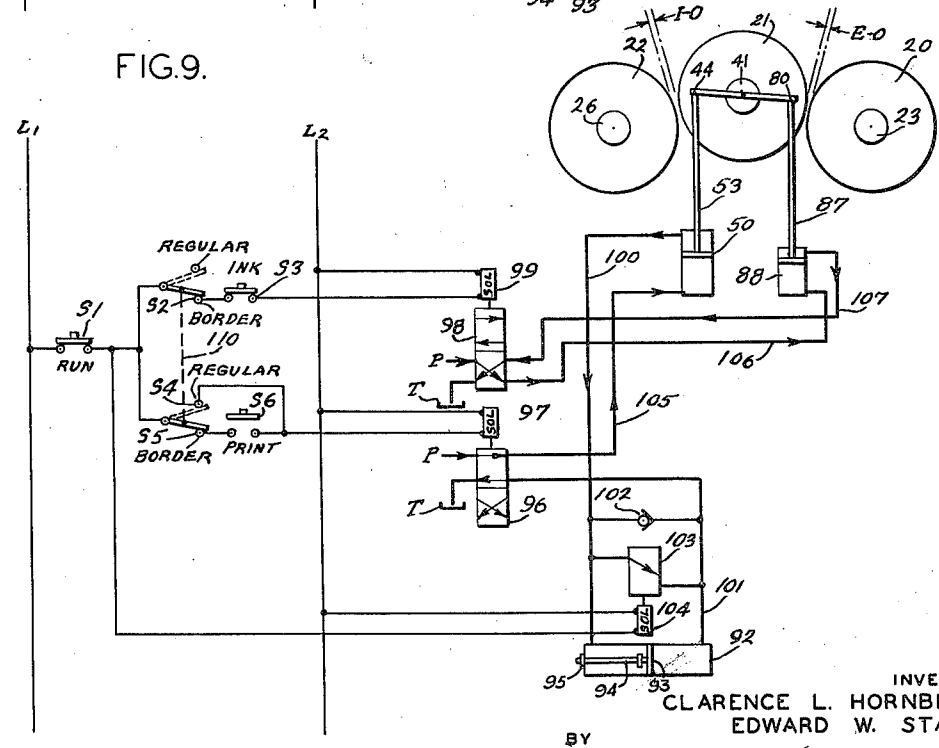


FIG.9.



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FIG. 10.

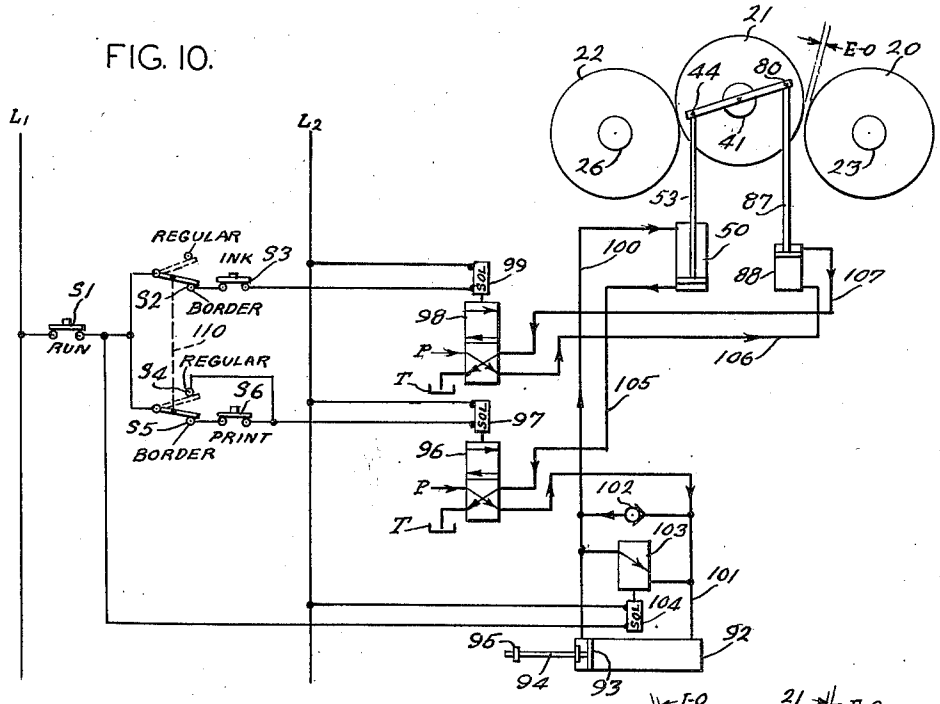
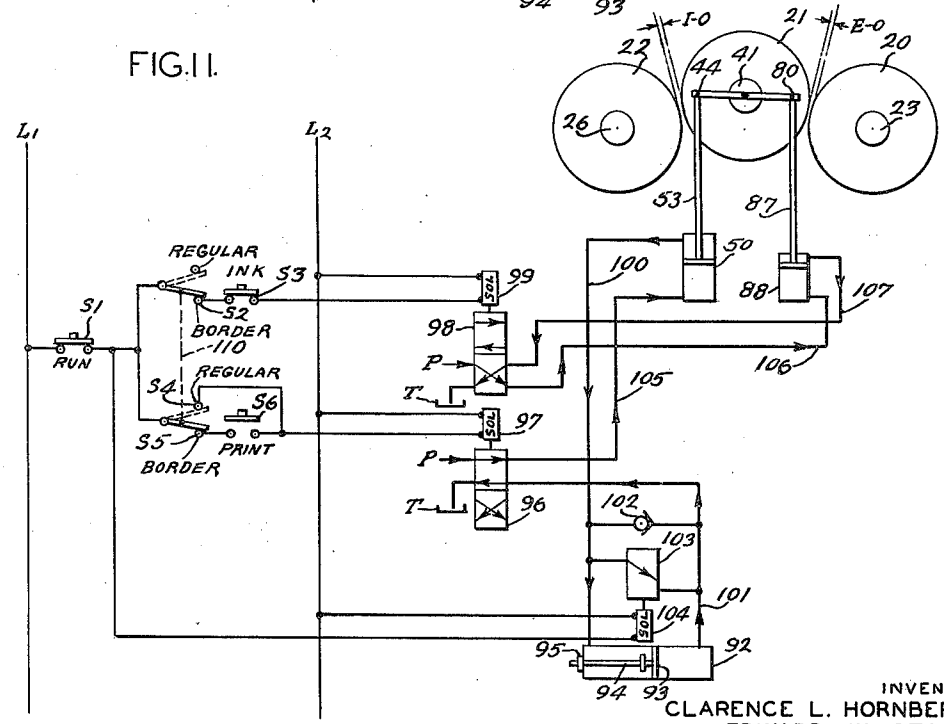


FIG. 11.



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FIG.12.

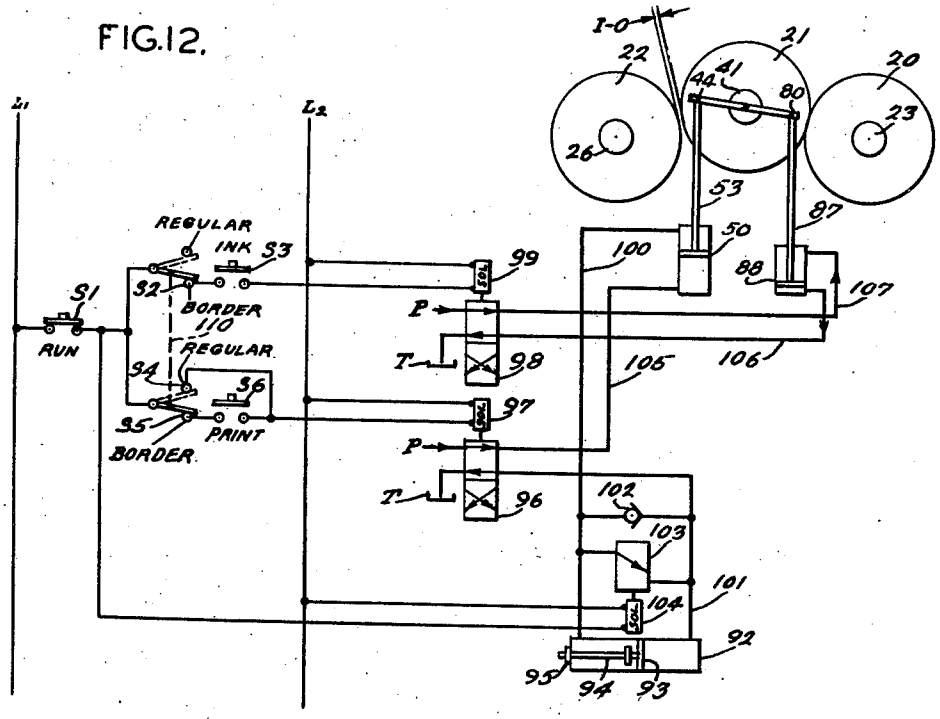
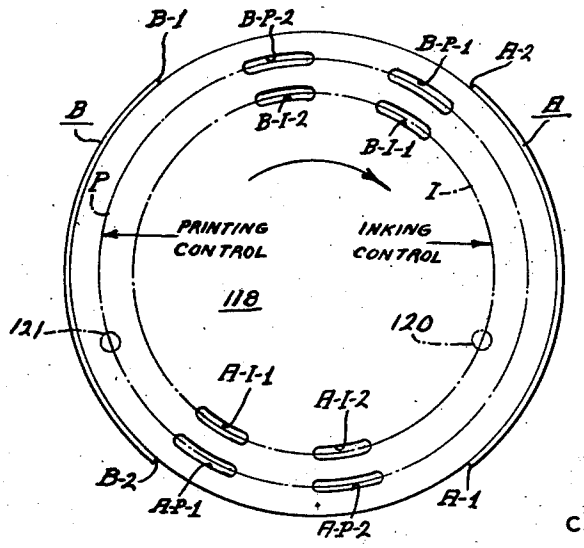


FIG.15.



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FIG. 13.

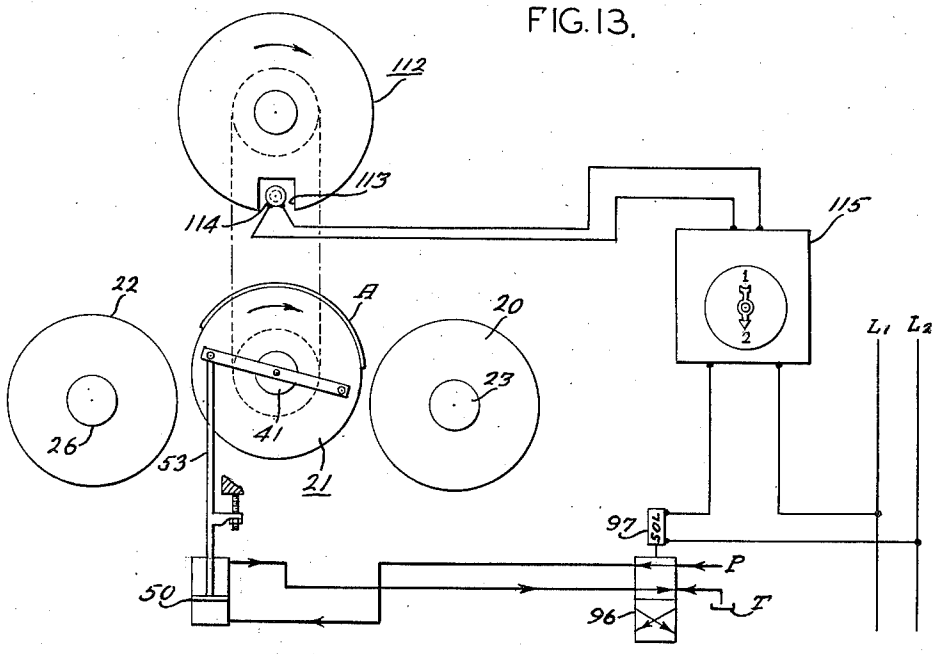
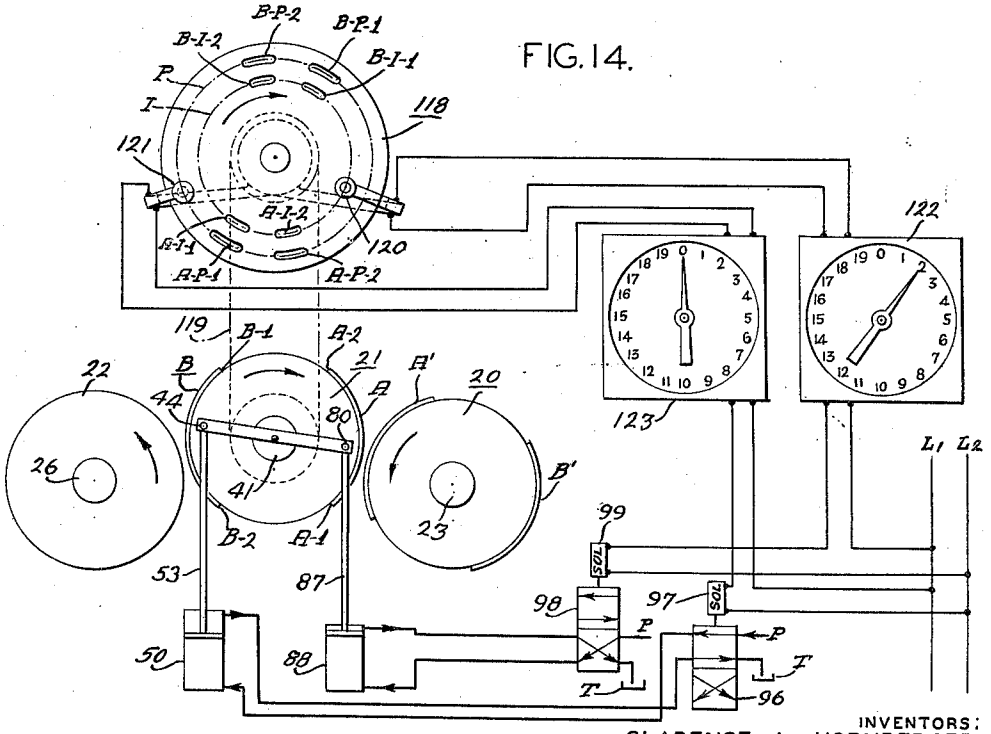


FIG. 14.



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United States Patent Office 3,196,786 Patented July 27, 1965

3,196,786

ROTARY PRINTING PRESS WITH MOVABLE TRANSFER CYLINDER

Clarence L. Hornberger and Edward W. Stanley, Lancaster, Pa., assignors to Armstrong Cork Company, Lancaster, Pa., a corporation of Pennsylvania

Filed Apr. 5, 1963, Ser. No. 270,870
10 Claims. (Cl. 101—154)

This invention relates to a rotary printing press, especially adapted for printing floor coverings, more particularly for printing the cross border portion of a peripheral border design, on felt base rugs, and has for an object the provision of improvements in this art.

In a copending application of the present applicants and others, Serial No. 134,606, filed August 29, 1961, now Patent No. 3,099,956, Aug. 6, 1963 and assigned to a common assignee, there is disclosed a rotary printing press system comprising a plurality of rotary presses for printing multi-color designs on felt base rugs. The present invention is related particularly to the provision of means on one or more of these presses or press stands to adapt it for a special form of skip printing, as for printing cross borders on rugs which have their multi-color field design and end borders printed by other presses or press stands in the system or line.

In printing multi-color designs on a line of press stands it is most important and, indeed indispensable for acceptable production, that the areas printed by successive press stands shall be in precise and exact registry with areas printed by other press stands. The copending application discloses improved means and adjustments for achieving such exact registry, both longitudinally and transversely of the advancing web of material being printed. The present invention is based upon the use of the system and press improvements disclosed in that application.

Each press stand in the system of printing apparatus disclosed in the copending application, which is known as the offset rotogravure system, involves the use of three cooperating rolls or cylinders which are geared to rotate in exact unison with each other. The first roll of this group, considering the order of ink application, is the engraved or plate roll which picks up a coating of ink on the exposed design surface, suitable associated equipment such as a doctor, etc., being employed in known manner to assure the proper application of ink to the engraved roll. The second roll is the offset or ink transfer roll, also referred to as the blanket roll, which takes off the ink coating from the engraved roll and transfers it to the web of material to be printed. The third roll is the impression or backing roll which supports thereon the web which receives the ink coating from the offset roll.

In printing cross borders and in similar skip-printing work it is necessary to periodically articulate, i.e., raise or lower, the offset roll relative to the engraved and printing rolls, either separately or together. The copending application discloses means for separating and re-engaging the offset roll while at all times, through suitable flexible drive means, keeping all of the three rolls rotating exactly in unison so that the circumferential points of separation and re-engagement will always be exact for precise registry.

The shifting of the offset roll is accomplished by mechanical means, which requires an appreciable amount of time to act, and this, in high speed printing, may considerably limit the printing speed. The distance of separation of the rolls, therefore, becomes an important factor in the ultimate printing speed, and this makes it highly desirable to keep the distance of roll separation to a minimum. Furthermore, a larger spatial separation causes greater impact between rolls when they are re-

engaged, with consequent greater damage to roll surfaces and printing quality.

Another consideration is that the flexible shaft drive experiences greater strains and wear as the distance of roll separation and consequent angularity of flexible shaft drive increases.

It is therefore an important object of the present invention to reduce the distance of separation between rolls for printing cross borders.

Another object is to provide means for readily shifting the offset roll selectively relative to either the engraved roll or the impression roll.

Another object is to provide improved means for shifting the offset roll from both the engaved roll and the impression roll at the same time.

Another object is to provide control means for the roll shifting means which provides a greater range of control and makes practical the printing of cross borders at shorter intervals than has been practicable heretofore.

To give a concrete idea of this situation, it may be assumed that the circumference of each of the rolls of a set of three rolls of a rug printing stand is 4½ feet. This means that a pattern will repeat for every 4½ feet along the length of the web to make rugs of a length of 4½ feet or multiples of this length. Assume that a cross border 7½ inches wide is to be printed on each end of a rug 4½ feet long. The rolls can have a design 15 inches wide at one location thereon to print a cross border 15 inches wide which, when the rugs are cut apart, will give a 7½ inch cross border at both ends of each rug. Assume that the printing rolls are 12 feet long and that other printing rolls will print longitudinal borders 7½ inches wide at the ends and a double longitudinal border which is 15 inches wide at the center, there will be produced rugs which are 4½ feet long and 6 feet wide (referring to dimensions on the rolls and web) with a 7½ inch border all around.

To make a 9′ x 12′ rug with a 7½″ border all around, it will obviously be necessary to shift the offset roll so that its single 15″ cross border will make an impression on the web only at every other revolution.

It is sometimes desirable to make rugs which are less than 4½′ long. By providing two cross border imprints on the 4½′ circumference rolls it is possible to print rugs 2¼′ (2′-3″) long and by suitable skip printing to make rugs of multiples of this length, say 4½′, 6¾′, 9′, 11¼′, 13¾′, and so on. No further attention need be given to the cross-web dimensions (width) of the rug units or of the longitudinal border printing since these are controlled by the longitudinal printing roll stands with which the present invention is not concerned.

The above and other objects of the invention, as well as various features of novelty and advantages, will be apparent from the following description of an exemplary embodiment, reference being made to the accompanying drawings, wherein:

FIG. 1 is an end elevation of a roll stand embodying the present invention;

FIG. 2 is an end elevation similar to FIG. 1 but more diagrammatic in nature, showing the position of parts while the rolls are idling;

FIG. 3 is a view like FIG. 2 but with the parts in position for normal printing, as for piece goods, where the full circumference of the rolls is used;

FIG. 4 is a view like FIG. 2 but with the parts in a first stage of skip cross border printing;

FIG. 5 is a view like FIG. 4 but showing the offset roll in contact with the engraved roll for inking;

FIG. 6 is a view like FIG. 4 but showing the offset roll in contact with the web on the impression roll for printing;

FIG. 7 is a schematic piping and wiring diagram showing parts in the stage of a regular printing cycle corresponding to FIG. 2;

FIG. 8 is a view like FIG. 7 but showing the parts in a position corresponding to that of FIG. 3 for regular printing;

FIG. 9 is a view like FIG. 7 but showing the parts in a preparatory stage for border skip printing;

FIG. 10 is a view like FIG. 7 but showing the parts in a second preparatory stage for border skip printing;

FIG. 11 is a view like FIG. 7 but showing the parts in a third preparatory stage for border skip printing, the position corresponding to that of FIG. 4;

FIG. 12 is a view like FIG. 7 but showing the parts in the first active or inking stage for border skip printing, the position corresponding to that of FIG. 5;

FIG. 13 is a schematic diagram showing an arrangement for printing cross borders where one cross border is formed for a complete revolution of the rolls;

FIG. 14 is a schematic diagram showing an arrangement for printing cross borders where two cross borders can be formed at a complete revolution of the rolls;

FIG. 15 is a diagram of a timing signal plate.

The roll stand, as shown in FIG. 1, comprises an engraved roll **20**, an offset roll **21** and a web-supporting impression roll **22**. The engraved roll and the impression roll are mounted in a fixed position, although all rolls can readily be freed for lifting out by a crane; and the offset roll is articulated or mounted for movement toward and from the engraved and impression rolls.

The engraved roll **20** is provided with journals or trunnions **23** at its ends, one being shown, supported in bearings **24** of the main roll stand frame **25**. Suitable means, not shown, are provided for coating the engraved surface with ink and removing the excess, as explained in the copending application referred to.

The impression roll **22** has journals or trunnions **26** mounted in bearings **27**. The bearing **27** at each end, for reasons fully explained in the copending application, is mounted on an arm **28** pivoted at its lower end on the main frame at a journal **29** and adjusted at the upper end, as by a pin **30** movable in a slot **31** of a member **32**, the pin being moved by the cam surface **33** of a cam arm **34** turnably mounted on a fixed pivot shaft **35**.

The web W which is to be imprinted passes up over the impression roll **22**, being fed up from below over a tension adjusting roll **37** mounted on an arm **38** pivoted at **39** and adjusted by a fluid power device **40**.

At each end the offset roll **21** has a journal or trunnion **41** supported in a bearing **42** and a bearing is supported on a cradle **43** for various controlled movements with which the present invention is especially concerned.

At one end, the left in FIG. 1, the cradle **43** is mounted on a pivot shaft **44** carried by an arm **45** which is turnably mounted on the same pivot shaft **35** as the cam arm **34**. The axis of the pivot shaft **44** is thereby made to be translatable from one position to another.

The arm **45** also carries a bearing **46** for the journal **47** of a blotter roll **48**, a slot **49** being provided in the main frame to accommodate the journal movements.

Controllable power motor means are provided for moving the arm **45** for turning movement about the axis of the shaft **35**, the means here provided being a fluid motor **50** comprising a cylinder, designated by the same number, pivoted on a hinge pin **51** carried by a fixed mount **52** and having a piston rod **53** connected to the arm **45** by a pivot pin **54**.

From a consideration of the parts thus far described, it may be seen that when the power device **50** acts on the arm **45** it will turn it about its hinge point, i.e., the axis of the shaft **35**, and this movement will cause the pivot shaft **44** at one end of the cradle **43** to describe an arc about the axis of shaft **35**. This movement of the cradle will separate the offset roll **21** from the impression roll **22** and tend to pull the offset roll away from the engraved roll **20** but a small movement of pivot shaft **44** does not separate the offset roll from the engraved roll.

The other end of the cradle **43** is bifurcated or slotted so as to have an upper finger **55** and a lower finger **56** embracing the upper and lower flat sides of a guide sleeve, bushing, or shoe **57** which is turnably mounted on an eccentric pin **58** of an eccentric shaft **59** mounted in the main frame.

The sleeve or shoe **57** may be moved up or down by moving the eccentric pin **58** up or down and this may be done by turning the eccentric shaft **59** in its bearings. For this purpose the shaft **59** is provided with an arm **60** adapted to be turned by suitable adjusting means.

The means for turning the eccentric shaft arm **60** to set for different adjusted pressure positions of the offset roll **21** against the engraved roll **20** comprises a bellcrank lever **65** turnably mounted on a stub shaft **66** secured on the main frame. One arm **65***a* of the bellcrank lever **65** is provided with a pin-and-slot connection, designated as **67**, with the end of the eccentric arm **60** and the other arm **65***b* is provided with a pivot connection **68** for an adjusting rod **69** which is moved and set in different positions by means which are fully described in the copending application.

Means are provided for limiting the upward movement of the arm **45** carrying the cradle pivot **44**, the means here shown comprising an adjustable stop element in the form of a lockable set screw **70**, carried by an extension **45***a* of the arm **45**, which engages some convenient fixed stop abutment, such for example, as a sleeve **71** mounted on the stub shaft **66**.

Adjustable means are provided for limiting the downward movement of the arm **45**, the means are shown comprising a lever **73** mounted on the stub shaft **66**, the lever having an arm **73***a* carrying a stop abutment surface **74** adapted to be engaged by a lockable set screw **75** carried by a projection **45***b* of the arm **45**. The other arm **73***b* of the lever **73** is provided with a pivot connection **76** for an adjusting rod **77** which is adjusted by suitable means, as fully described in the copending application.

The organization as thus far described is that of the copending application. Initially, in the interest of shorter and faster movement of the offset roll to accommodate for higher press roll speeds, the adjustment screw **70** is made longer to limit the outward movement of the offset roll. In the original arrangement the movement was such as to provide a separation of about $\frac{3}{8}$" at the nip I–O between the impression and offset rolls and a separation of about $\frac{1}{16}$" at the nip E–O between the engraved and offset rolls. This condition is shown in FIG. 2. By adjustment of the screw **70** the opening in the impression offset nip I–O can be cut down to about $\frac{3}{16}$" while still providing separation at the engraved-offset nip E–O of about $\frac{1}{32}$", which is about the minimum safe operating space at the nip E–O. This is achieved solely by movement of the cradle pivot **44** by turning the arm **45** by the power motor **50**.

This reduced movement of articulation contributes to smoother operation, less impact against stops, less wear in the roll shaft coupling and less time for action. The total time for articulating the offset cylinder is fixed as a function of response of the various components and does not vary with press speeds. Hence for increased press speeds and shorter spacings between cross borders which are desired, the present invention makes a number of modification to the existing equipment, as will now be described.

While these improvements are provided for the desired special purposes, they are designed to be fully compatible with the existing equipment and of such a nature that there may be a quick selective reversion to the original type of operation.

As a first departure, it is arranged that the offset roll **21** may be separately and independently articulated relative to the engraved roll **20**. This is done by providing sepa-

rate controllable power motor means for moving the other (right hand) end of the cradle **43** up and down.

To permit of this independent movement of the right hand end of the cradle 43, a clearance space is provided between the lower finger **56** of the cradle and the bottom surface of the guide sleeve or shoe **57**. For a concrete example, this bottom clearance or lost motion space may be about ¼".

The lower finger **56** is provided with a projection **56***a* and to this projection there is secured, as by a pivot pin **80**, an operating link **81**, the link at its lower end being connected, as by a pivot pin **82**, to an arm **83***a* of a bellcrank lever **83** turnably mounted on a fixed pivot pin **84** carried by the main frame.

The other arm **83***b* of the bellcrank lever **83** is connected by a pivot pin **85** to a clevis member **86** adjustably secured, as by screw threads, to the end of a piston rod **87** of an auxiliary fluid power motor **88**. The cylinder of the motor **88**, designated by the same number **88**, is turnably secured to the main frame by a pivot pin **89**.

It is arranged, by the adjustable clevis member **86**, that the upper finger **55** always comes to rest on the top surface of the shoe **57**; that is, the piston in the cylinder **88** never bottoms on the instroke (toward the head end) but always bottoms on the outstroke (toward the rod end), the point of stoppage and the extent of lift of he right end of the cradle **43** being established by the adjustment of the clevis **86**.

The relationships are such that by action of the auxiliary fluid motor **88** alone, and without any action by the main or primary motor **50**, the offset roll **21** may be moved or articulated relative to the engraved roll **21** to open the space E–O between the rolls by about 1/32". Movement of the cradle **43** about the pivot point **44** does not change the contact relationship between the offset and impression rolls at the nip I–O because the pivot point **44** is located very near the nip. For a similar reason, very limited turning of the cradle **43** about the pivot point of the axis of the eccentric pin **58** does not change the relationship between the engraded and offset rolls at the nip E–O because the axis of pin **58** is located very near the nip between these rolls. It is only the swinging movement of the point **44** about the remote axis **35** that, in continued movement, causes the finger **55** to slide back on the shoe **57** and the offset roll to pull away from the engraved roll.

FIG. 7 shows additional auxiliary equipment which has been provided by the present invention. Here, as in other views, only one end of the rolls is shown but it will be understood that the other end of the offset roll is moved by duplicate means provided there so as to exactly match the movements at the end which is shown.

There is an auxiliary cylinder **92** having a piston **93** therein with a rod **94** of appreciable size to make a significant difference in effective area between the head end and the rod end. An adjustable stop collar **95** is provided on the rod **94** to limit its inward movement and thereby to limit the length and capacity of the cylinder space on the rod end side of the piston.

In effect the cylinder **92** acts to shorten the stroke of the piston of the main power motor **50** much like the action obtainable by adjusting the screw **70** but secures the change in action automatically without requiring stoppage of operations as would be required to re-set the screw **70**.

A flow reversing control valve **96**, operated by a solenoid **97**, is provided for the main power cylinder **50**; and a flow reversing control valve **98**, operated by a solenoid **99**, is provided for the auxiliary power cylinder **88**.

The rod-end space of the auxiliary cylinder **92** is interposed in the rod-end fluid line **100** of the main power cylinder **50**, a fluid line **101** being provided between the head end of the cylinder **92** and the reversing valve **96**. Between the fluid lines **100** and **101** there are provided a spring-loaded check valve **102** opening toward line **100** and a cut-off valve **103** operated by a solenoid **104**.

A fluid line **105** connects the head end of the main power cylinder **50** with the reversing valve **96**. Fluid lines **106** and **107** connect the head end and rod end, respectively, of the auxiliary power cylinder **88** with the reversing valve **98**.

A press run switch **S1** is provided to control the entire sub-circuit here shown, this switch directly controlling the solenoid **104** of the valve **103** so as to move it from its normally open position and close it. A switch **S2**, which is normally open for regular printing, may be closed by a selective gang operator **110** when border printing is desired.

The switch **S2** is in series with the switch **S1** and an inking control counter switch **S3** in a line to the solenoid **99** of the reversing valve **98** which controls the auxiliary fluid motor **88**. The switch **S3** is controlled by a counter which is tied in with the rotation of the offset roll **21** and controls the engagement of the offset roll with the engraved roll for transferring an engraved ink impression from the engraved roll to the offset roll. The operation of the counter and this switch will be described presently.

The gang control selector operator **110** also moves a common contact plate for a "regular" switch **S4** and a border-print switch **S5** in a line from the switch **S1** to the solenoid **97** of the reversing valve **96** for the main power motor **50**. A switch **S6** is in series with the switch **S5** and is operated by a counter which controls printing, that is, the engagement of the offset roll **21** with the web on the impression roll **22**. This counter will also be described presently.

FIG. 13 shows the offset roll **21** to be provided with a single inking segment pad A and to have associated with it a signal producing disk **112** provided with a single signal notch **113** for a signal input-output device **114** of a signal producing counter **115**. If a cross border is printed every other revolution of the 4½' rolls, a bordered 9' rug will be produced.

FIG. 14 shows an arrangement in which the offset roll **21** is provided with two segment pads A and B and the engraved roll **20** is provided with matching engraved portions A' and B'. The shaft of the offset roll **21** drives a timing disk **118**, either directly or through a chain **119** and suitable sprockets. For the front and rear ends of the pads A and B, the disk **118** is provided with an inner circular set of "Ink" signal openings A–I–1, A–I–2, B–I–1, B–I–2 for controlling inking by a signal input-output device **120** and also is provided with an outer circular set of signal "Print" openings A–P–1, A–P–2, B–P–1, B–P–2 for controlling printing by a signal input-output device **121**. The device **120** is connected with an inking timing counter **122** and the device **121** is connected with a printing timing counter **123**.

OPERATION

(A) *Regular printing*

Referring to FIG. 7 switch **S1** is closed when the roll stand becomes active for printing. The gang operator **110** is in the "Regular" position.

As soon as switch **S1** closes, the solenoid **104** of valve **103** is energized and the valve **103** is closed. It remains closed as long as switch **S1** remains closed. Valve **103** is shown in open position in FIG. 7; in FIGS. 8–12 it is shown in closed position.

The solenoid **99** for the valve **98** of the auxiliary motor cylinder **88** is de-energized (because of the gap at **S2**) and fluid pressure is imposed on the rod end of the cylinder **88** to keep the right hand end of the offset roll cradle **43** in its lower position.

Switch **S4** is in closed position to energize the solenoid **97** of valve **96** for the main motor cylinder **50**. Pressure fluid flows to the rod end of the main power cylinder

50, as shown in FIG. 8, and lowers the piston and, with it the offset roll 21, into contact with the other rolls, fluid flowing from the head end of the cylinder directly to tank T.

The cylinder device 92 has no effect for the following reason: pressure fluid flows from the valve 96 to the line 101 and flows through the check valve 102 and line 100 to the cylinder 50. Assume that the check valve opens at a pressure of 65 p.s.i. This means that fluid pressure from valve 96 is exerted on both sides of the piston in the cylinder 92; but the pressure on the head end is greater than on the rod end by the amount of 65 p.s.i., valve 103 being closed; and there is no action by the cylinder device 92.

The ink switch S3 and the print switch S6 of the counter may operate but they are not in circuit and will have no effect.

At the end of the run, switch S1 opens and the parts revert to the FIG. 7 idling position with the offset cylinder held clear above the engraved and impression cylinders.

It is thus seen that the auxiliary equipment which has been added has no effect on regular printing operations, the power device 50 operating in the usual manner.

(B) *Border skip printing*

Gang switch operator 110 is moved to close switches S2 and S5.

Solenoid 99 of valve 98 will be energized when "Ink" switch S3 is closed—and it is shown in closed position (FIG. 9).

Solenoid 97 of valve 96 will be de-energized because "Print" switch S6 is open at this time (FIG. 9).

STAGE 1, FIG. 9

Valve 103 is closed and will remain closed as long as switch S1 is closed, so this valve may be assumed to remain closed and may be disregarded in all further discussion of skip printing operations.

Valve 98, being shifted by its solenoid 99 which is now energized through S2 and S3, will supply pressure fluid to the head end of cylinder 88 to cause the right end of cradle 43 to be raised.

There has been no action of the controls for cylinder 50 so its piston will be raised as high as the movement of piston 93 in cylinder 92 will permit by moving away from the rod end.

The offset roll cradle is held up by both cylinders 50 and 88.

STAGE 2, FIG. 10

"Print" switch S6 closes; "ink" switch S3 still closed.

The controls for cylinder 88 have not been affected so cylinder 88 will hold the right end of the cradle 43 in raised position.

Closing of "print" switch S6, selector switch S5 being held closed, will energize the solenoid 97 of valve 96 to supply pressure fluid to the rod end of cylinder 50 and lower the left end of the cradle.

This will bring the offset roll against the impression roll but there will be no imprint because the offset roll has not been inked.

The cylinder device 92 will have no effect for the same reason as was pointed out above in connection with regular printing (A) where the closure of switch S4 produced the same condition relative to the main power device 50 as does the closure of S5 and S6, now being considered.

STAGE 3, FIG. 11

"Print" switch S6 opens; "ink" switch S3 remains closed.

The controls for cylinder 88 have not been affected, hence it will continue to hold the right end of the rocker in raised position.

The opening of S6 de-energizes solenoid 97 and valve 96 returns to normal position.

Pressure fluid from valve 96 flows to the head end of cylinder 50 and raises its piston and the left end of the rocker.

However, fluid flowing from the rod end of cylinder 50 is trapped, insofar as flow to the tank side of valve 96 is concerned, check valve 102 being shut against the return side and valve 103 being closed; so return fluid flows into the rod end of cylinder 92 to move the piston over until the stop 95 halts its movement. Fluid is free to flow out from the head end of cylinder 92 to the valve 96 and tank.

This limits the upward movement of the piston in the cylinder 50 to a position where the left end of the cradle is raised only just enough to clear the offset roll from the impression roll.

The offset roll is now held clear of both the engraved roll and the impression roll.

STAGE 4, FIG. 12

"Ink" switch S3 opens. "Print" switch S6 remains open.

The result of this is that the right hand end of the cradle is lowered to engage one of the pad segments of the offset roll with an ink-coated engraved segment of the engraved roll to pick up an ink impression on the segment of the offset roll.

It is here to be noted that there are low spaces or gaps in the rubber covering of the offset roll; that the raised segment on the engraved roll will be circumferentially longer than the raised pad segment on the offset roll; and that the timing is so arranged that the engraved segment arrives and leaves the nip at a low space between offset roll segment pads. This avoids scuffing the raised pad segments on the offset roll by the action of engaging the engraved roll segments. Of course, the ink-coated engraved area of the engraved roll will fall fully on the raised pad segment of the offset roll.

STAGE 6, FIG. 11, FIG. 10

The next action, an intermediate stage corresponding to FIG. 11, is that the "ink" switch S3 closes and the cylinder 88 acts to raise the right-hand end of the cradle; but since the left-hand end is being held up by cylinder 50 there is no action. The offset roll is clear of both other rolls as shown in FIG. 11.

After this, the next action is the closure of "print" switch S6. This brings the parts to the condition shown in FIG. 10.

The cylinder 50 allows the left end of the cradle to be lowered and the offset roll is brought against the web on the impression roll to make a printing impression on the web.

The action which occurred is as follows: when solenoid 97 was energized and valve 96 reversed, fluid from the head end of cylinder 50 could flow directly to tank. Pressure fluid from the valve 96 was admitted to line 101 and acted on the head end of cylinder 92 to force the piston back to the rod end and force fluid therefrom back into the rod end of cylinder 50 to force the piston down. Since check valve 102 is spring loaded toward closed position, the pressure on the head end of piston 93 is greater than on the rod end and it is forced to return to the rod end. Moreover, the pressure exerted on the head end of piston 93 acts through it to increase the pressure on the rod end and hence on the valve 102 to keep it closed. Besides, the weight of the offset roll tends to force the piston in cylinder 50 downward to admit fluid to the rod end. If needed, more fluid could flow through the check valve 102 from the line 101.

Continued border printing

Thereafter, as the "ink" and "print" counters alternately close and open at the predetermined count for which the counters 122 and 123 are set, the positions of FIGS. 10, 11 and 12 will be repeated in the order FIG. 12 (ink),

FIG. 11 (clear), FIG. 10 (print), FIG. 11 (clear), FIG. 12 (ink), and so on.

The printing action always follows promptly after the inking action even when there is a long count or skip for long rugs between printing actions.

It is contemplated that the counters **122** and **123** will be of a type known on the market as Veeder-Root counters, or the equivalent, which operate the switch at the high count for which the counter is selectively set and then drop back to zero and shift the switch at the count of one (1) on the next up-count. The counters shown indicate a capacity of a maximum count of twenty (20) and since there is a count of four (4) for each revolution of the offset roll (A–1—start of segment A; A–2—end of segment A; B–1—start of segment B; and B–2—end of segment B) the counters will accommodate for a skip length of five (5) revolutions or a web length of twenty-two and one-half (22½) feet.

It may be well to note here that the "ink" counter is always initially set up two units in advance of the "print" counter to be sure that a pad always passes the inking nip before it reaches the printing nip.

The signal input-output devices may be of various known types, such as sonic-electric, photo-electric, and the like. The "ink" switch S3 will be actuated by the "ink" counter **122** and the "print" switch S6 will be actuated by the "print" counter **123**.

FIG. 15 is a disk face diagram to illustrate the positions of the holes or slots in the disks relative to the segment pads on the offset roll and the nominal positions of the beams (of light, sound, etc.) through the holes for a representative speed of the rolls and a minimum travel of the ends of the cradle. Necessarily, the pressure of the fluid used in the cylinders **50** and **88** will affect the speed of action. By making the travel distance very short the pressure and impact can be minimized while still realizing very fast action by the shortened travel distance.

OPERATION OF THE ARRANGEMENTS OF FIGS. 13 AND 14

The above description of operation applies, as indicated, to an arrangement in which the skip printing means can be interposed and removed by the operation of control switches (S2, S4, S5) to shift from regular printing to skip printing.

The arrangements of FIGS. 13 and 14 provide for the permanent inclusion of the skip printing arrangements, thus simplifying the controls and allowing simple articulating power devices to be used.

The action of the arrangement of FIG. 13 has already been almost fully explained. The signal disk **112**, having only one signal producing gap, gives one signal for each revolution. One signal for one revolution moves the pointer of counter **115** to position "2" to move the piston of the single power device **50** up and thereby move the transfer roll **21** toward inking position with the engraved roll **20**; and the other signal for another revolution moves the pointer of the counter **115** to position "1" to move the power piston down and thereby move the transfer roll **21** toward printing position with the impression roll **22**. As stated, this arrangement is limited to printing rugs 9 feet long. Obviously, if the disk **112** had two notches for operating two signal devices, using the same counter, there would be inking and printing at each revolution to print rugs 4½ feet long.

The action of the arrangement of FIG. 14 is more versatile than that of FIG. **13** in that two power devices, **50** and **88**, are provided for the two ends of the cradle for the transfer roll **21**; that a counter **122** or **123** is provided for each power device; that the signal disk **118** is provided with means to furnish separate signals to each counter; and that the disk provides a separate signal for the beginning and end of each printing segment A, B. Also there are two printing segments, hence four signals to each counter for each revolution. If the counters are set at "2" there will be inking and printing by both segments for each revolution, making 2¼ foot rugs; if the counters are set at "4" there will be inking and printing by one segment for each revolution, making 4½ foot rugs; if the counters are set at "6" there will be inking and printing by a segment for each 1½ revolutions, making 6¾ foot rugs; if the counters are set at "8" there will be inking and printing by a segment for each 2 revolutions, making 9 foot rugs; and so on.

It is thus seen that the invention provides improved means and method for printing cross borders on webs in a large range of selective lengths and for controlling the articulation stroke to obtain shorter and faster movement with less impact and damage whereby shorter length at greater roll speeds can be printed with great accuracy of registration; also that the controls provide immediate restoration to normal printing where the rolls are articulated through a greater range of printing and idling conditions.

While one embodiment of the invention has been disclosed for purposes of illustration it is to be understood that there may be various embodiments and modifications within the general scope of the invention.

We claim:

1. Roll skip printing apparatus, as for printing rug cross borders on a travelling web, by rolls which turn together at all times, comprising in combination: a roll stand having a set of cooperating rolls, including an engraved roll, an impression roll with the web to be imprinted passing thereover, and an offset roll mounted to be articulated from and toward said engraved and impression rolls while turning in continued coordination therewith; and articulating means for moving said offset roll from and toward said engraved and impression rolls; said articulating means including, for each end of the offset roll, a cradle pivoted at two points adjacent the nips between the offset roll and the engraved roll and impression roll respectively and supporting the offset roll between said two pivot points; separate independently controllable power motor means for selectively moving either end of the cradle about the pivot at the other end to separate the offset roll at either nip selectively; and control means for said power motor means operated coordinately with the turning of said rolls for either placing the offset roll in engagement with both the engraved and impression rolls, or separating it from both rolls, or selectively separating it from either roll.

2. Apparatus as set forth in claim **1**, further characterized in that the cradle at the end adjacent the engraved roll is mounted on its pivot at that end for lateral sliding movement relative to the engraved roll, the cradle also having vertical movement relative to its pivot at that end, said power motor means at the engraved roll end being connected directly to the end of the cradle to move it up and down relative to its pivot support but the cradle end resting on its pivot support when in its lower position, the power motor means at the impression roll end pivot of the cradle having a stroke of sufficient length to separate the offset roll from the impression roll and also by lateral sliding movement of the cradle on its other pivot to pull the offset roll clear of said engraved roll.

3. Apparatus as set forth in claim **1**, further characterized in that the cradle at the end adjacent the engraved roll is mounted on its pivot at that end for lateral sliding movement relative to the engraved roll, the cradle also having vertical movement relative to its pivot at that end, said power motor means at the engraved roll end being connected directly to the end of the cradle to move it up and down relative to its pivot support but the cradle end resting on its pivot support when in its lower position.

4. Apparatus as set forth in claim **3**, which further includes means for adjusting the pivot of the cradle at the end adjacent the engraved roll to vary the engagement pressure of the offset roll with the engraved roll,

leaving the power motor means at all times in control of the greater movement required to separate the offset roll from the engraved roll.

5. Apparatus as set forth in claim 1, further characterized in that the power motor means are fluid operated cylinder-piston motors; an auxiliary fluid cylinder, having a movable piston, connected with one end of the cylinder of the power motor which is connected to the impression roll end of the cradle; and valve means and controls therefor timed with the operation of the rolls for selectively confining fluid in said auxiliary cylinder to shorten the power motor stroke during skip printing or to by-pass said auxiliary cylinder to provide full stroke of said power motor at other times.

6. Apparatus as set forth in claim 5, which includes valve means and selectively settable rotation unit counting control means therefor for causing operation of the cylinder-piston power motor means connected with said auxiliary cylinder for a selective predetermined number of unit turning movements of said rolls.

7. Roll skip printing apparatus, as for printing rug cross borders on a travelling web by rolls which turn together at all times, comprising in combination: a roll stand having a set of cooperating rolls, including an engraved roll, an impression roll with the web to be imprinted passing thereover, and an offset roll mounted to be articulated from and toward said engraved and impression rolls while turning in continued coordination therewith; and articulating means for moving said offset roll from and toward said engraved and impression rolls; said articulating means including, for each end of the offset roll, a cradle pivoted at two points adjacent the nips between the offset roll and the engraved roll impression roll respectively; said cradle having a sliding support on its pivot adjacent the engraved roll, controllable power motor means for moving said cradle at the impression roll end in a direction and by an amount to separate the rolls at both nips; and control means selectively operative on said power motor means for limiting its movement to an amount which will separate the rolls only at the nip adjacent the impression roll end of the cradle which is connected to said moving means.

8. Roll skip printing apparatus, as for printing rug cross borders on a travelling web at selectable multiples of a given minimum unit length which corresponds to one arcuate engraved plate segment unit on an engraved plate roll, by rolls which turn together at all times, comprising in combination, a printing roll set including an engraved roll with at least one engraved plate segment unit thereon, an impression roll, and an offset roll supported on a cradle between said engraved roll and said impression roll, separate independently controllable power motor means connected to the opposite ends of said cradle respectively, for articulating the offset roll selectively and alternately with said engraved roll to take an inked printing impression and with said impression roll to print the inked impression on a passing web, or to engage the offset roll selectively with both other rolls or to separate it from both other rolls, signal means geared with said rolls which gives a signal with the passage of each engraved plate segment unit, settable self-zeroing counter means for said power motor means which is actuated to register a unit for each unit signal produced by said signal means, said counter means being settable for multiples of the minimum unit of length whereby to cause inking and printing at selectable multiples of the unit length in continuous cyclic repetition of the counter setting.

9. Roll skip printing apparatus as set forth in claim 8, in which a separate signal means and a separate counter is provided for each said power motor means for selectively controlling the articulating action for inking and printing.

10. Roll skip printing apparatus as set forth in claim 9, in which a separate signal means is provided for each end of each segment.

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