United States Patent

[11] 3,536,006

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[45] Patented **Oct. 27, 1970**
[73] Assignee **Vandercook & Sons, Inc.**
Chicago, Illinois
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[54] **MULTICOLOR ROTARY OFFSET PRINTING PRESS WITH CYLINDER INTERRUPTION**
22 Claims, 36 Drawing Figs.

[52] **U.S. Cl.** **101/137,** 101/148, 101/209, 101/247, 101/415.1
[51] **Int. Cl.** **B41f 7/06,** B41f 13/48, B41f 31/18
[50] **Field of Search** ..... 101/174, 175, 177, 182, 183, 184, 185, 137, 139, 140, 217, 218, 247, 148, 352, 351, 206—209, 415.1

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Primary Examiner—Robert E. Pulfrey
Assistant Examiner—J. Reed Fisher
Attorney—Hill, Sherman, Meroni, Gross and Simpson

ABSTRACT: A multi color offset printing press of the rotary type in which a single circumferentially color-segmented plate cylinder is disposed above a single circumferentially segmented blanket cylinder, and the impression cylinder is disposed to one side of the blanket cylinder. A series of circumferentially extending cams is formed on the plate cylinder to successively move corresponding series of cam follower-driven inking and dampener rolls into and out of engagement with corresponding color segments of the plate cylinder as the plate cylinder rotates. A second series of cams is mounted on the sides of the blanket cylinder. This second series cooperates with cam followers connected to the journal members of the blanket and impression cylinders for tripping the blanket cylinder alternately to a print position, at which it engages the plate cylinder, and to a trip position, at which it is out of engagement with the plate cylinder, and for tripping the impression cylinder alternately to a print position, at which it engages the blanket cylinder, and to a trip position, at which it is out of printing engagement with the blanket cylinder, as the blanket cylinder is rotated at normal operational speeds. Electric solenoids are provided for selectively maintaining the respective cylinders in the printing positions thereof with respect to one or more of the corresponding color segments of the plate and blanket cylinders.

The plate cylinder is driven by a variable speed motor. The rolls of the dampener systems which engage and apply the water to the plate cylinder are driven at a speed proportionate to the speed of the plate cylinder. The fountain rolls of the dampener systems are mounted on a door member which is pivotally mounted on the frame of the press and are individually driven by variable speed motors. Speed controls operatively interconnect the plate cylinder motor and the fountain roll motors to vary the ratio of plate cylinder speed to fountain roll speed as a function of variations in plate cylinder speed.

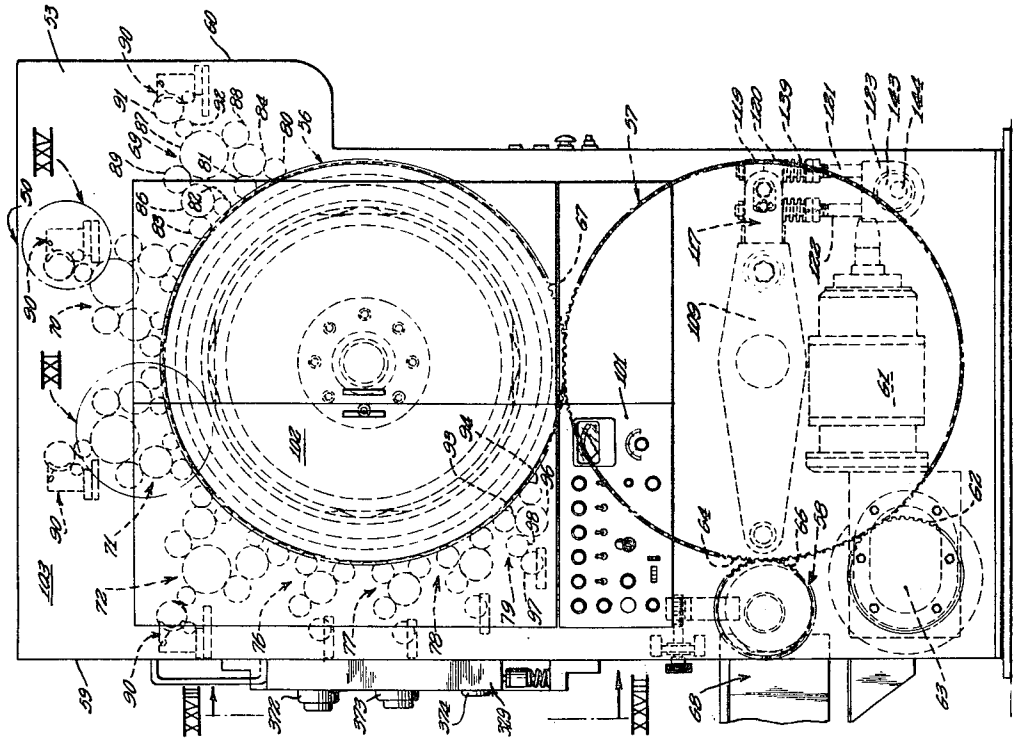

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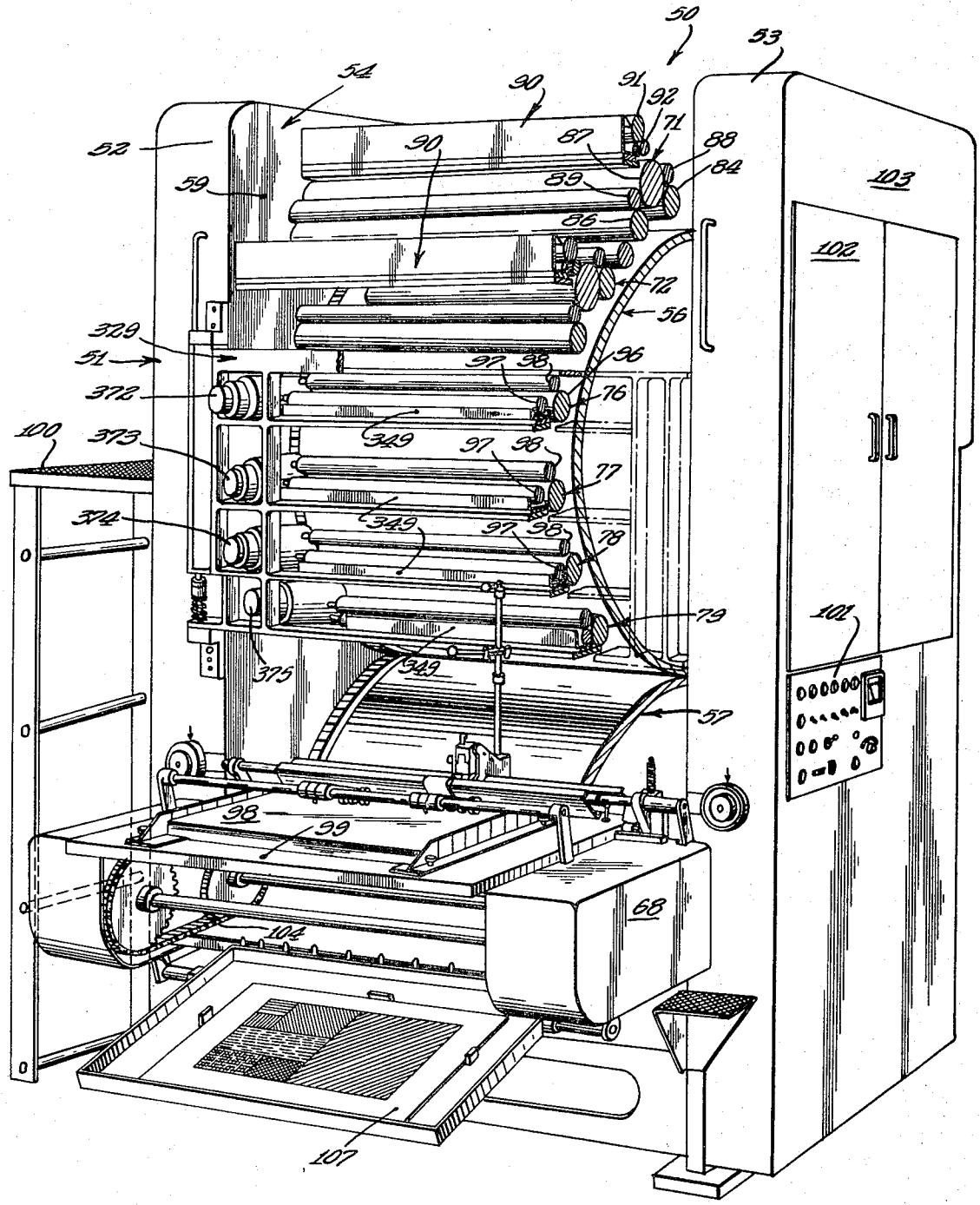
Fig. 1



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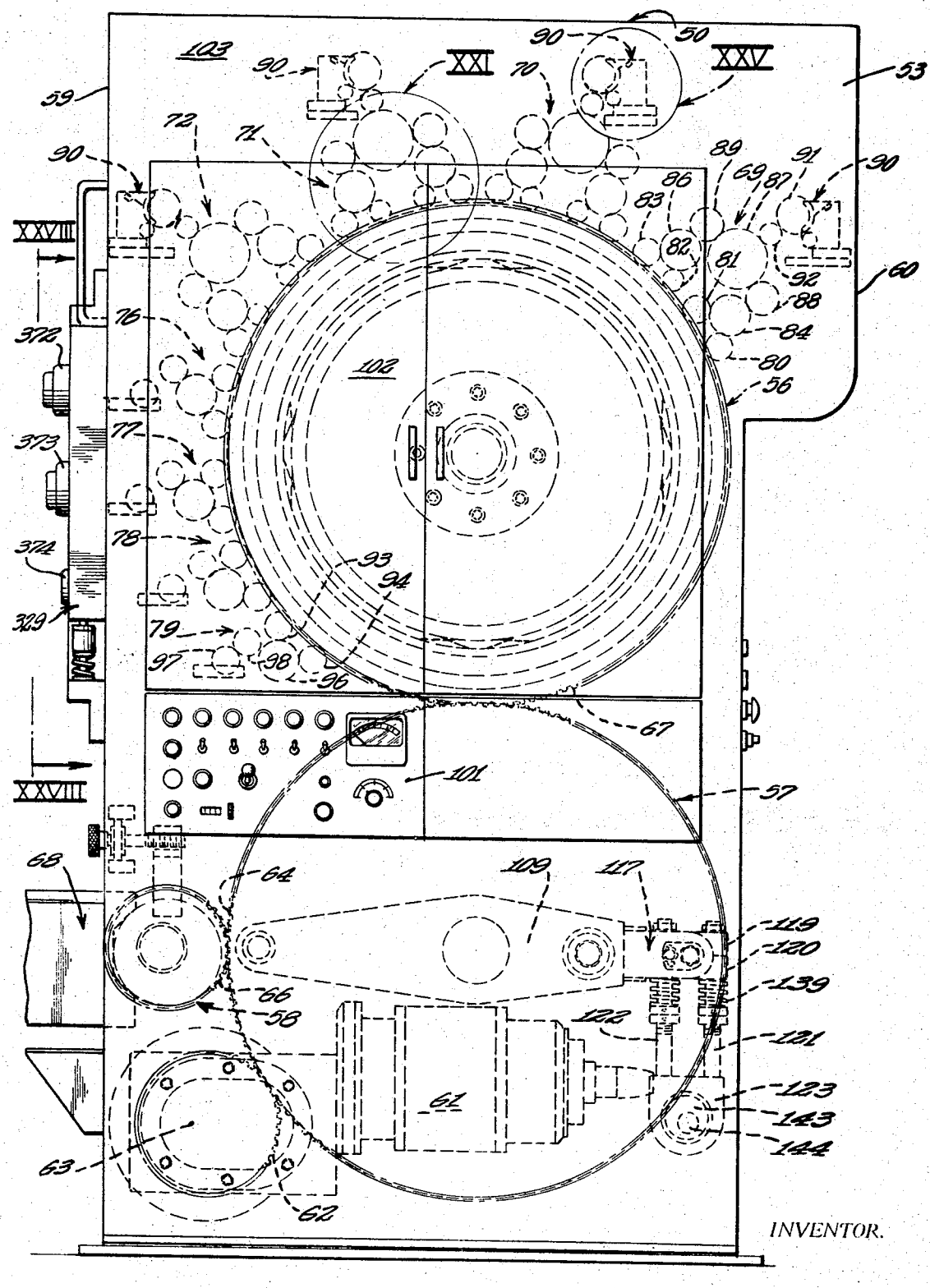

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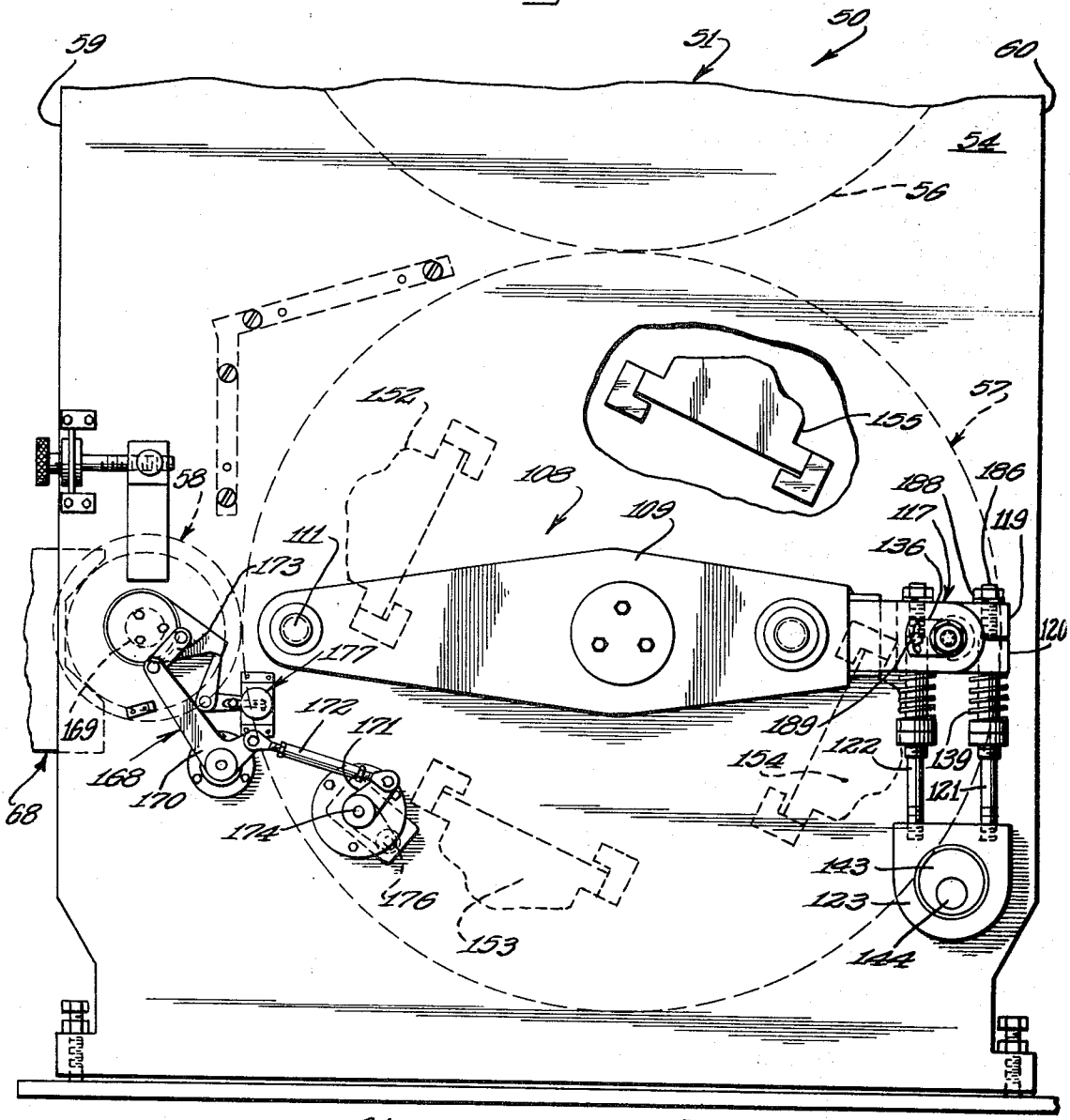
Fig. 3



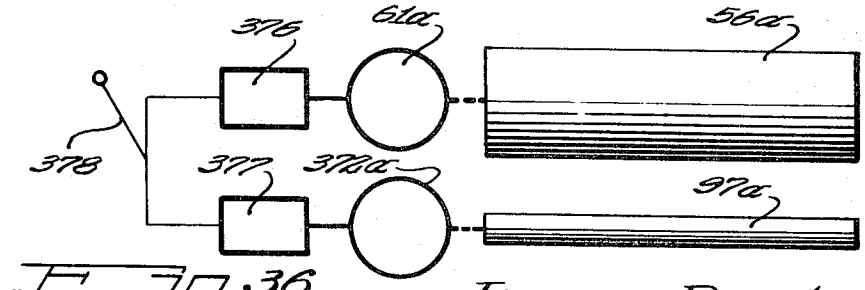


Fig. 36

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FIG. 5

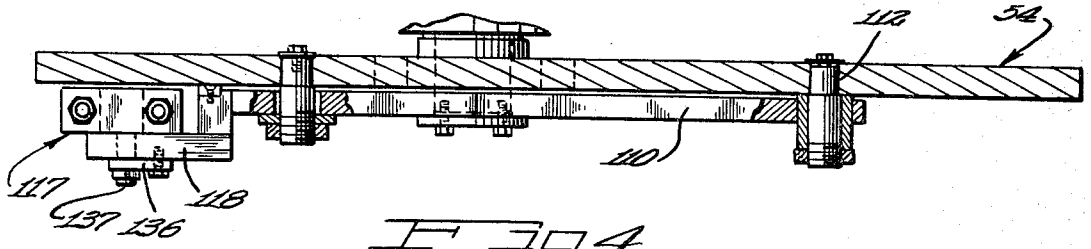
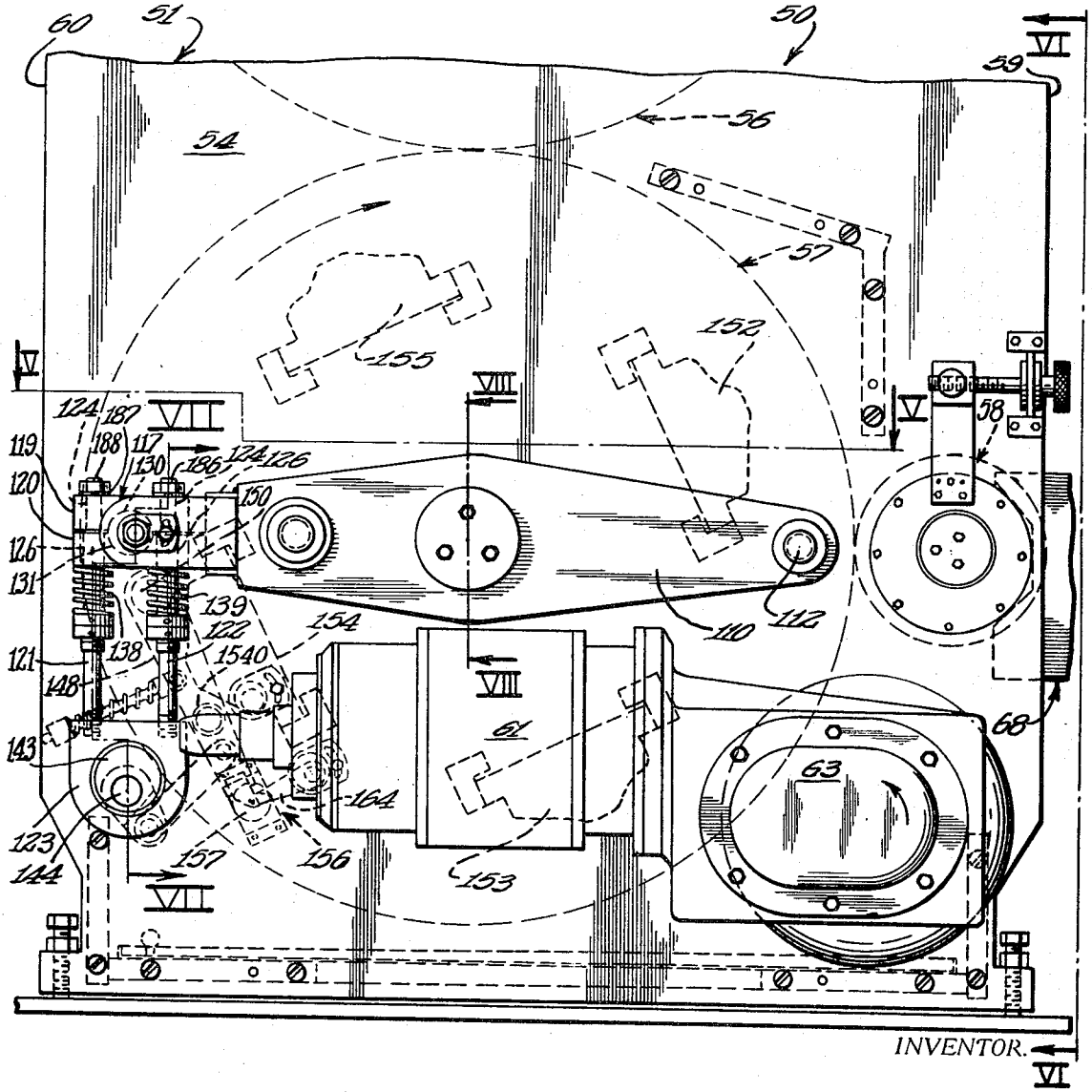


FIG. 4



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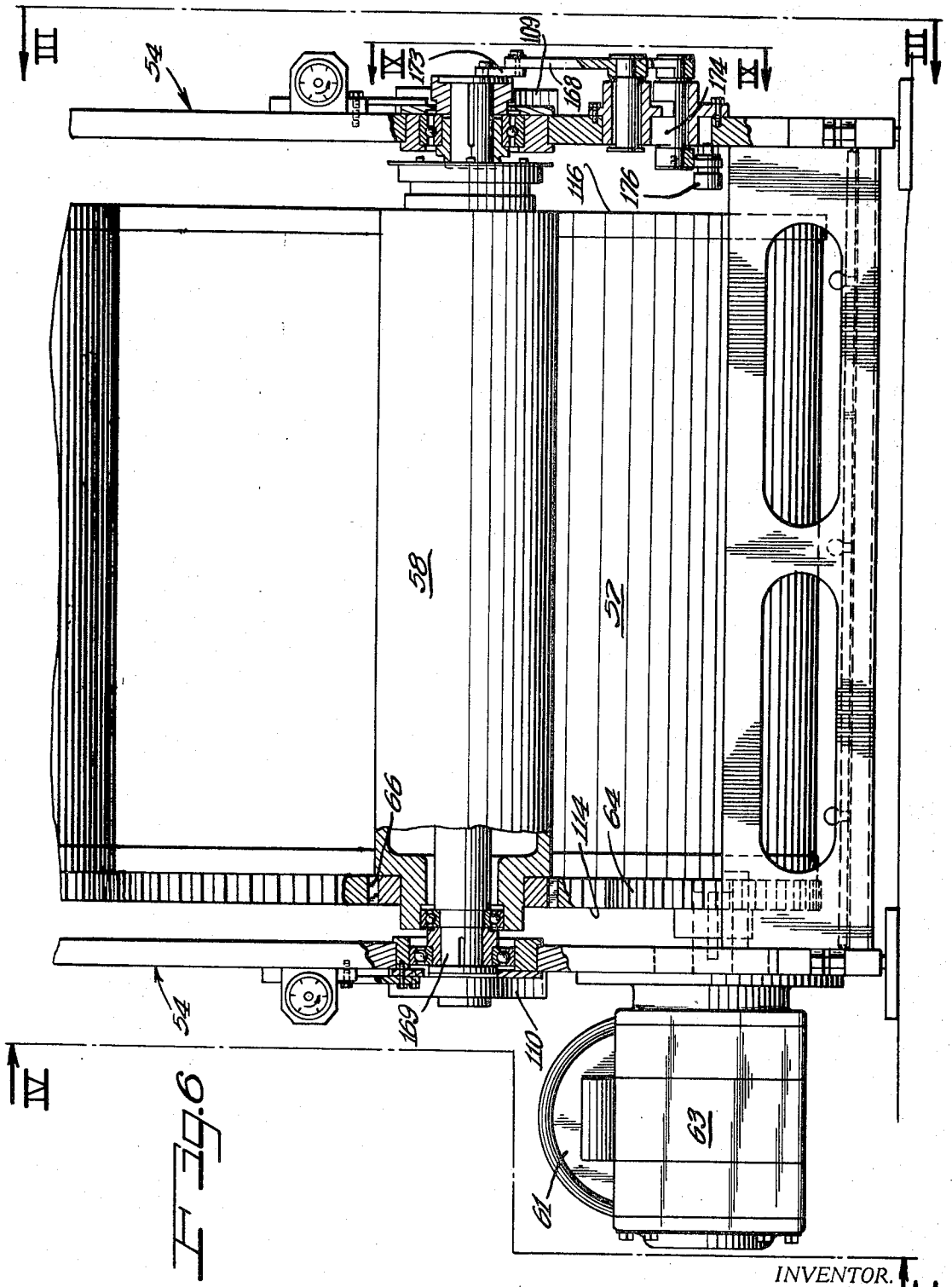

FIG. 6

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Fig. 24

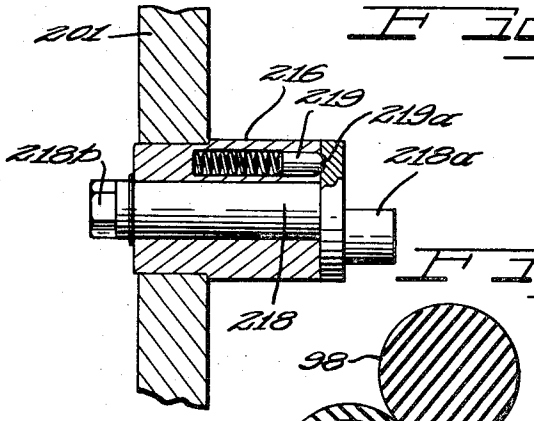


Fig. 7

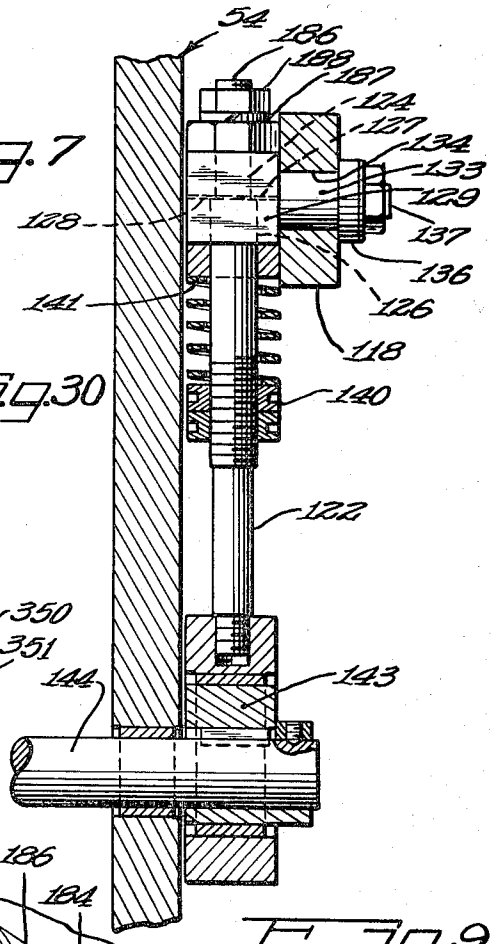


Fig. 30

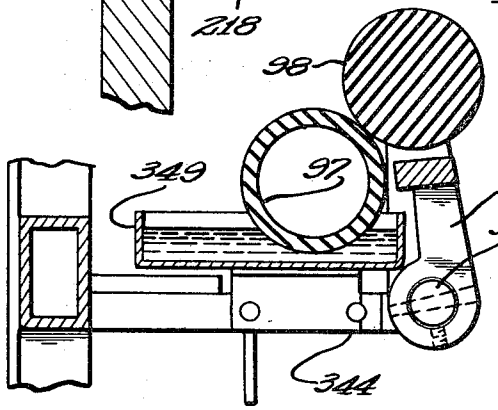
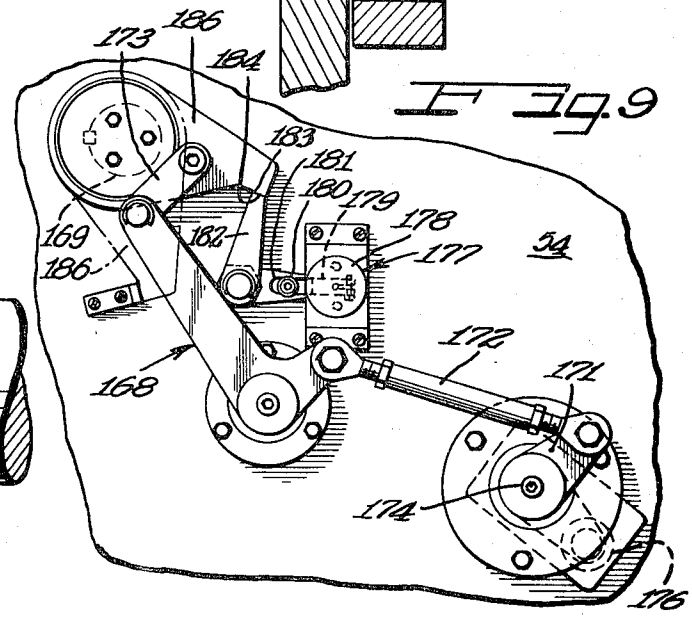


Fig. 9



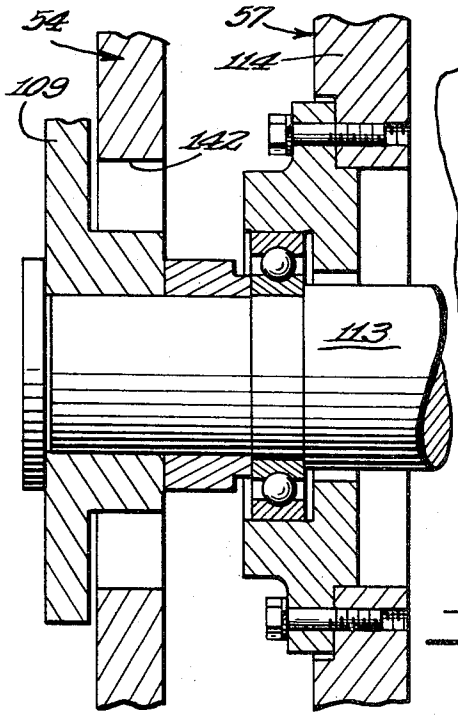


Fig. 8

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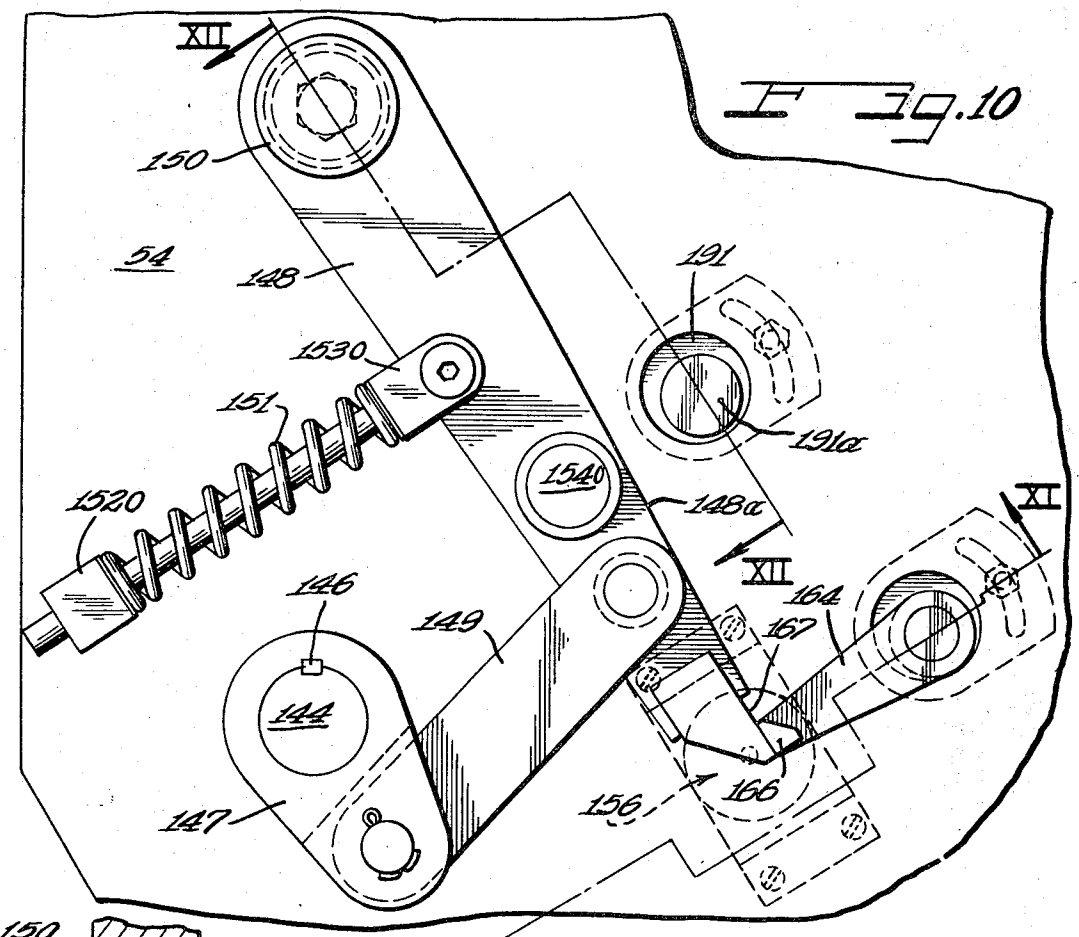

Fig. 10

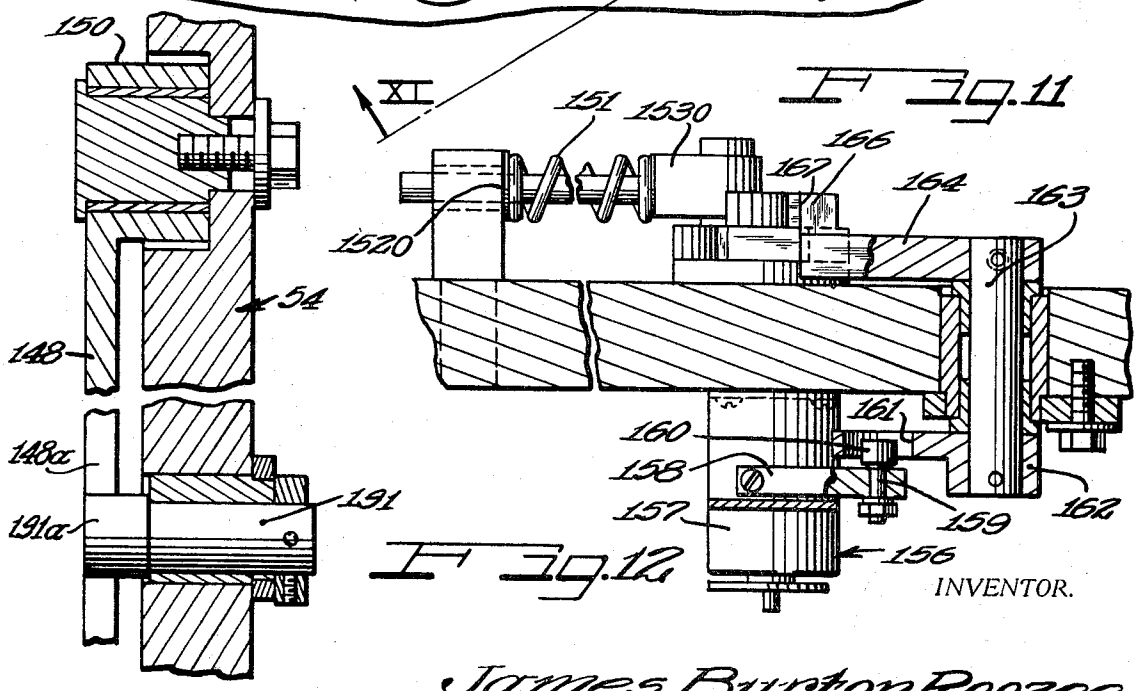

Fig. 11

Fig. 12

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FIG. 13

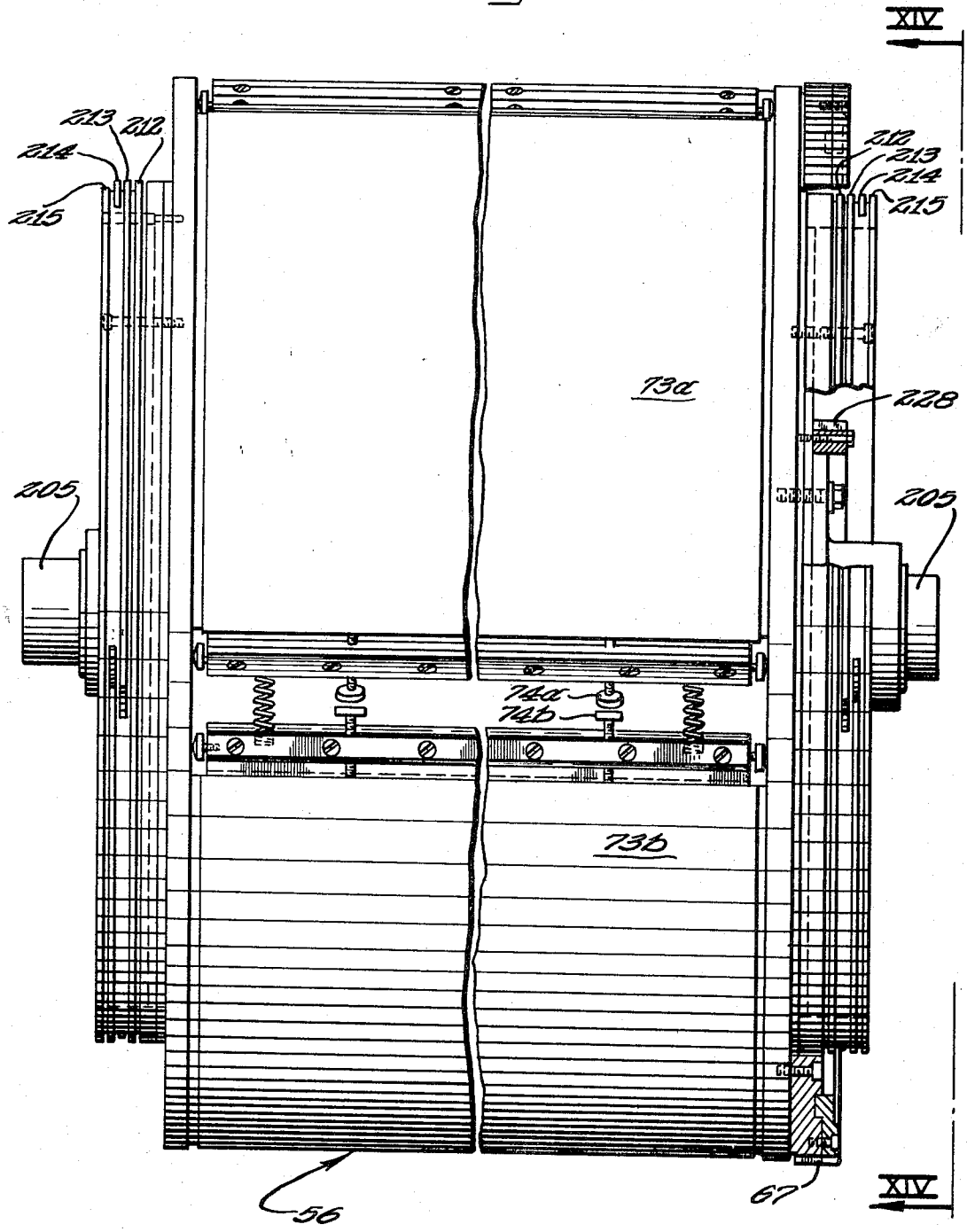

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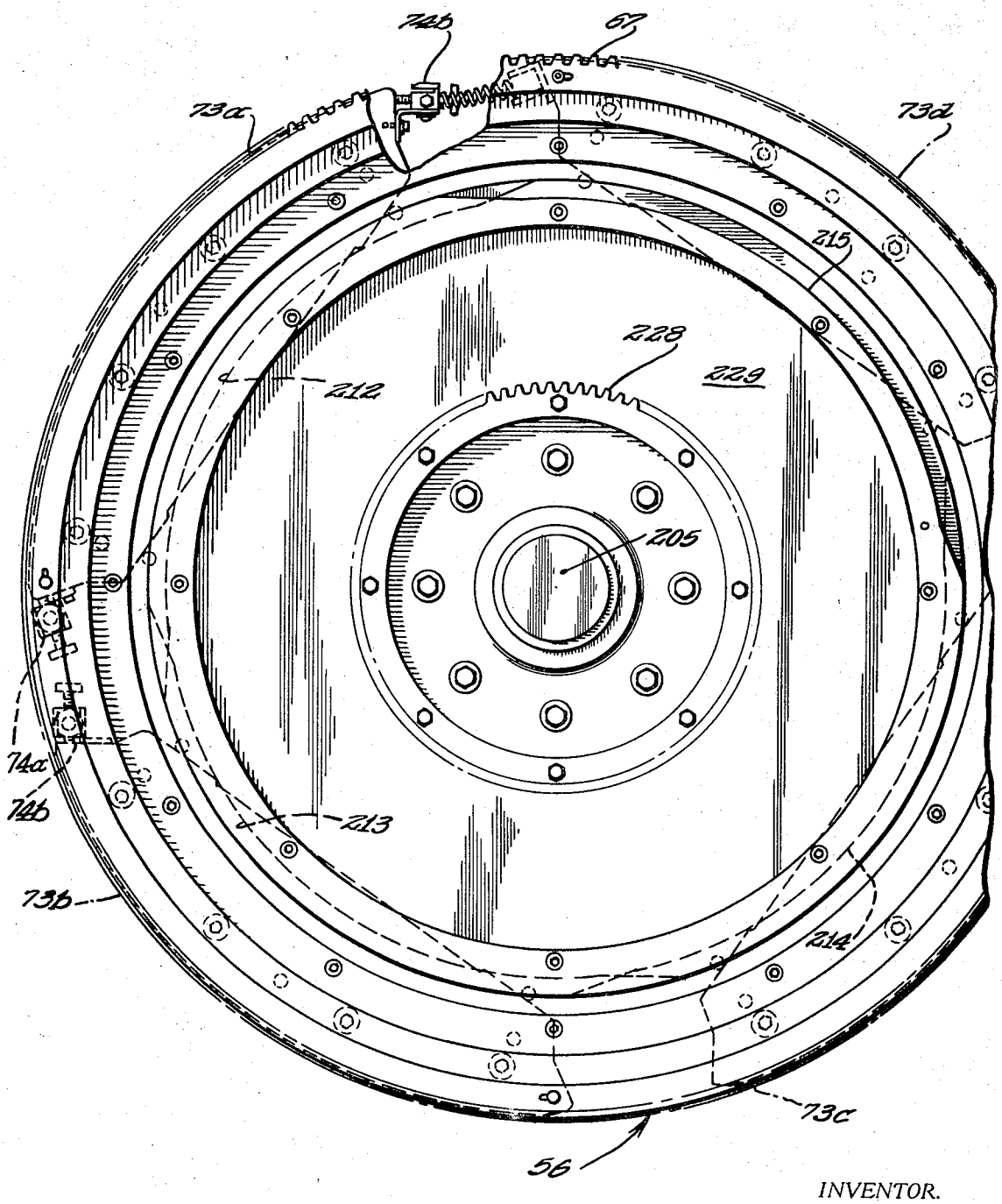
Fig. 14



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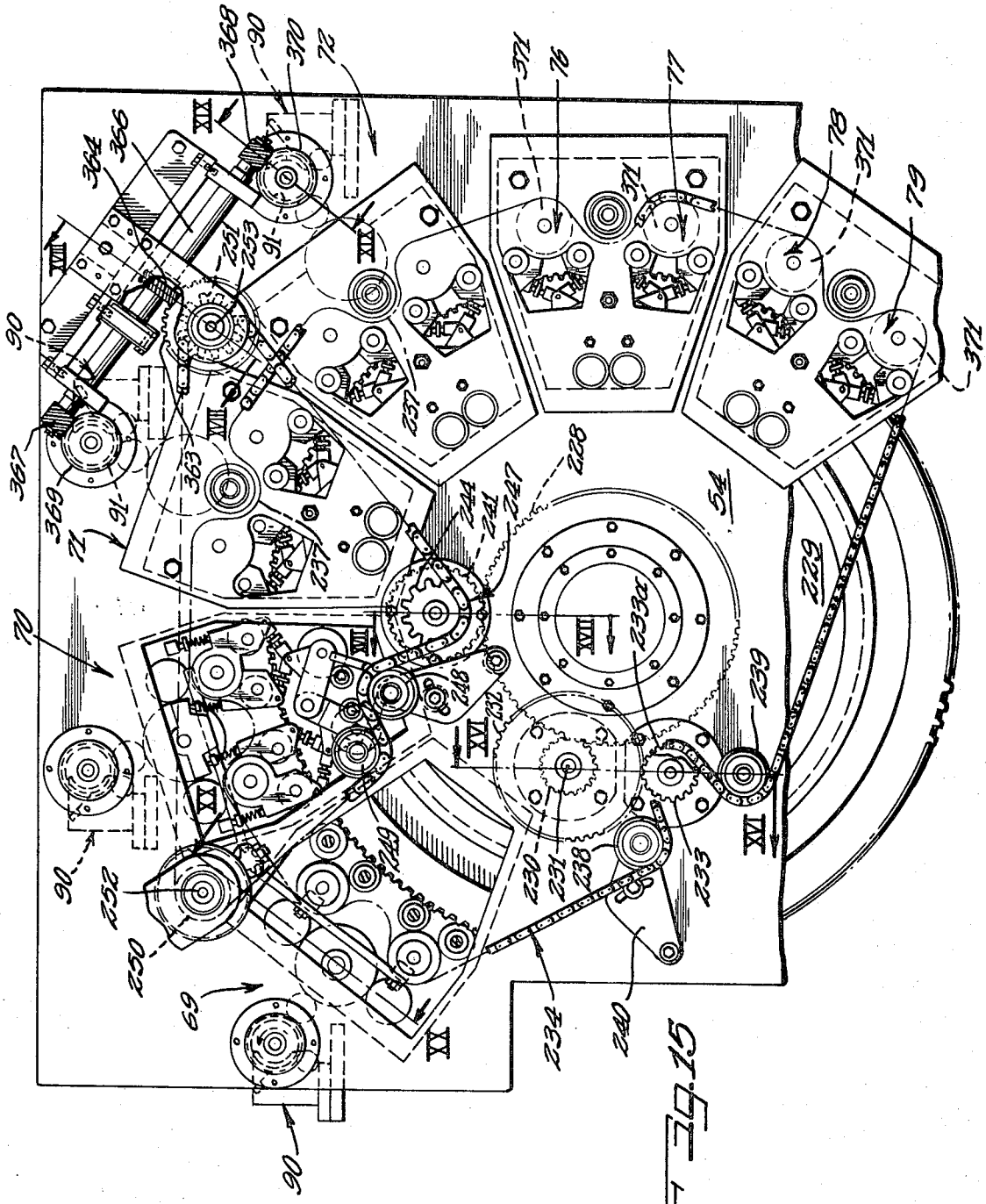

FIG. 15

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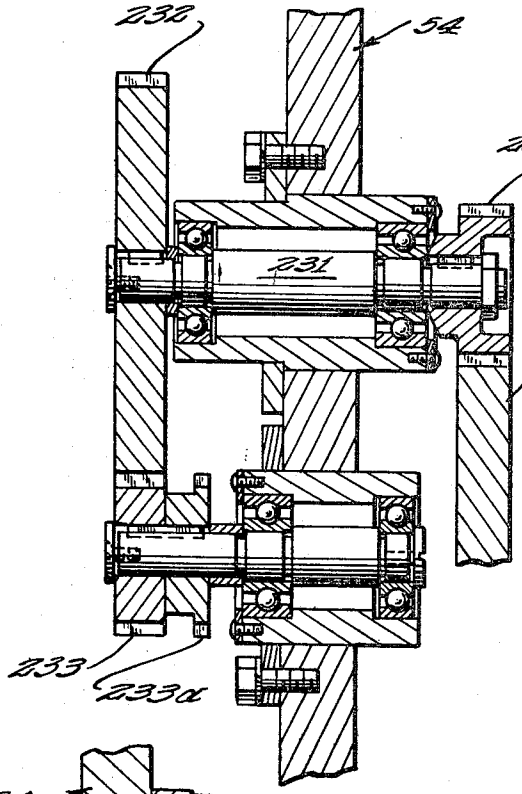
Fig. 16



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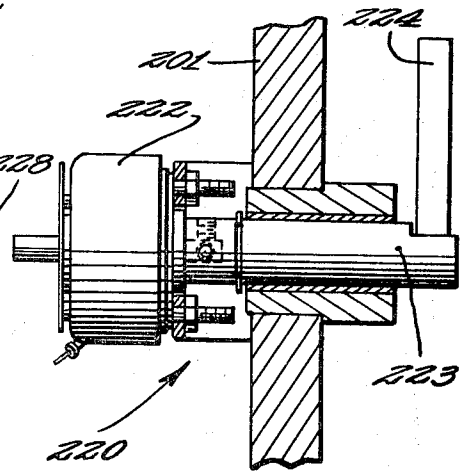

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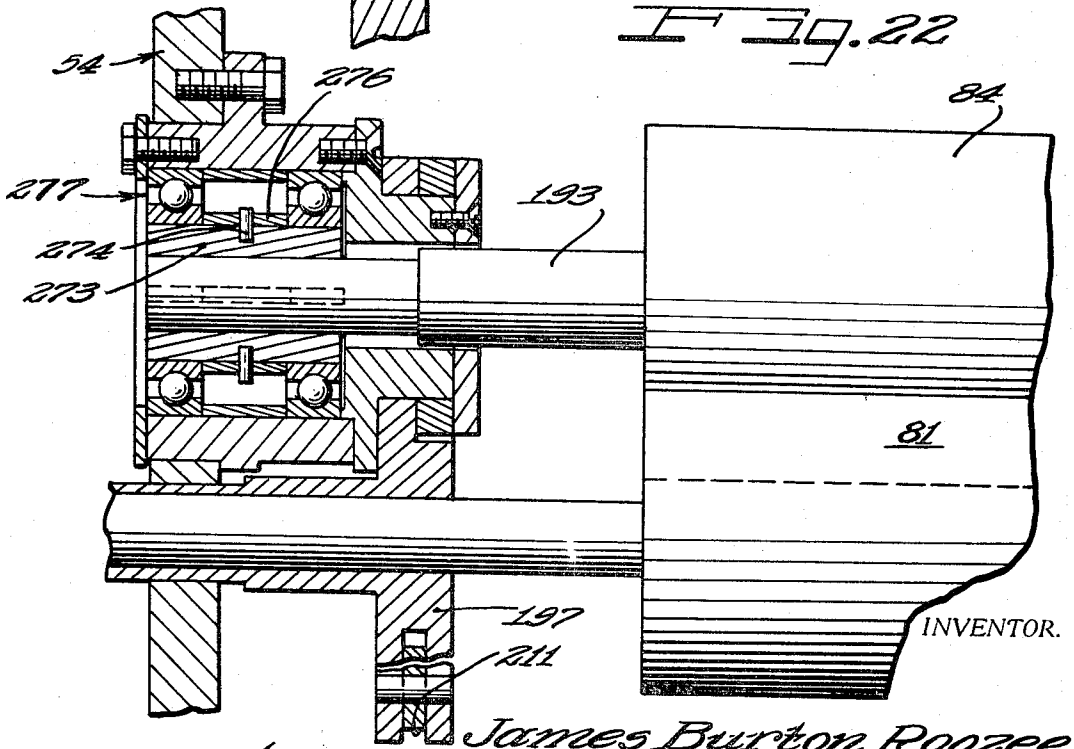

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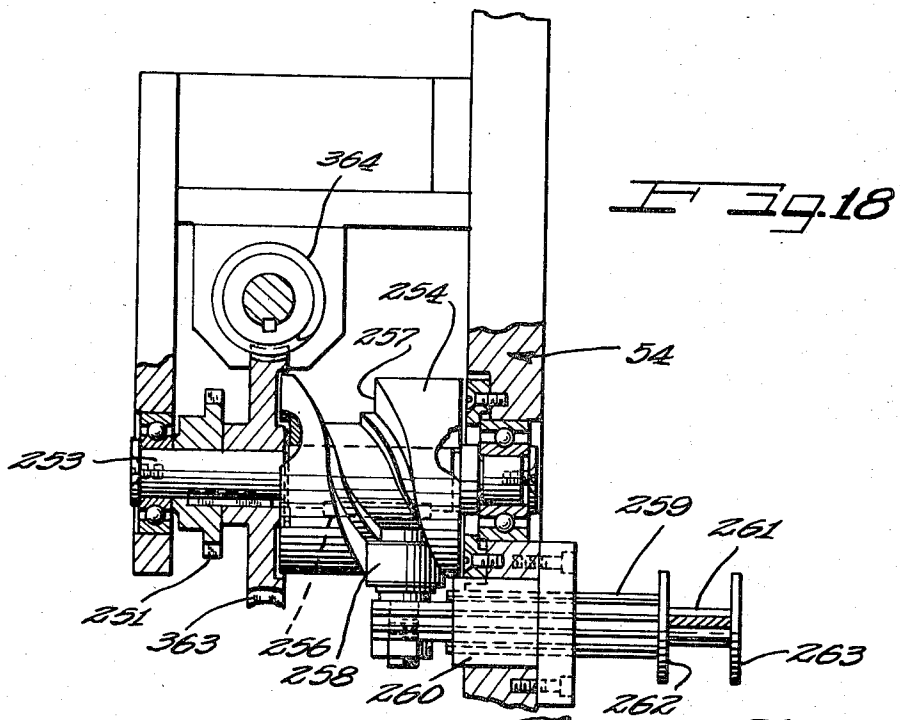

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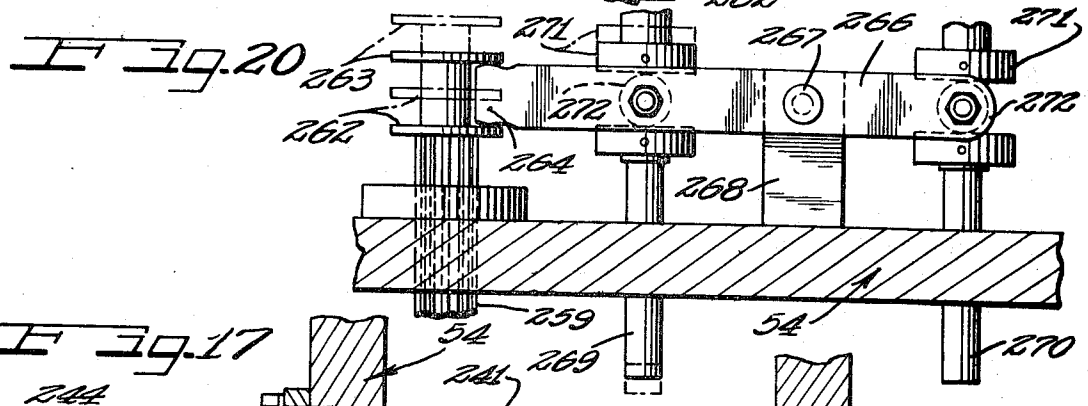

Fig. 20

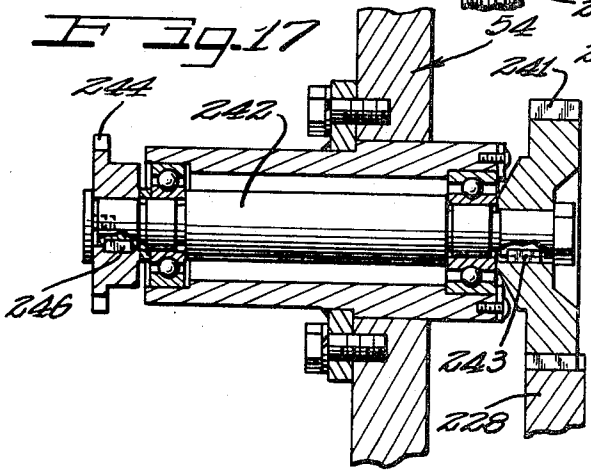

Fig. 17

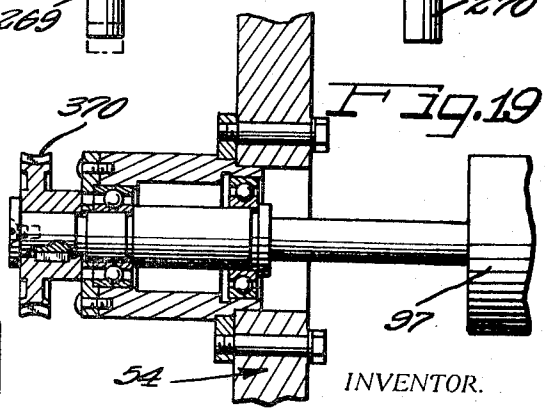

Fig. 19

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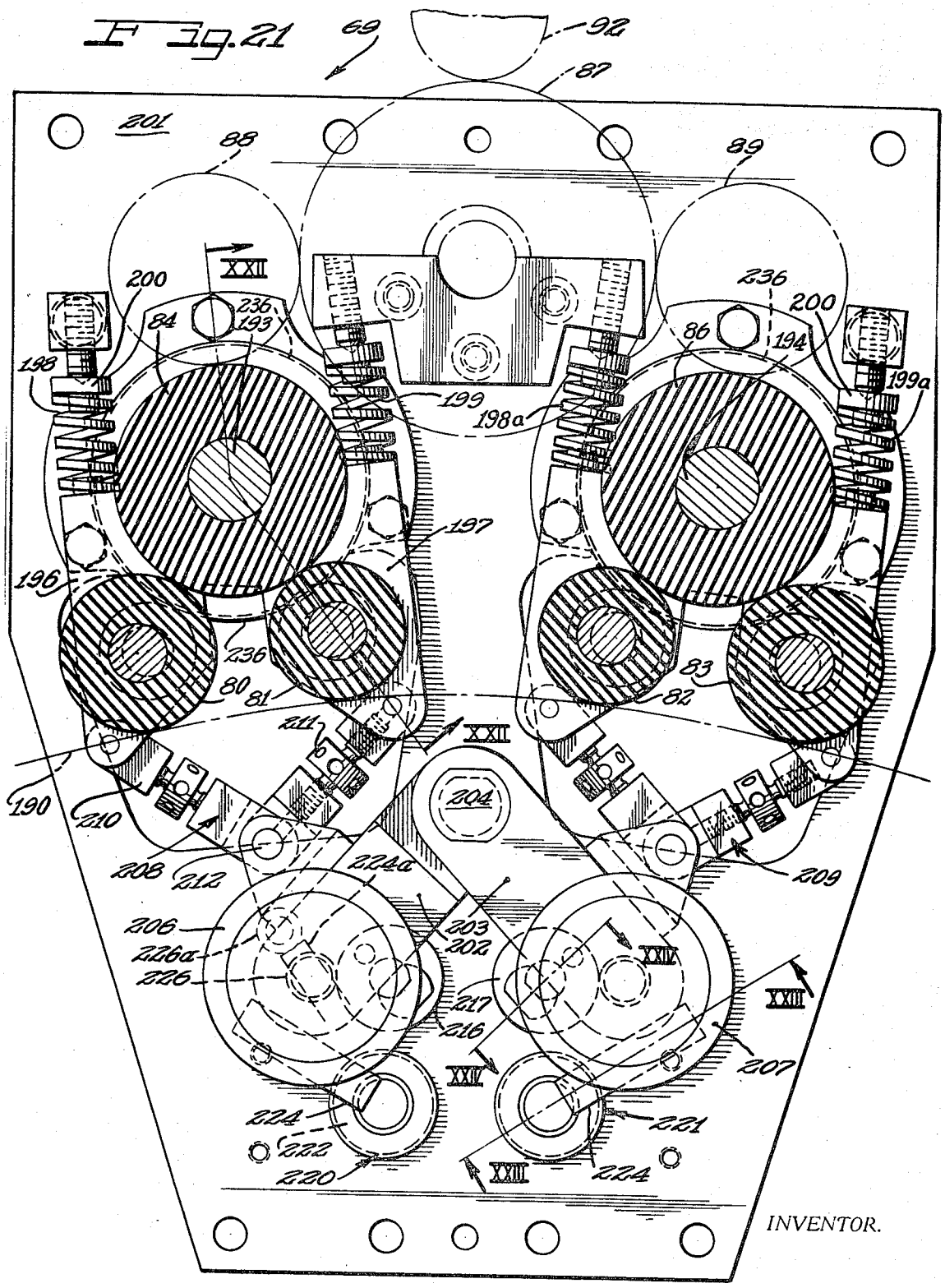
Fig. 21



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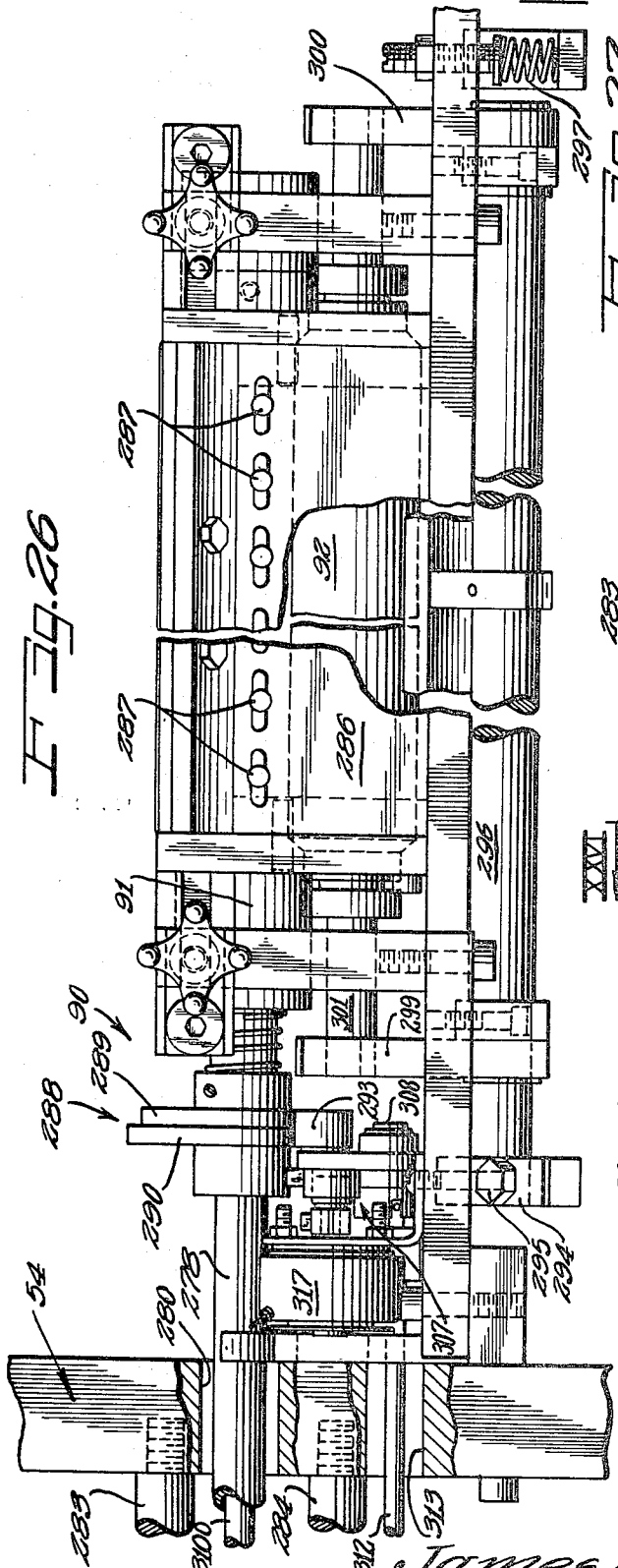

FIG. 26

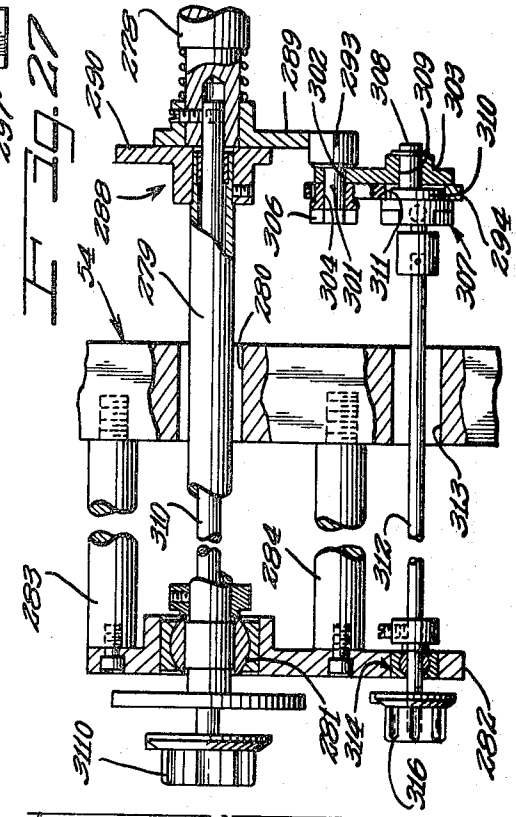

FIG. 27

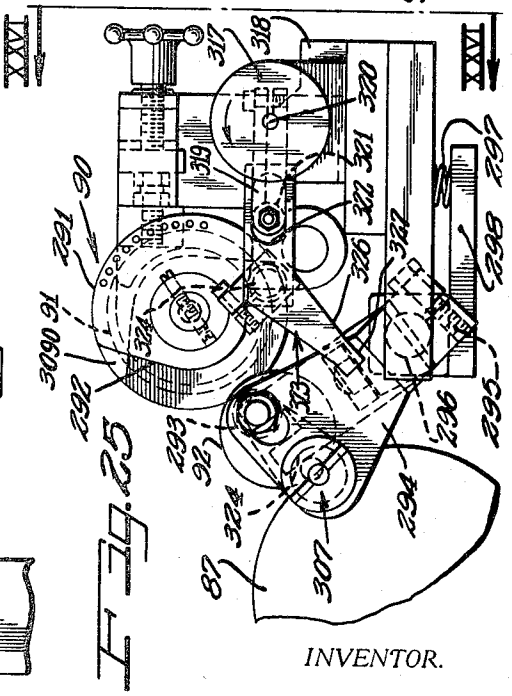

FIG. 25

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Fig. 28

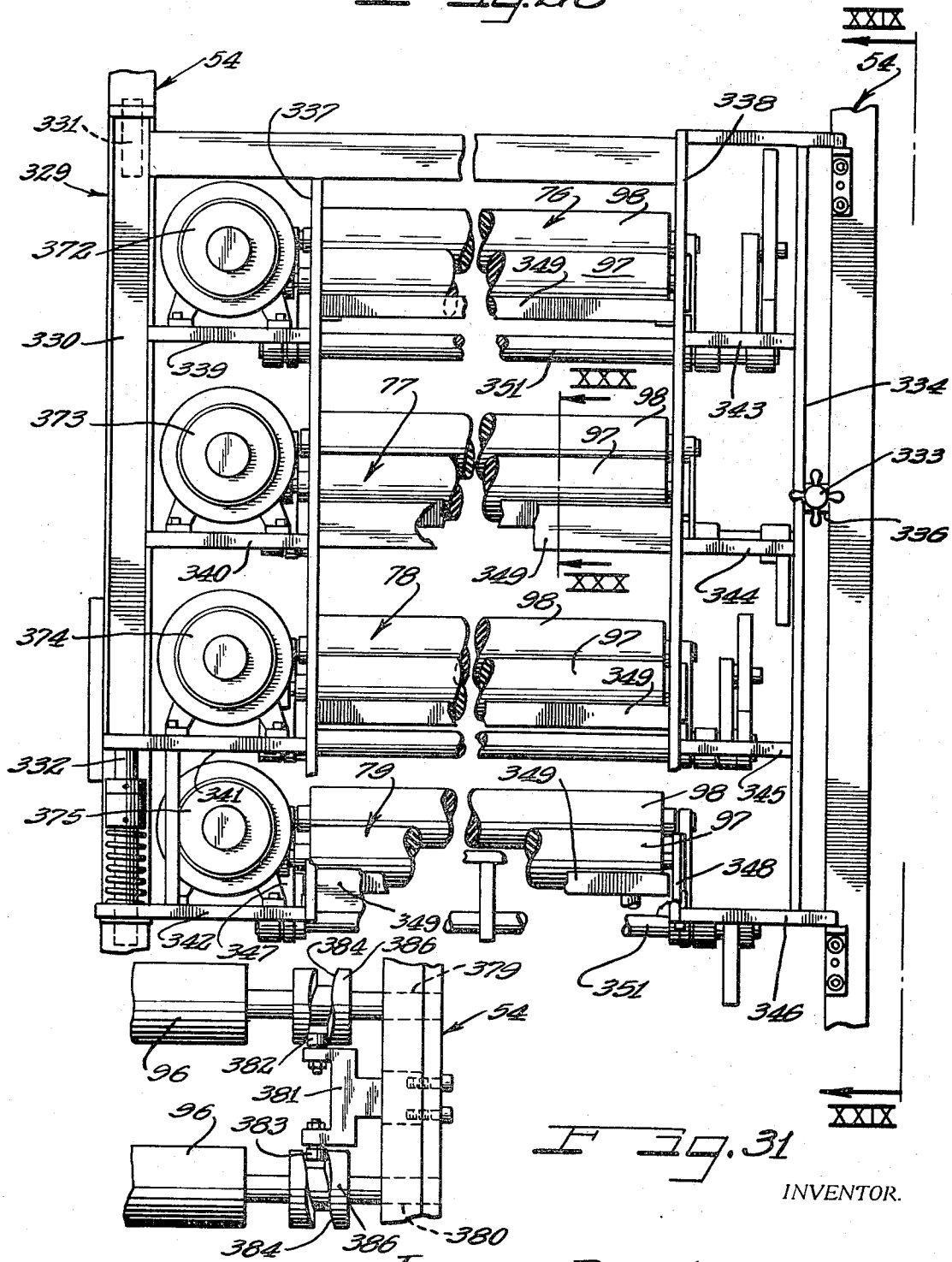

Fig. 31

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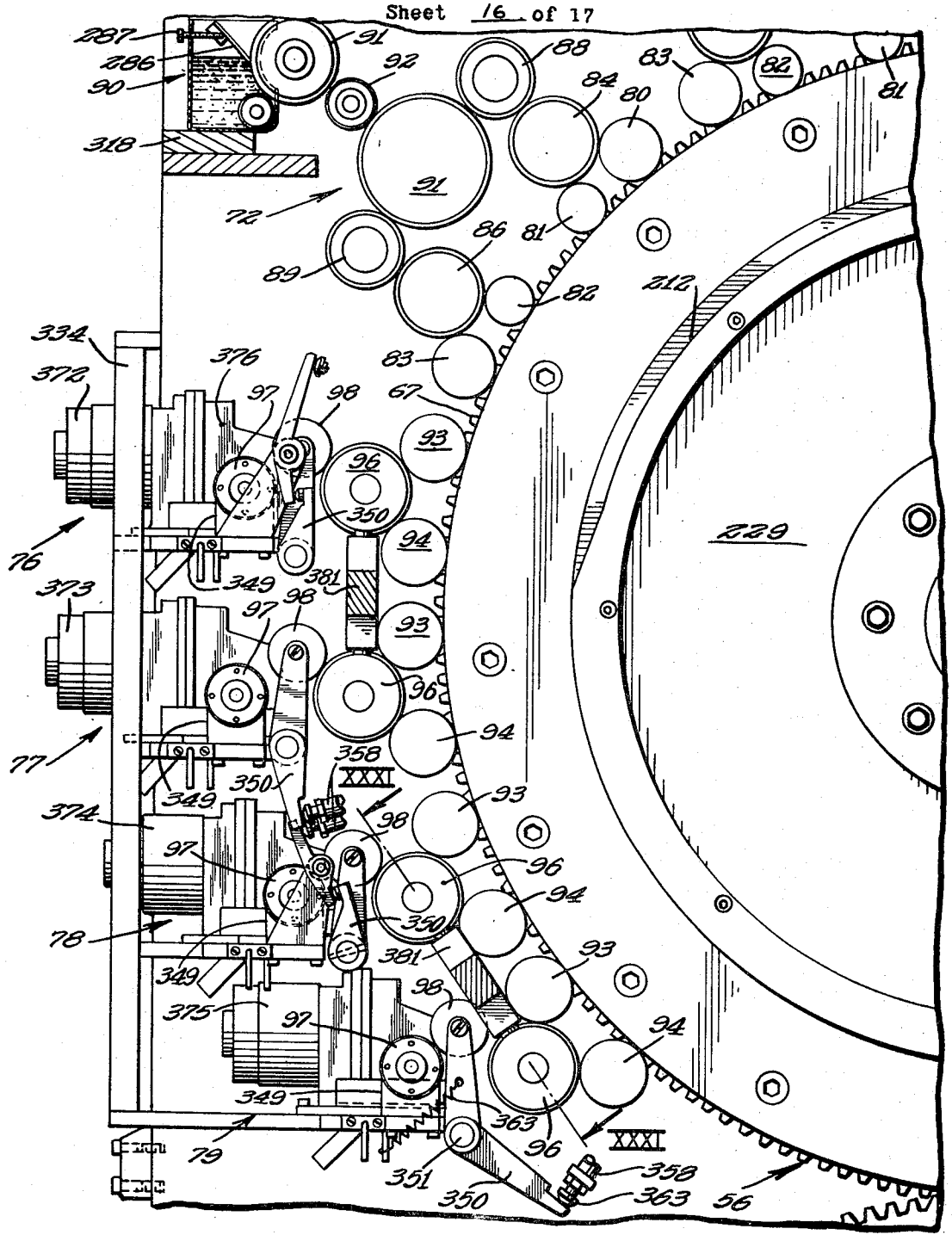

FIG. 29

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Fig. 32

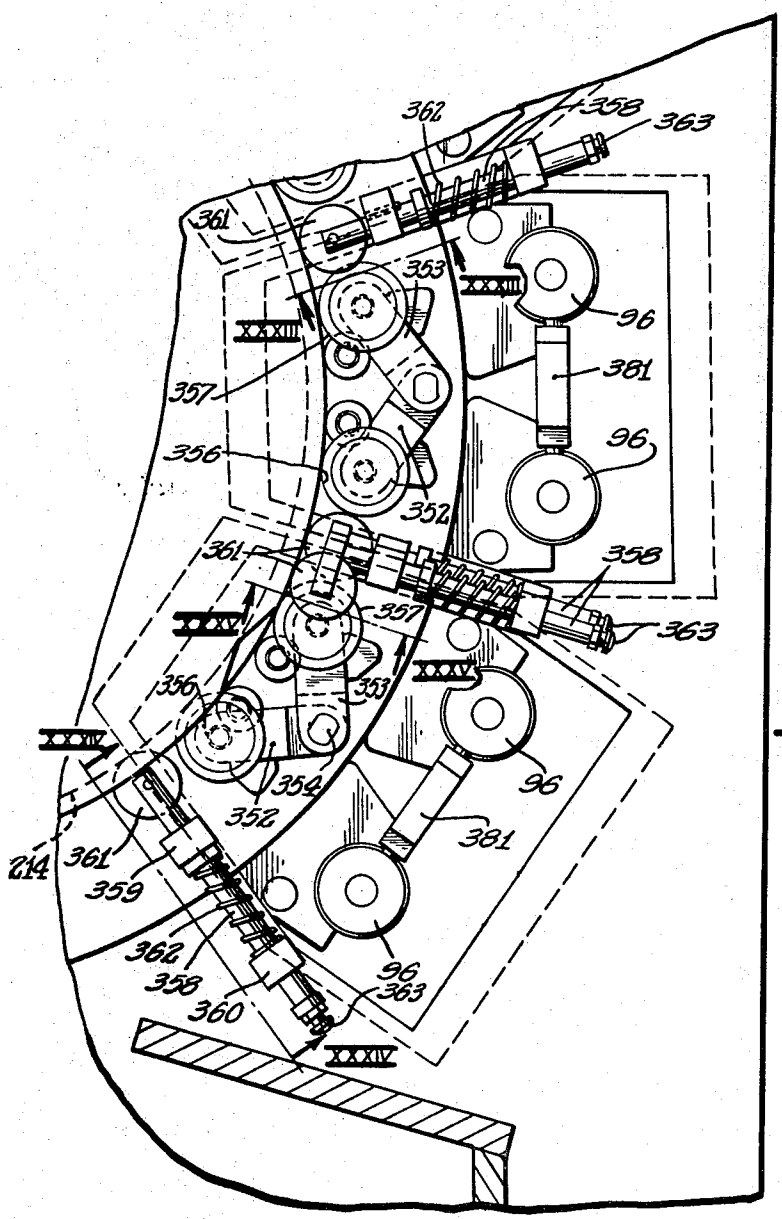


Fig. 33

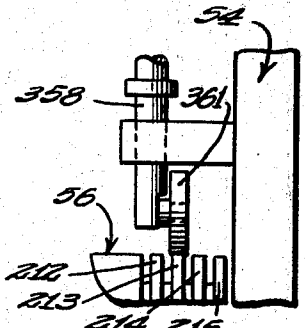


Fig. 34

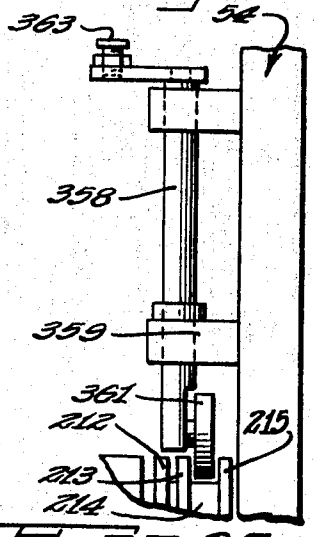
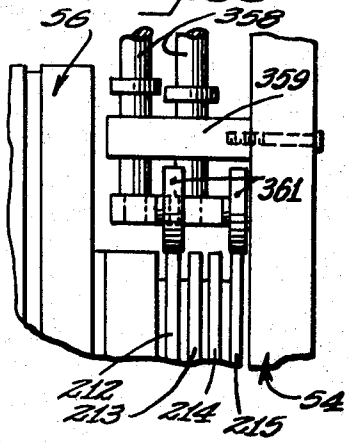


Fig. 35



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MULTICOLOR ROTARY OFFSET PRINTING PRESS WITH CYLINDER INTERRUPTION

BACKGROUND OF THE INVENTION

This invention relates generally to printing presses and more particularly to the field of multicolor rotary offset printing presses.

Printing presses of this general category are known in the art. See, for example, Firm U.S. Pat. No. 1,025,258. Generally such presses employ multiple plate cylinders in multiple color applications, although my copending application Ser.No. 464,784 filed June 17, 1965, now U.S. Pat. No. 3,347,160, discloses a multicolor press having a single plate cylinder, a single blanket cylinder and a single impression cylinder.

SUMMARY OF THE INVENTION

The present invention employs a single plate cylinder which is circumferentially divided into various color segments which equal in number the number of colors to be printed on the press. The embodiment of the invention disclosed herein comprises a four-color press but the principles of the present invention are applicable to a multicolor rotary offset press regardless of the number of colors the press is designed to accommodate.

The blanket cylinder is located directly below the plate cylinder and is equal in diameter to the plate cylinder. The impression cylinder is spaced horizontally from the blanket cylinder and has a diameter equal to one quarter the diameter of the blanket cylinder since the impression cylinder rotates four times for each revolution of the blanket cylinder.

In normal four-color operation all four-color segments of the plate cylinder engage corresponding segments of the blanket cylinder during each revolution of the two cylinders, and the impression cylinder similarly engages the corresponding four-color segments of the blanket cylinder for printing all four colors. However the present invention contemplates the provision of means for tripping the blanket cylinder out of printing engagement with the plate cylinder and the impression cylinder out of printing engagement with the blanket cylinder for omitting one or more of the four colors from the final printed sheet.

A plurality of inking and dampening systems are disposed around a portion of the periphery of the plate cylinder and include means for moving their respective ink and water dampener rolls into engagement only with their corresponding color segments of the plate cylinder. In the event one (or more) of the colors is to be omitted, however, means is provided for maintaining the corresponding ink and dampener rolls completely out of engagement with their respective color segment of the plate cylinder.

In order to trip the blanket cylinder between the print and trip positions thereof a pair of elongated arms are pivotally mounted at one of the ends thereof to the frame of the press for supporting and journaling the blanket cylinder in the order of second class levers. The opposite ends of the arms are connected to an eccentric shaft which is rotated by cooperating cam and cam follower members operatively interconnecting the blanket cylinder and the eccentric shaft. The impression cylinder is mounted on an eccentric shaft for movement between its print and trip positions with respect to the blanket cylinder and cam and cam follower means also operatively interconnect the blanket cylinder and the eccentric shaft which journals the impression cylinder. By virtue of this arrangement the blanket and impression cylinders are moved between their print and trip positions accurately and without undue vibration of the press. The blanket cylinder is also spring biased into the plate cylinder for selectively controlling the nip pressure of the print couple therebetween. Electric solenoids are provided for selectively holding the blanket and impression cylinders in the print positions. When the solenoids for one or more colors are not energized, the blanket and impression cylinders are moved by springs from the print position which they always assume in the gap between each plate, to the trip position thereof for omitting one or more of the colors of the press.

Each of the inking and dampening systems comprises a vibrator roll for applying the ink or water evenly to a pair of ink or dampener rolls which actually engage the plate cylinder. The plate engaging rolls are movable into and out of engagement with the plate cylinder while maintaining continuous contact with their corresponding vibrator roll. A cam and cam follower arrangement interconnects the plate cylinder and the plate engaging rolls so that the movement of the rolls is synchronized with rotation of the plate cylinder and so that each of the plate engaging rolls contacts only its corresponding color segment of the plate cylinder. Electric solenoids are also provided for holding the plate engaging rolls out of contact with the plate cylinder when one or more of the colors is to be omitted.

Each of the dampening systems comprises a fountain roll which turns continuously but at a speed which varies nonlinearly with respect to variations in the speed of the plate cylinder. A transfer roller oscillates back and forth between the fountain roll and a vibrator roll during each revolution of the plate cylinder. The motor driven fountain rolls are mounted on a door member which in turn is pivotally mounted on the frame of the press for greater accessibility to the fountain rolls and their associated fountains and transfer rollers as well as for greater accessibility to the vibrator rolls and the plate cylinder itself.

The overall arrangement as well as specific features embodied in the present invention provides for increased press speed, simplified construction, improved printing characteristics, reduced overall size, improved performance and a longer useful life. Ease of operation and maintenance are important advantages of the present invention.

It is, therefore, an object of the present invention to provide a multicolor rotary offset printing press having a single plate cylinder mounted on a fixed axis, a single blanket cylinder and a single impression cylinder and means for tripping the blanket cylinder into and out of engagement with the plate cylinder and for tripping the impression cylinder into and out of engagement with the blanket cylinder.

Another object of the invention is to provide improved means for tripping the blanket and impression cylinders.

Another object is to provide an improved inking system for a multicolor rotary offset press.

Another object is to provide an improved dampening system for a multicolor rotary offset press.

Another object is to provide a dampening system comprising a fountain roll, a transfer roller and a vibrator roll in which the transfer roller oscillates between the fountain roll and the vibrator roll during each revolution of the plate cylinder and remains in contact with each of the rolls during a fixed angle of rotation of the plate cylinder. The speed of rotation of the fountain roll is nonlinearly variable with respect to the speed of rotation of the plate cylinder to accommodate variations in requirements in the transfer of water to the plate cylinder as the speed of the plate cylinder varies.

Another object of the present invention is to provide a multicolor rotary offset press wherein the blanket cylinder and the impression cylinder are moved from print to trip positions by mechanical means but are selectively maintained in such print positions by electromechanical means.

Another object is to provide a multicolor offset press wherein the plate-engaging rolls of the inking and dampening systems are moved out of engagement with the plate cylinder by mechanical means but are selectively maintained in the disengaged positions thereof by electromechanical means.

Another object of the invention is to provide a more compact multicolor rotary offset printing press with increased printing speed and ease of operation and high performance printing characteristics.

Many other features, advantages and additional objects of the present invention will become manifest to those versed in the art upon making reference to the detailed description

which follows and the accompanying sheets of drawings, in which preferred structural embodiments incorporating the principles of the present invention are shown by way of illustrative example only.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a perspective view of a multicolor rotary offset printing press constructed in accordance with the principles of the present invention with certain parts removed and others shown in section for purposes of clarity and to show the relative disposition of parts.

FIG. 2 is an elevational view of one side of the press with certain of the basic parts indicated in dashed lines to show the overall arrangement thereof.

FIG. 3 is an enlarged fragmentary elevational view of the press taken from the same side as FIG. 2 and with parts omitted to emphasize portions of the blanket and impression cylinder supporting and tripping assemblies.

FIG. 4 is similar to FIG. 3 but is taken from an opposite side of the press.

FIG. 5 is a fragmentary horizontal substantially sectional view taken along lines V–V of FIG. 4.

FIG. 6 is a vertical view taken along lines VI–VI of FIG. 4 with certain parts shown in section and other parts removed to simplify the drawing.

FIG. 7 is a vertical sectional view taken along line VII–VII of FIG. 4.

FIG. 8 is a vertical sectional view taken along line VIII–VIII of FIG. 4.

FIG. 9 is an enlarged elevational view of portions of the impression cylinder supporting and tripping assembly shown in FIG. 3.

FIG. 10 is an enlarged elevational view of portions of the blanket cylinder supporting and tripping mechanism locked in their printing positions shown in FIG. 4.

FIGS. 11 and 12 are taken along lines XI–XI and XII–XII, respectively, of FIG. 10.

FIG. 13 is a front elevational view of the plate cylinder of the illustrated embodiment of the invention with portions thereof shown in section.

FIG. 14 is a side elevational view of the plate cylinder taken along XIV–XIV of FIG. 13.

FIG. 15 is a side elevational view of the plate cylinder with a plurality of inking and dampening systems arranged therearound, some parts thereof having been removed and others being shown in phantom lines for clarity.

FIG. 16 is an enlarged cross-sectional view of an inking roll and dampener roll drive arrangement taken along line XVI–XVI of FIG. 15.

FIG. 17 is an enlarged cross-sectional view of another drive arrangement for driving the ink vibrator rolls and ink fountain rolls and is taken along line XVII–XVII of FIG. 15.

FIG. 18 is a cross-sectional view of a drive arrangement interconnecting the ink vibrator rolls and the ink fountain rolls and taken along line XVIII–XVIII of FIG. 15.

FIG. 19 is a cross-sectional view of the ink fountain roll drive assembly taken along line XIX–XIX of FIG. 15.

FIG. 20 is a fragmental elevational view of a walking beam assembly associated with the ink vibrator rolls and taken along line XX–XX of FIG. 15.

FIG. 21 is an enlarged view of an inking system partly in section and partly in elevation and identified in FIG. 15 in the area encircled at XXI–XXI.

FIGS. 22, 23 and 24 are sectional view taken along lines XXII–XXII; XXIII–XXIII and XXIV–XXIV respectively, of FIG. 21.

FIG. 25 is an enlarged side elevational view of an ink fountain system of the present invention and is identified in FIG. 2 in the area encircled at XXV–XXV.

FIGS. 26 and 27 together comprise a front elevational view of the ink fountain systems taken along line XXVI–XXVI of FIG. 25, FIG. 27 being an extension of the left end of FIG. 26.

FIG. 28 is a front elevational view of the dampening systems taken along line XXVIII–XXVIII of FIG. 2.

FIG. 29 is a side elevational view of the dampening systems taken along line XXIX–XXIX of FIG. 28.

FIG. 30 is a cross-sectional view of the fountain roll and transfer roller of one of the dampening systems taken along line XXX–XXX of FIG. 28.

FIG. 31 is a fragmentary elevational view of the vibrator rolls of one of the dampening systems taken along lines XXXI–XXXI of FIG. 29.

FIG. 32 is a side elevational view of the dampening systems showing some of the rolls in phantom lines for clarity and showing portions of the cam follower members shown in FIG. 29 for oscillating the transfer rollers of the dampening systems.

FIGS. 33, 34 and 35 are elevational views taken along lines XXXIII–XXXIII: XXXIV–XXXIV and XXXV–XXXV of FIG. 32.

FIG. 36 is a schematic wiring diagram of the plate cylinder and dampening system fountain roll electric drive arrangements.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring to FIG. 1, reference numeral **50** indicates generally a multicolor rotary offset printing press constructed in accordance with the present invention. The press **50** may be used either as a production or a proof press since the principles of the present invention are applicable equally to both types of presses.

GENERAL ARRANGEMENT

In order to facilitate an understanding of the invention the general arrangement thereof will be described at the outset

The press **50** comprises a press frame **51** having a pair of spaced parallel vertical wall members **52** and **53** Included in each of the wall members **52** and **53** is a heavy plate as indicated at **54** which forms an internal wall surface and which together bear the major portion of the weight of the press.

Extending between the wall plates **54**, **54** on spaced parallel horizontal axes are a plate cylinder **56**, a blanket cylinder **57** and an impression cylinder **58**. The plate cylinder **56** is of the circumferentially segmented type. that is, it is divided around the circumference thereof in spaced portions equal in number to the number of colors which the illustrated embodiment of the press **50** is arranged to accommodate. In the illustrated embodiment the press **50** is arranged to accommodate four colors, and thus the plate cylinder is circumferentially divided into four color segments. Each of the segments receives a plate for printing one of the four colors, as will be understood by those skilled in the art.

The blanket cylinder **57** is disposed directly vertically below the plate cylinder **56** and is of the same diameter as is the plate cylinder so that each of the four quadrants of the blanket cylinder **57** receives the ink transferred from one of the four plates of the plate cylinder. The impression cylinder **58** is situated to one side of the blanket cylinder **57** and has a diameter which is equal to one-quarter of the diameter of the plate cylinder **56** and the blanket cylinder **57**.

The press frame **51** may be characterized as comprising a front side **59** and a rear side **60**. The impression cylinder **58** is disposed at the front side of the press frame **51** with respect to the blanket cylinder **57**.

The plate cylinder **56**, the blanket cylinder **57** and the impression cylinder **58** are all journaled for rotation on the press frame **51**. They are also drivingly interconnected for joint rotation, that is, the rotation of all of the cylinders occurs simultaneously.

The main power source for operating the press **50** comprises an electric motor **61** mounted on the wall member **53** and connected to a main drive gear **62** through a speed reducer **63**. The gear **62** is in mesh with a gear **64** formed on the blanket cylinder **57** which in turn is in mesh with a gear **66**

formed on the impression cylinder **58** and another gear **67** formed on the plate cylinder **56**.

Also situated at the front side **59** of the press frame **51** is a paper feeder and stacking assembly indicated generally at reference numeral **68**. The assembly **68** may be of a type known in the art and need not be described herein in detail but performs the function of feeding the blank paper sheets to the impression cylinder **58** and then receiving and stacking the printed sheets as they are released from the impression cylinder. Disposed around the periphery of the plate cylinder **56** and extending generally from the upper quadrant of the plate cylinder near the rear side **60** of the press frame **51** to the lower quadrant at the front side **59** of the frame **51** are a plurality of plate cylinder inking and dampening systems. Since the illustrated embodiment of the invention comprises a four-color press there are four inking systems, one for each color, indicated respectively at reference numerals **69**, **70**, **71** and **72**. There are also four dampening systems, one for each color, and these are indicated generally at reference numerals **76—79**, respectively.

The four inking systems **69—72** are identical in most basic respects, although it may be noted in FIG. **2** that the relative disposition of some of the parts thereof are reversed merely to maintain optimum compactness of the press **50** and to enhance the overall design and construction thereof.

Briefly, each of the inking systems comprises two pairs of ink rolls, which rolls are indicated respectively in connection with inking system **69** at reference numerals **80**, **81**, **82** and **83**. The ink rolls **80—83** actually engage the plate mounted on the plate cylinder **56** which corresponds to the color of ink being applied by the inking system **69**. Also included are a pair of vibrator rolls **84** and **86**, each of which engages a pair of the ink rolls **80—83**.

Inking system **69** also includes an ink drum **87** and a pair of doctor rolls **88** and **89** interposed respectively between vibrator rolls **84** and **86** and the ink drum **87**. The ink is supplied to the ink drum **87** from an ink fountain **90** through a fountain roll **91**, which rotates on a fixed axis, and a transfer roller **92** which pivots back and forth between the fountain roll **91** and the ink drum **87** to transfer ink in desired amounts from the fountain roll **91** to the ink drum **87** and then, through the doctor rolls **88** and **89** and vibrator rolls **84** and **86** to the ink rolls **80—83**.

All of the dampening systems **76—79** are similar to one another although it is noted that some slight modifications from one dampening system to another have been made once again in the interest of optimum overall press design. The dampening system **79**, for example, includes a pair of dampener rolls **93** and **94** which actually engage one of the four plates mounted on the plate cylinder **56** and corresponding thereto in terms of one of the four colors which may be printed on the press **50**. Also included is a vibrator roll **96** which engages the dampener rolls **93** and **94**, a fountain roll **97** which rotates on a fixed axis and a transfer roller **98** which pivots back and forth between the fountain roll **97** and the vibrator roll **96**. The purpose of the dampening systems **76—79** is to add a slight film of water to the various plates of the plate cylinder **56** before the plates are inked by the inking systems **69—72**. Each of the dampening systems **76—79** applies water only to one of the four plates, just as each of the inking systems **69—72** applies its particular color of ink to only one of the plates. Thus there is one dampening system and one inking system for each of the four plates of the four-color press illustrated herein.

In operation, a stack of blank sheets to be printed, as shown at reference numeral **98**, is placed on a bed **99** of the paper feeder and stocking assembly **68**. The operator may ascend a ladder **100** to visually inspect the upper reaches of the press to ensure proper readiness and then may start the press by actuating suitable switches and other control devices mounted on a control panel **101** on the wall member **53**. Access doors **102** are also mounted on the wall member **53** for access through an outer panel **103** for making other adjustments that may be desirable.

The main drive motor **61** is energized to drive the plate cylinder **56**, the blanket cylinder **57** and the impression cylinder **58** jointly, and through suitable power takeoffs, also to drive the inking systems **69—72** as well as the dampening systems **76—79**. A power takeoff indicated generally at reference numeral **104** drives the paper feeder and stacking assembly **68** from the impression cylinder **58** as a result of which movable arm members indicated at **106** feed the sheets from the stack **98** to the impression cylinder **58** seriatim.

The impression cylinder **58** is equipped with grippers to grip each sheet as it is received from the assembly **68** and to carry the sheet through four revolutions of the impression cylinder **58** before the sheet is released in printed form to a stacking plate indicated at **107**. As each sheet revolves four times on the impression cylinder **58** the four colors of ink from the blanket cylinder **57** are transferred thereto. During this time the blanket cylinder **57** and the plate cylinder **56** each turn one revolution, each of the four quadrants or color segments of each serving to print one of the four colors.

As shown in FIGS. **13** and **14**, the four-color segments of the plate cylinder **56** are identified at reference numerals **73***a* , **73***b* , **73***c* and **73***d* . Each of the four segments are equipped with two pairs of clamping devices **74***a* and **74** *b* for securing the ends of its respective plate thereto. Note that there exists a gap between the adjacent segments **73***a* —**73***d* to provide recesses in which the clamps **74***a* and **74***b* are disposed. As a result of these gaps similar spaces occur on the periphery of the blanket cylinder **57** during operation of the press between the color segments thereof which receive the ink transferred thereto from the four plates of the plate cylinder **56**.

BLANKET CYLINDER TRIPPING MECHANISM

Occasion may arise from time to time in the operation of the press **50** when less than all four of the colors are to be used. For example, some types of printed work may require merely black ink and red ink while another application may require black, red and yellow color inks The press **50** is constructed and arranged to accommodate printing of all four colors or of any number less than four To this end means are provided for moving the blanket cylinder **57** out of printing engagement with the plate cylinder **56** during rotation of the two cylinders through one or more quadrants or color segments corresponding to one or more of the colors to be omitted. The impression cylinder **58** is also moved out of printing engagement with the blanket cylinder **57** during any revolution thereof corresponding to an omitted color. In other words, during operation of the press with less than all four colors printing the blanket cylinder moves to a nonprint or trip position, *i.e.* out of printing engagement with the plate cylinder **56**, during that angle of rotation of the blanket and plate cylinders corresponding with the omitted color or colors. The blanket cylinder **57** returns to a print position at which it engages the plate cylinder **56** in printing relation at the nip or printing couple formed with the plate cylinder **56** as the two cylinders rotate through the quadrants or color segments corresponding to the colors being printed.

To confer upon the blanket cylinder **57** this ability to move or jog back and forth between a print and a trip position with respect to the plate cylinder **56** the blanket cylinder **57** is mounted on a tripping mechanism indicated generally at reference numeral **108**. Referring to FIGS. **3—8**, the tripping mechanism **108** may be more particularly characterized as comprising a pair of elongated lever arms **109** and **110** which are pivotally mounted respectively at one of the ends thereof on the heavy wall plates **54**,**54** by means of a pair of pivot pins **111** and **112** which, as shown in FIG. **5**, extend through their corresponding wall plates **54** and are fixedly secured thereto. The blanket cylinder **57** comprises a shaft **113** which extends outwardly from a pair of end walls **114** and **116** and is journaled for rotation on the shaft **113**, the shaft being fixed at the ends thereof on the elongated lever arms **109** and **110**.

Mounted on each of the lever arms **109** and **110** at an end opposite its corresponding pivot pin **111** and **112** is a trip

block 117 as shown in FIGS. 4, 5 and 8. Each of the trip blocks 117 comprises an L-shaped plate 118 which forms an extension of its respective lever arm 109 and 110. The plate 118 is connected in fixed assembly to a lower one of a pair of horizontally split block plates 119 and 120 so that the lower block plate 120 moves with its respective lever arm whereas the upper block plate 119 may move relative thereto.

A pair of linking studs 121 and 122 are threaded at their lower ends into a journal member 123 and extend at their upper ends through registered bores formed in the upper and lower block plates 119 and 120 as indicated at 124 and 126. The diameter of bores 124 is reduced compared to the diameter of bores 126 and the studs 121 and 122 are also reduced in diameter to provide a shoulder 127 abutting a bottom wall 128 of the upper block plate 119.

An upper end 186 of each of the linking studs 121 and 122 is threaded as at 186 to receive a washer 187 and a complementarily threaded nut 188 for securing the studs 121 and 122 within the bores 124 of the upper block plates 119.

An eccentric shaft 129 is received in semicircular recesses 130 and 131 formed respectively in the bottom wall of the upper block plate 124 and in a top wall 132 of the lower block plate 120. An eccentric stub 133 of the shaft 129 is received in a bore 134 formed in the L-shaped plate 118 and is connected in fixed assembly to an adjustment plate 136 which may be pivoted and locked by suitable means such as a threaded bolt 137.

Also mounted on the linking studs 121 and 122 are heavy-duty helical springs 138 and 139 which are bottomed at one end thereof on threaded sleeves 140 and bottomed at the other end thereof on an underside 141 of the lower block plate 120.

The heavy wall plates 54,54 of the press frame 51 are apertured respectively as at 142 to enable the shaft 113 of the blanket cylinder 57 to extend therethrough and the aperture is oversized to enable the shaft 113 to move freely therewithin as the blanket cylinder 57 is pivoted between the print and trip positions thereof.

The journal member 123 into which the linking studs 121 and 122 are threaded is mounted on an eccentric 143 of a shaft 144 extending between and journaled for rotation on the heavy wall plates 54,54. Extending from the shaft 144 and keyed at 146 for joint rotation therewith is an arm member 147 connected to a trip arm 148 through an intermediate linkage 149 pivotally connected at the ends thereof to the arm member 147 and the trip arm 148. The trip arm 148 is, in turn, pivotally mounted at 150 to a wall plate 54 of the press frame 51.

The trip arm 148 is biased in a counterclockwise direction as viewed in FIG. 10 by a heavy spring 151 which is bottomed at one end 1520 on the wall plate 54 and at an opposite end 1530 on the trip arm 148. A cam follower 1540 also projects from one side of the trip arm 148.

A series of cam members indicated respectively at reference numerals 152, 153, 154 and 155 which are mounted on one of the end walls 114 of the blanket cylinder 57 also comprise the blanket cylinder tripping mechanism. The cam members 152—155 are spaced 90° about the axis of the blanket cylinder and are spaced radially to engage the cam follower 1540 mounted on the trip arm 148 and move the trip arm 148 clockwise against spring 151 as the blanket cylinder 57 rotates. Thus for each revolution of the blanket cylinder 57 the trip arm 148 will, unless locked in "print" position by a hereinafter described solenoid, jog or pivot the eccentric shaft 144 a total of four times, during each of which periods the journal member 123 is moved slightly downwardly to pivot lever arms 109 and 110 in a manner to move the blanket cylinder 57 into a trip position or out of printing engagement with the plate cylinder 56. As each of the respective cams 152—155 rotates past the cam follower 1540 the spring 151 pivots the trip arm 148 to rock or rotate the eccentric shaft 144 in an opposite direction to move the blanket cylinder 57 back to a trip position with respect to the plate cylinder 56.

The cam surfaces 152—155 are constructed and arranged to printing the blanket cylinder 57 to a trip position just as each of the four corresponding color segments of the plate cylinder 56 and the blanket cylinder 57 enters the printing couple defined by the nip between the two cylinders, that is, in a gap between adjacent color segments. In order to maintain the blanket cylinder 57 in a print position for any one or all of the four color segments of the plate and blanket cylinders electric solenoid means indicated generally at reference numeral 156 are provided to lock the trip arm 148 in a print position as shown in FIG. 10. In the illustrated embodiment thereof, the electric solenoid means 156 comprises a rotary solenoid 157 mounted on the wall plate 54 and having a pivotal arm 158 which pivots between two positions as the rotary solenoid 157 is energized and deenergized. Mounted on the end of the arm 158 is a rotatable shaft 159 having an enlarged head 160 housed in an elongated groove 161 formed in a bushing 162. The bushing 162 is mounted on a shaft 163 which extends through and is journaled by the wall plate 54 and which has mounted on an opposite end thereof a locking arm 164.

Formed on the distal end of the locking arm 164 is a boss 166 which, in the energized or print, position of the rotary solenoid 157 engages an abutment wall 167 formed at the distal end of the trip arm 148 to prevent the trip arm from pivoting counterclockwise under the force of spring 151 as viewed in FIG. 10 to return the blanket cylinder 57 to the trip position thereof.

It is noted that the power of the rotary solenoid 157 need not be sufficient to move the trip arm 148 against the bias of spring 151 to a print position since the trip arm is moved to the print position by the cams 152—155 on the blanket cylinder 57 acting on the cam follower 154. Further, cams 152—155 are so constructed and arranged to move the abutment wall 167 off of the boss 166 at the high points of cams 152—155 to facilitate easy operation and turning of the rotary solenoid 157.

The solenoid 157 is wired to suitable switch means in the control panel 101 to pivot to the print position thereof shown in FIG. 10 and to maintain the blanket cylinder 57 in a print position for one or more of the four color segments or quadrants of the blanket cylinder. For example, if three colors are being printed, the rotary solenoid 157 will be deenergized so as to automatically rotate to the trip position thereof (a position where it is rotated counterclockwise from the position shown in FIG. 10) as that quadrant of the blanket cylinder corresponding with the omitted color rotates along with the plate cylinder 56 to form the printing nip or couple therebetween. As soon as that quadrant of the corresponding omitted color rotates beyond the printing couple the cam follower 1540 is tripped by the next succeeding cam 152—155 to move trip arm 148 to the print position and the rotary solenoid 157, which has just been energized is pivoted toward the abutment wall 167 to enable the trip arm 148 and the blanket cylinder 57 to be retained in the print position shown in FIG. 10 for the next three succeeding quadrants of the blanket cylinder 57.

In the print position thereof the blanket cylinder 57 is biased into printing engagement with the plate cylinder 56 by the heavy-duty helical springs 138 and 139 and the nuts 188 and washers 187 which are actually raised slightly off of the upper block plates 119. Thus a predetermined nip pressure is provided at the printing couple between the plate cylinder 56 and the blanket cylinder 57. This nip pressure can be selectively varied by adjustably rotating the eccentric shaft 129 by means of the adjustment plate 136 and then locking it in place with a locking nut 189. The use of springs 138 and 139 accommodates the slight movement of abutment wall 167 away from boss 166 at the high points of cams 152—155 and also precludes damage to the press that may otherwise result from an increased thickness in the plates on the plate cylinder 56.

It may be noted in FIG. 10 that a stop 191 which, in the illustrated embodiment, comprises an eccentric shaft is

mounted on wall plate 54 and comprises an offset stub 191*a* located in the pivotal path of travel of an adjacent side 148*a* the trip arm 148. By adjusting the angular disposition, of the shaft 191 and varying the position of the stub 191*a* the counterclockwise movement of the trip arm 148 is limited.

IMPRESSION CYLINDER TRIPPING MECHANISM

As noted, a tripping mechanism for the impression cylinder 58 is also provided in order to move the impression cylinder 58 to a trip position, that is, out of printing engagement with the blanket cylinder 57, during each of the four revolutions of the impression cylinder 58 which correspond to the four color segments of the blanket cylinder 57.

Referring to FIGS. 3 and 9, the impression cylinder tripping mechanism is indicated generally at reference numeral 168 and comprises an eccentric shaft 169 extending between and journaled on the wall plates 54, 54 of the press frame 51 and mounting thereon for joint rotation therewith the impression cylinder 58. Thus as the eccentric shaft 169 rotates or oscillates slightly back and forth the impression cylinder 58 is moved back and forth between the print and trip positions thereof with respect to the blanket cylinder 57.

The tripping mechanism 168 is more particularly characterized as comprising a pair of arms 170 and 171 pivotally mounted on the wall plate 54. Arms 170 and 171 are interconnected by a linkage 172 and the arm 170 is connected to the eccentric shaft 169 by a linkage 173.

Mounted on a shaft 174 on which arm 171 rotates is mounted a cam follower 176 situated in the path of travel of and arranged to be engaged by each of the cam members 152—155 as the blanket cylinder 57 is rotated. Thus in the gap between each of the color segments or quadrants of the blanket cylinder 57 the impression cylinder is moved to a print position. In order to maintain the impression cylinder 58 in print position for any one or more of the color quadrants of the blanket cylinder 57 an electric solenoid locking means 177 is mounted on the wall plate 54.

Referring to FIG. 9, the illustrated embodiment of the locking means 177 comprises an electric rotary solenoid 178 having a pivotal arm 179 enlarged at the end thereof as at 180 to be received in a slot 181 of a pivotal arm 182. An end wall 183 of arm 182 forms an abutment wall for engaging in face-to-face contact another abutment wall 184 formed on a flange 186 which rotates with the eccentric shaft 169. Thus the impression cylinder 58 is moved to a print position at the beginning of each revolution thereof and is maintained in such print position by actuation of the rotary solenoid 178 if the particular color to which that revolution corresponds is desired. If a color is to be omitted, the solenoid 178 is deenergized so as to permit the arm 179 to move to its trip position. As in the case of rotary solenoid 157 of the blanket cylinder tripping mechanism the power requirements of the rotary solenoid 178 need merely be sufficient to pivot the arm 179 since the abutment wall 184 is tripped out of abutting engagement with the end wall 183 by the action of cams 152— 155 against cam follower 176. The rotary solenoid 178 is, of course, suitably interconnected with the switching mechanism in the control panel 101 for automatic energization and deenergization thereof as the number of printed colors of the press is changed.

INKING SYSTEMS

As noted, the illustrated embodiment of the press 50 comprises four independent inking systems 69—72 for the four colors of the press. As shown in FIG. 15 each of the inking systems 69—72 has a generally wedge-shaped configuration in side elevation and since all of the wedges or inking systems are substantially identical with one another it is necessary that only one be described in detail.

Referring to the enlarged sectional view of the wedge-inking system 69 in FIG. 21 a total of four ink rolls 80—83 are disposed adjacent the periphery of the plate cylinder 56, such periphery being indicated by the dashed line at reference numeral 190. Ink rolls 80 and 81 engage a vibrator roll 84 and ink rolls 82 and 83 engage another vibrator roll 86. The vibrator rolls 84 and 86 are mounted respectively on shafts 193 and 194 which extend between and are journaled for rotation on the wall plates 54, 54 of the press frame 51. The ink roll 80 is rotatably mounted at the ends thereof on a pair of mounting plates situated respectively within the wall members 52 and 53 of the press frame 51, only one of which is shown in FIG. 21 at reference numeral 196. The mounting plate 196 is, in turn, rotatably mounted on the shaft 193 of the vibrator roll 84 so that the ink roll 80 can move about the periphery of the vibrator roll 84 while maintaining constant engagement therewith. Similarly ink roll 81 is rotatably mounted on a mounting plate 197 also journaled on the shaft 193 of the vibrator roll 84 whereby the ink roll 81 can also pivot or move about the periphery of the vibrator roll 84 while maintaining engagement therewith.

The ink rolls 80 and 81 are biased in the direction of the periphery 190 of the plate cylinder 56 by means of a pair of spring members 198 and 199 which are bottomed at one end against an adjustable abutment 200 mounted on a wedge-shaped plate 201 which in turn is mounted on one of the heavy wall plates 54, 54 of the press frame 51. The other end of the springs 198 and 199 are bottomed on their respective mounting plates 196 and 197. The ink rolls 82 and 83 are similarly mounted and are also biased in the direction of the plate cylinder periphery 190 by springs 198*a* and 199*a* respectively.

Also mounted on the wedge-shaped plate 201 are a pair of cam follower arms 202 and 203 which are journaled for pivotal movement on a pin 204. Rotatable disc-shaped urethane-covered cam followers 206 and 207 are mounted on the arms 202 and 203 adjacent the distal ends thereof.

A pair of toggle joints 208 and 209 interconnect the arms 202 and 203 with the mounting plates 196 and 197 of their respective ink rolls. For example, toggle joint 208 comprises a pair of linkages 210 and 211 pivotally connected to the mounting plates 196 and 197 and a pivot pin 212 mounted on the arm 202. The linkages 210 and 211 comprise turnbuckles for adjustably varying the distances between the ink rolls and the periphery or plates of the blanket cylinder 57 in the trip positions of the ink rolls.

Referring to FIGS. 13, 14 and 21 the cam followers 206 and 207 of each of the inking systems 69—72 are in radial alignment with one another to engage one of four axially spaced cam surfaces 212, 213, 214 and 215 formed at opposite ends of the plate cylinder 56. In other words the two cam followers 206 and 207 of each of the inking systems 69—72 engages and is moved radially with respect to a shaft 205 of the plate cylinder 56 on a corresponding one of the cam surfaces 212—215. As shown in FIG. 14 each of the cam surfaces 212—215 corresponds to one of the four color quadrants or segments of the plate cylinder indicated at reference numerals 73*a* —73*d*.

The configuration of each of the cam surfaces 212—215 is such as to enable its corresponding cam followers 206 and 207 to move radially inwardly to engage its corresponding ink rolls with its corresponding color quadrant of the plate cylinder 56 and to move its corresponding ink rolls radially outwardly away from the plate cylinder as the other color quadrants rotate therepast. As a consequence the ink rolls of each of the inking systems 69—72 engage only the particular plate on the plate cylinder which corresponds to such ink rolls.

Each of the cam followers 206 and 207 is provided with electric solenoid locking means for holding the cam followers and their corresponding ink rolls in a trip position out of engagement with their corresponding color quadrant of the plate cylinder 56 in the event that one or more of the colors is to be omitted. Referring to FIGS. 21 and 23, electric solenoid locking means are indicated generally at reference numerals 220 and 221 and may be more particularly characterized as comprising respectively an electric rotary solenoid 222 mounted on the wedge plate 201. The solenoid 222 has a

rotatable shaft **223** projecting therefrom and extending through the wedge plate **221**. Fixedly connected to the distal end of shaft **223** is a pivotal arm **224** which oscillates back and forth between two pivotal positions as the solenoid **222** is energized and deenergized.

The "trip" position of the pivot arm **224** is shown in the dashed lines indicated at reference numeral **224***a* in FIG. **21**. In this position the pivot arm is aligned with a shaft **226** on which the cam follower **206** is mounted on the arm **202**, thereby preventing the cam follower **206** from moving radially inwardly and preventing the ink rolls **80** and **81** from engaging their corresponding color quadrant of the plate cylinder **56**.

The cam surfaces **212—215** are constructed so as to slightly raise the cam follower shafts **226** off of the pivot arm **224** of their respective electric solenoid locking means **220** and **221**. As a result the rotary solenoids **222** can easily turn to pivot their respective pivot arms back to the print positions thereof as indicated at reference numeral **224** in FIG. **1** with minimal power requirements. The rotary solenoids **222** are, of course, interconnected to suitable switch means in the control panel **101** (FIG. **1**) to operate in suitable timed relation to the rotary solenoids **157** and **178** of the blanket cylinder tripping mechanism shown in FIG. **10** and the impression cylinder tripping mechanism illustrated in FIG. **9**. Consequently when it is desired to omit one or more of the four colors of the press **50** the electric rotary solenoids of the inking systems and the blanket and impression cylinder tripping mechanisms are energized and deenergized in timed relation to one another to maintain the ink rolls **80—83** of the inking systems corresponding to the omitted colors in trip positions and to maintain the blanket cylinder **57** and the impression cylinder **58** in trip positions during the required angles of rotation thereof and in proper sequence.

Each of the cam follower arms **202** and **203** is provided with a night latch to maintain its respective ink rolls out of engagement with the plate cylinder **56** during cleanup of the press. Referring to FIGS. **21** and **24** the night latches which are identified at reference numerals **216** and **217**, each comprise an eccentric shaft **218** journaled on plate **201** and rotatable to vary the disposition of a stud **218***a* extending therefrom to maintain its corresponding cam follower arm in a trip position without the necessity of energizing its respective rotary solenoid **224**. One end of the shaft **218** is formed in the shape of a nut **218***b* to facilitate turning of the shaft with a hand tool. A spring biased pawl **219** cooperates with a series of circumferentially spaced detents **219***a* to facilitate indexing of the shaft **218**.

As noted, the ink rolls **80—83** are in constant engagement with their corresponding vibrator rolls **84** and **86** and are frictionally driven thereby at a peripheral speed which corresponds to the peripheral speed of the plate cylinder **56**. Referring to FIGS. **14**, **15** and **16**, a power takeoff gear **228** is mounted on a side wall **229** of the plate cylinder **56** to mesh with a pinion gear **230** keyed to a shaft **231** which is journaled for rotation on one of the wall plates **54** of the press frame **51**. Also keyed to shaft **231** for joint rotation therewith is another gear **232** which meshes with a smaller gear **233** rotatably mounted on the wall plate **54**.

Trained around gear **233** is a drive chain **234** which is also trained around sprockets **236** (FIG. **21**) mounted on the vibrator rolls **84** and **86** of each of the inking systems **69—72**. Idler sprockets **237** are interposed between the vibrator rolls **84** and **86** of each of the inking systems **69—72** as shown in FIG. **15**, although it will be appreciated that the idler sprockets **237** of inking systems **69** and **70** are not shown in FIG. **15** in order to simplify the drawing. Another pair of idler sprockets **238** and **239** are mounted on the wall plate **54** adjacent gear **233**, sprocket **238** being mounted on a pivotally adjustable plate **240** for maintaining desired tension in the drive chain **234**.

The pitch diameters of gears **228**, **230**, **232** and **233** as well as the pitch diameters of the sprockets **237** are interrelated to maintain the peripheral speeds of the ink rolls **80—83** equal to the peripheral speed of the plate cylinder **56** and because of the direct driving relation between the plate cylinder **56** and the ink rolls **80—83** it will be appreciated that the speed of the ink rolls varies in direct proportion to variations in speed of the plate cylinder **56**.

The vibrator rolls **84** and **86** of the inking systems **69—72** are oscillated axially by another power takeoff system driven by the plate cylinder **56**. In FIG. **15** is shown gear **241** which is mounted on the wall plate **54** (FIG. **17**) and which meshes with the gear **228** mounted on the plate cylinder **56**. A shaft **242** which is keyed to gear **241** as shown at reference numeral **243** carries a sprocket **244** which is also keyed thereto at **246** for joint rotation with gear **241**.

A second drive chain indicated generally at reference numeral **247** is trained around the sprocket **244** as well as a pair of idler sprockets **248** and **249**. The drive chain **247** then extends from sprocket **249** over a pair of vibrator roll oscillator sprockets **250** and **251** which are keyed respectively to shafts **252** and **253** which are journaled for rotation on the wall plate **54** of the press frame **51**.

The vibrator roll oscillator sprocket **250** is interconnected with the vibrator rolls **84** and **86** of the inking systems **69** and **70**, and the oscillator sprocket **251** oscillates vibrator rolls **84** and **86** of the inking systems **71** and **72**. The drive arrangements of oscillator sprockets **250** and **251** are substantially identical and thus only one will be described in detail.

Referring to FIGS. **15**, **18** and **20** an enlarged shaft **254** is keyed at **256** to the shaft **253** and has formed in the periphery thereof a continuous groove **257** which provides a cam surface for axially oscillating a cam follower **258** projecting therein as the shaft **254** rotates in a single direction.

The cam follower **258** is connected to an externally splined shaft **259** which is mounted for axial movement in a complementarily internally splined bushing **260** mounted on the wall plate **54**. A spool member **261** is secured to one end of the splined shaft **259** and receives between a pair of spaced flanges **262** and **263** and an end portion **264** of a walking beam **266** which is mounted for pivotal movement on a pin **267** and a bracket **268** secured to the wall plate **54** of the press frame **51**.

Spaced on either side of the pivot pin **267** are a pair of oscillator rods **269** and **270** each of which has mounted thereon a driving spool **271** which receives a follower stud **272** projecting from the walking beam **266**. The rods **269** and **270** are connected to the shafts **193** and **194** of the vibrator rolls **84** and **86**, and as the walking beam **266** is pivoted in opposite directions about the pivot pin **267** the vibrator rolls **84** and **86** are oscillated axially to provide an even ink profile along the length of the ink rolls **80—83**.

As shown in FIG. **22**, the end of vibrator roll shaft **193** is keyed to a sleeve bearing **273** in a manner to provide relative axial movement of the shaft **193**. The sleeve bearing **273** is in turn pinned at **274** to the inner race **276** of a ball bearing **277**. The ball bearing **277** is mounted on the wall plate **54** of the press frame **51**.

INK FOUNTAIN SYSTEMS

Associated with the inking systems **69—72** are an equal number of ink fountain systems shown at reference numerals **90** in FIG. **2**. As previously noted, each of the ink fountain systems **90** comprises a fountain roll **91** and a transfer roller **92** which pivots between the fountain roll and its corresponding ink drum **87**.

Referring to FIGS. **25**, **26** and **27**, the fountain roll **91** of each of the ink fountain systems **90** is mounted on a shaft **278** supported on a shaft extension **279** which extends through an aperture **280** formed in an adjacent wall plate **54** of the press frame **51**. An outer end of the shaft extension **279** is journaled in a bearing member **281** mounted on a support plate **282**. The support plate **282** is secured in spaced relation to the wall plate **54** by means of a plurality of spacer bars **283** and **284**.

A portion of the periphery of the fountain roll **91** is in open communication with an ink receptacle or fountain which is

formed in part by a fountain plate or wiper blade **286** and which houses a supply of ink for application thereof to the fountain roll **91**. A series of adjustment knobs **287** are spaced along the face of the fountain plate **286** for controlling the thickness of the layer of ink or the ink profile on the fountain roll **91** as will be understood by those skilled in the art.

A fountain roll cam indicated generally at reference numeral **288** rotates in unison with the fountain roll **91** and comprises relatively rotatably movable cam portions **289** and **290** mounted respectively on the fountain roll shaft **278** and the shaft extension **279**. The cam portions **289** and **290** are axially aligned and comprise respectively an outer circularly shaped cam surface **291** radially inwardly extending cam surfaces **292**. Since the cam members **289** and **290** are relatively rotatable it will be appreciated that the overall effective cam surface of the cam **288** varies as the cam portions **289** and **290** are rotated relative to one another.

Disposed radially with respect to the cam **288** is a cam follower **293** mounted on a cam follower bracket **294** which is in turn mounted for pivotal movement on a shaft **296**. The bracket **294** is fixedly clamped to the shaft **296** for joint movement therewith by means of a threaded bolt **295** and the shaft **296** is rotatably biased to maintain the cam follower **293** in engagement with the surface of the cam **288** by means of a spring **297** bottomed on a lever arm **298** fixedly secured to the shaft **296**.

Also securely clamped to the shaft **296** are a pair of spaced mounting flanges **299** and **300** which journal the ends of a shaft **301** of the transfer roller **92**. Thus the transfer roller **92** and the cam follower **293** pivot jointly around the shaft **296**.

The cam follower **293** is mounted on a shaft **301** which extends through an aperture **302** formed in an adjustment plate **303** in face-to-face contact with the bracket **294** and slidable relative thereto. The shaft **301** continues to a slot **304** formed in the bracket **294** and is held on the bracket by means of a nut or the like at **306**.

Also extending through the bracket **294** and the adjustment plate **303** is an eccentric shaft **307** which comprises a stud **308** received in a cylindrical bore **309** and an eccentric member **310** housed in a bore **311** formed in the bracket **294**. As the eccentric shaft **307** is rotated the adjustment plate **303** moves with respect to the bracket **294**, thus moving the cam follower **293** relative to bracket **294**.

In the operative position of the cam follower **293** the transfer roller **92** engages the surface of the ink drum **87** as the cam follower **293** rides on the outer surface **291** of the cam **90**. As the cam follower **293** drops into a recess **309** between the adjacent inner cam surfaces **292**, **292** the bracket **294** pivots in a clockwise direction as viewed in FIG. **25**, so that the transfer roller **92** engages the periphery of the fountain roll **91**. Thus for each revolution of the fountain roll **91** the transfer roller **92** pivots back and forth into engagement with the ink drum **87** and with the fountain roll **91**.

The distance between the inner cam surfaces **292**, **292** of the cam portions **289** and **290** determines the size of the recess **3090** therebetween as well as the angle of rotation of the fountain roll **91** during which the transfer roller **92** is in engagement therewith. This in turn determines the thickness of the ink on the ink drum **87**.

Accordingly, in order to vary the size of the recess **3090** the cam portions **289** and **290** are rotated by means of an adjustment shaft **3100** which extends through the tubular shaft extension **279** and which has mounted thereon an adjustment knob **3111**. Thus the thickness of the ink on the ink drum **87** as well as on the ink rolls **80—83** of the inking systems **69—72** varies as a function of the indexing of the cam portions **289** and **290** of the respective cam member **288**.

The cam follower **293** may be adjusted on the bracket **294**, however, in order to maintain the transfer roller in an inoperative position, at which it is maintained in constant engagement with the fountain roll **91**, thereby precluding the transfer of ink to the ink drum **87**.

In order to adjust the cam follower **293** to an inoperative position the eccentric shaft **307** may be rotated by means of a rod **312** which extends through an aperture **313** formed in the wall plate **54** and which is journaled in a bearing member **314** mounted in the support plate **282**. A knob **316** is mounted on the rod **312** for rotating the eccentric shaft **307** to move the cam follower **293** between the operative and inoperative positions thereof.

Generally, the cam follower **293** is adjusted to the inoperative position thereof during "cleanup" of the press during which the ink is removed from the ink rolls, the vibrator rolls, the doctor rolls and the ink drums.

The present invention also contemplates the provision of means for maintaining the transfer roller **92** in engagement with the ink drum **87** during periods when one or more of the colors of the press is being omitted, thereby precluding the transfer of ink from the pertinent fountain roll **91** to its corresponding ink drum **87**. Accordingly there is provided an electric rotary solenoid **317** mounted on a fountain base plate **318** and having a pivotal arm **319** extending from a rotatable shaft **320** thereof. Extending from the arm **319** at the distal end thereof is a shaft **321** which slides in a slot **322** formed in a rocker arm **323**. The rocker arm **323** is mounted for pivotal movement on a stationary shaft **324** and includes a finger **326** pivotal into abutting engagement with an abutment boss **327** formed on the bracket **294**.

Thus as the solenoid **317** rotates in one direction the finger **326** of the rocker arm **323** engages the abutment boss **327** for preventing the bracket **294** from rotating clockwise as viewed in FIG. **25** and for maintaining the transfer roller **92** in engagement with the ink drum **87**. Rotation of the rotary solenoid **317** in an opposite direction moves the finger **326** out of the path of travel of the abutment boss **327**, thereby enabling the bracket **24** to again pivot in a clockwise direction to move the transfer roller **92** into engagement with the fountain roll **91**.

Once again, in order to reduce the power requirements of the rotary solenoids **317** as the cam follower **293** rides on the outer surface **291** of the cam **288** the abutment boss **327** is moved slightly off of the finger **326**, thereby enabling the rocker arm **323** to be pivoted easily as the rotary solenoid **317** is energized and deenergized. This solenoid is also wired to the main control panel **101** (FIG. **1**) to operate in timed relation with the electric solenoids **156** and **177** of the blanket cylinder and impression cylinder tripping mechanisms during such periods as one or more of the colors of the press is being omitted.

DAMPENING SYSTEMS

Referring to FIGS. **1**, **2** and **28—35**, the dampener rolls **93** and **94** as well as the vibrator roll **96** of each of the dampening systems **76—79** are mounted on the press frame **51** similarly to the ink rolls **80—83** of each of the inking systems **69—72**, whereas the fountain roll **97** and the transfer roller **98** of each of the dampening system **76—79** are mounted on a door frame **329** situated at the front open side **59** of the press frame **51**. The door frame **329** is pivotally mounted at one side **330** thereof to the wall member **52** by means of a pair of hinges **331** and **332**. The door frame can be locked in a closed position by means of a clamp **333** mounted on an opposite side **334** of the door frame which cooperates with a rocking flange **336** mounted on the press frame **51**. The fountain rolls **97** and transfer rollers **98**, therefore, can be swung away from their associated vibrator rolls **96** and dampening rolls **93** and **94** to facilitate cleaning and maintenance operation and accessibility of the vibrator and dampening rolls as well as the entire adjacent portion of the plate cylinder **56**.

The door frame **329** comprises a pair of spaced vertical members **337** and **338**, four mounting plates **339—342** extending between vertical member **337** and the side **330** of the frame and four other mounting plates **343—346** extending between the vertical member **338** and the other side **334** of the frame **329**.

The fountain roll 97 of each of the dampening systems 76—79 is journaled on a pair of spaced journal members 347 and 348 connected in fixed assembly to a horizontally aligned pair of the mounting plates 339—346. A fountain 349 for receiving a supply of water is disposed directly below the fountain roll 97 and the transfer roller 98 is mounted on a rocker arm 350 pivotally mounted on a shaft 351 which is mounted on a fixed axis between a corresponding horizontally aligned pair of base plates 339—346.

The fountain rolls 93 and 94 as well as the vibrator roll 96 of each of the dampening systems 76—79 are mounted on the press frame 51 in a manner similar to the mounting arrangement of the ink rolls 80—83 of each of the inking systems 69—72 and thus a detailed description of this mounting arrangement will not be repeated herein.

It is noted, however, that the fountain rolls 93 and 94 of each of the dampening systems 76—79 are mounted respectively on plate members connected to arms 352 and 353 pivotally mounted on a shaft 354. Rotatable cam followers 356 and 357 are mounted on the distal ends of arms 352 and 353 and engage respectively the particular one of the cam surfaces 212—215 on the plate cylinder 56 which corresponds to its respective color quadrant of the plate cylinder 56. Thus the cam followers 356 and 357 of each of the dampening systems 76—79 engage the same one of the cam surfaces 212—215 which is engaged by the cam followers 206 and 207 of the corresponding one of the inking systems 69—72.

The transfer rollers 98 are pivoted back and forth between the vibrator rolls 96 and the fountain rolls 97 by means of the rocking action of the rocker arm 350. Each of the rocker arms 350 is pivoted independently of the rocker arms of the other dampening systems.

Associated with each of the rocker arms 350 is a cam follower arm 358 mounted for slidable movement in an axial direction on a pair of bearing members 359 and 360. A cam follower 361 is mounted at the radially inner end of each of the cam follower arms 358 and engages that one of the cam surfaces 212—215 of the plate cylinder 56 that is engaged by its corresponding fountain roll cam follower 356 and 357. Each of the cam followers 361 is biased into engagement with its corresponding cam surface by means of a spring 362. A radially outer end 363 of each of the cam follower arms 358 abuts its corresponding rocker arm 350 and another spring 363 (FIG. 29) is associated with each of the rocker arms 350 to maintain a pivotal bias thereof into engagement with the end 363 of the cam follower arm 358.

It will thus be appreciated that each of the transfer rollers 98 of the dampening systems 76—79 moves back and forth between its corresponding vibrator roll 96 and fountain roll 97 once for each revolution of the plate cylinder 56, and that the angle of rotation of the plate cylinder 56 during which each of the cam followers 98 engages its corresponding vibrator roll 96 and fountain roll 97 is constant regardless of the speed of the plate cylinder 56.

Unlike the application of ink to the ink rolls, the optimum amount of water applied to the dampener rolls varies with the speed of the plate cylinder 56. This is as a result of the very thin layer of water which is applied to the plates of the plate cylinder as well as to the variation in the rate of evaporation of water as contrasted with ink.

For any given speed of rotation of the plate cylinder 56 an optimum amount of water is transferred from the fountain roll 97 to the vibrator roll 96 of each of the dampening systems 76—79. As the speed of rotation of the plate cylinder 56 increases a greater amount of water should be transferred to the vibrator rolls 96 per revolution of the plate cylinder but this increase in water should not be in direct proportion to the increase of the speed of the plate cylinder. This is because the amount of water evaporated from the vibrator rolls 96 during one revolution of the plate cylinder 56 decreases as the speed of the plate cylinder increases.

It is known in the prior art to vary the amount of water applied to the vibrator roll per unit of time as a function of variations in plate cylinder speed. Generally this has been accomplished by varying the number of degrees of the angle of rotation of the plate cylinder during each revolution of the plate cylinder during which the transfer roller is in contact with the fountain roll. Most prior art arrangements accomplish such compensation by employing an adjustable cam and cam follower arrangement which is manually adjusted in accordance with changes in speed of the plate cylinder.

The present invention contemplates the provision of means for such nonlinear compensation without varying the degrees of angle of rotation of the plate cylinder during which the transfer rollers are in engagement with their corresponding fountain rolls. Instead, while the speed of the vibrator rolls 96 and the dampener rolls 93 and 94 varies in direct proportion to variations in the speed of the plate cylinder, the speed of the fountain rolls 97 varies nonlinearly with respect to changes in plate cylinder speed.

Referring to FIG. 15, the drive chain 247 which effectively oscillates the vibrator rolls of the inking systems 69—72 also serves to rotate the ink fountain rolls 91 at a speed directly proportional to the speed of the plate cylinder 56. Thus each of the sprocket-turned shafts 252 and 253 has mounted thereon for joint rotation a gear 363 which engages a worm 364 formed on a rotatable shaft 366. Two other worms 367 and 368 are also formed on shafts 366 to turn gears 369 and 370 mounted respectively on the shafts of the fountain rolls 91, 91. As a consequence, the ink fountain rolls 91 are always rotated at a speed which varies directly with variations in the speed of the plate cylinder 56.

The vibrator rolls 84 and 86 of the dampening systems 76—79 are also driven at a speed which varies directly with variations in plate cylinder speed. Note that driven chain 234 (FIG. 15) is trained around sprockets 371 mounted for joint rotation on the shafts of the vibrator rolls 84 and 86.

The fountain rolls 97, however, of the dampening systems 76—79 are rotated respectively by means of individual variable speed electric motors 372—374 mounted on the plates 339—342 of the door frame 329 The motors 372—374 are connected to their corresponding fountain rolls 97 through gear boxes indicated at reference numerals 376.

The schematic shown in FIG. 36 illustrates means for varying the speed fountain rolls of the dampener systems nonlinearly with respect to variations in plate cylinder speed The plate cylinder is indicated diagrammatically at reference character 56*a* and one of the dampener system fountain rolls is indicated at 97*a*. Reference character 61*a* indicates the variable speed motor which drives the plate cylinder 56*a* and reference character 372*a* indicates one of the variable speed motors of the dampener systems 76—79.

A pair of speed controls 376 and 377 are connected respectively to motors 61*a* and 372*a* and are interconnected to provide a variable proportionality factor between the speeds of the motors as the speed of the motor 61*a* is varied by means of a controller or the like at 378. Such nonlinear speed controls are known in the art and thus need not be described in greater detail. It will be apparent that this arrangement provides automatic speed compensation between the speed of the plate cylinder 56 and the speed of the dampener system fountain rolls 97.

Referring to FIG. 31, one end of each of the vibrator rolls 96 of the dampening systems 76—79 is journaled for axial oscillating movement in one of the wall plates 54 as indicated at reference numerals 379 and 380. Extending from the wall plate 54 is a bifurcated member 381 mounting a pair of oppositely facing rollers 382 and 383 which project into helical grooves 384 formed in collars 386 connected in fixed assembly to the shafts of the vibrator rolls 96, 96. Thus as the vibrator rolls are rotated they are oscillated axially by the camming action of the rollers 382 and 383 against the walls of the helical grooves 384.

I claim:

1. A multicolor rotary offset printing press comprising:

A plate cylinder having a plurality of circumferentially spaced color segments therearound;

a blanket cylinder in nip-defining relationship with said plate cylinder and having a plurality of circumferentially spaced color segments therearound corresponding respectively to the color segments of said plate cylinder;

an impression cylinder in nip-defining relationship with said blanket cylinder;

variable speed drive means for rotating said cylinders jointly;

speed control means connected to said plate cylinder drive means for varying the speed of said plate cylinder, means for supporting and tripping said blanket cylinder out of engagement with said plate cylinder to a trip position and then back into engagement therewith to a print position as each pair of corresponding color segments is rotated into the nip between said plate and said blanket cylinders;

means for holding said blanket cylinder in the trip position thereof as any preselected pair of said corresponding color segments rotates through the nip between said plate and blanket cylinders;

means for supporting and tripping said impression cylinder out of engagement with said blanket cylinder to a trip position and then back into engagement therewith to a print position as each of said color segments of said blanket cylinder is rotated into the nip between said impression and said blanket cylinders;

means for holding said impression cylinder in the trip position thereof as any preselected color segment of said blanket cylinder rotates through the nip between said impression and said blanket cylinders;

a plurality of inking systems corresponding in number to the number of color segments arranged around a portion of the periphery of said plate cylinder, each of said inking systems comprising an ink roll movable into and out of engagement with said plate cylinder and means for moving said ink roll into engagement only with its corresponding color segment on said plate cylinder during rotation thereof; and

a plurality of dampening systems arranged around another portion of the periphery of said plate cylinder, each of said dampening systems comprising a dampener roll, a vibrator roll, a fountain roll and a transfer roller pivotal back and forth between said vibrator and said fountain roll, means for rotating said vibrator and dampener rolls at a peripheral speed corresponding to the peripheral speed of said plate cylinder, means operatively interconnecting said transfer roller and said plate cylinder for pivoting the transfer roller alternately into engagement with said fountain roll and said dampener roll during preselected angles of rotation of said plate cylinder, variable speed drive means for rotating said fountain roll, and speed control means connected to said fountain roll drive means and to said plate cylinder drive means to drive said fountain roll at a speed which varies nonlinearly as a function of variations in the speed of the plate cylinder.

2. The printing press as defined in claim 1 wherein said means for holding said blanket cylinder and said impression cylinder in the trip positions thereof comprise, a pair of independently operable electric solenoid means engageable with said blanket cylinder and said impression cylinder supporting and tripping means, respectively,

3. The printing press as defined in claim 1 and including, a plurality of circumferential cam surfaces on said plate cylinder corresponding respectively to each of said color segments; said transfer roller pivoting means of said dampening systems comprising respectively cam follower means engageable with only one of said cam surfaces for driving relation therebetween.

4. The printing press as defined in claim 1 and including, a plurality of circumferential cam surfaces on said plate cylinder corresponding respectively to each of said color segments, said ink roll moving means of said inking systems comprising respectively cam follower means engageable with only one of said cam surfaces for driving relation therebetween.

5. The printing press as defined in claim 1 and including, a press frame, and door means pivotally mounted on said frame adjacent said another portion of said plate cylinder for swingable movement therefrom, said fountain roll, said transfer roller and said fountain roll variable speed drive means of each of said dampening systems being mounted on said door means and said dampener rolls and said vibrator rolls being mounted on said frame.

6. A multicolor offset printing press comprising a press frame; a plate cylinder having a plurality of circumferentially spaced color segments therearound mounted on said frame; a blanket cylinder in nip-defining relationship with said plate cylinder and having a plurality of circumferentially spaced color segments therearound corresponding respectively to the color segments on said plate cylinder; an impression cylinder in nip-defining relationship with said blanket cylinder; a plurality of inking systems on said frame corresponding in number to the number of color segments arranged around a portion of the periphery of said plate cylinder, each inking system having means for inking only a selected color segment on said plate cylinder during rotation thereof; means for rotating said plate cylinder at a speed which corresponds to the speed of said blanket cylinder; means for journaling said blanket cylinder on said frame for movement between first and second positions at which said blanket cylinder is moved into and out of printing engagement with said plate cylinder; and means for selectively and repeatedly tripping one or more of the said color segments on said blanket cylinder into and out of printing engagement with one or more of the color segments on said plate cylinder which correspond thereto while said press is operating at its normal operating speed to thus enable printing from any one or any combination of the said plurality of plates.

7. A multicolor rotary offset printing press as defined in claim 6 wherein an eccentric shaft is rotatably mounted on said frame; said impression cylinder being mounted on said eccentric shaft for relative rotation therewith; and means for selectively rotating said eccentric shaft in opposite directions to selectively and repeatedly move said impression cylinder between a print position and a trip position relative to one or more of the color segments on said blanket cylinder as a function of the angular disposition of said blanket cylinder as it rotates at its normal operating speed.

8. The printing press as defined in claim 7 wherein said eccentric shaft rotating means comprises, a plurality of cam members mounted on said blanket cylinder for rotation therewith, and means including cam follower means disposed in the path of travel of said cam members and operatively connected to said eccentric shaft for rotation thereof as each of the cam members engages said cam follower means.

9. A multicolor rotary offset printing press as defined in claim 6 wherein said plate cylinder, blanket cylinder and impression cylinder are situated on spaced parallel axes with said plate cylinder being mounted on said frame for rotation on a fixed axis; means for journaling said impression cylinder; said blanket cylinder tripping means and an impression cylinder tripping means mounting said blanket cylinder journaling means and said impression cylinder journaling means on said frame, each of said tripping means being selectively and repeatedly movable between two positions for moving respectively said blanket cylinder between a print position and a trip position with respect to said plate cylinder and said impression cylinder between a print position and a trip position with respect to said blanket cylinder; driving means for jointly rotating said cylinders; and means driven by said driving means and operative to selectively and repeatedly move said tripping means respectively between said two positions thereof as a function of the radially angular disposition of said blanket cylinder upon rotation thereof at normal operating speeds.

10. The printing press as defined in claim 9 wherein each of said tripping means comprises an eccentric shaft mounted on said frame and said last named means comprises cooperating

cam members and cam follower means mounted respectively on one of said cylinders and on said tripping means for rotating said eccentric shafts in response to rotation of said one cylinder.

11. The printing press as defined in claim **9** and including, first and second electrically operated means mounted on said frame and engageable with said last named means for selectively independently locking said last named means in the print positions thereof.

12. The printing press as defined in claim **11** wherein said electrically operated means comprises electric solenoid means.

13. The printing press as defined in claim **11** wherein said electrically operated means comprises electric rotary solenoid means.

14. The printing press as defined in claim **6** wherein said means for journaling comprises:

bearing means at the ends of said blanket cylinder;

guide means mounting said bearing means on said frame for guiding said bearing means between said first and second positions;

means biasing said bearing means towards said second position; and

means operatively interconnecting said blanket cylinder and said bearing means for moving said bearing means to said first position as a function of the angular disposition of said blanket cylinder as it rotates.

15. The printing press as defined in claim **14** wherein said bearing moving means comprises:

plural cam members spaced angularly about the axis of and mounted on said blanket cylinder; and

cam follower means located in the path of travel of said cam members for engagement therewith as said blanket cylinder rotates and operatively connected to said bearing means for moving said bearing means to said first position as said cam members respectively engage said cam follower means.

16. The printing press as defined in claim **14** wherein said bearing means comprises an elongated lever arm and said guide means comprises a pin pivoting said lever arm to said frame at one end of the arm.

17. The printing press as defined in claim **16** wherein said biasing means and said bearing moving means operatively engage said lever arm at the opposite end of the arm.

18. The printing press as defined in claim **17** wherein said bearing moving means comprises:

a trip block movable in one direction against said lever arm to move said blanket cylinder into printing engagement with said plate cylinder and movable in an opposite direction away from said lever arm to enable said blanket cylinder to move out of printing engagement with said plate cylinder;

an eccentric shaft mounted on said frame; and

means interconnecting said trip block and said eccentric shaft for moving said trip block in said opposite directions in response to rotation of said eccentric shaft in opposite directions, and means operatively interconnecting said eccentric shaft and said blanket cylinder for rotating said shaft in said opposite directions of rotation as a function of rotation of said blanket cylinder.

19. The printing press as defined in claim **18** wherein said eccentric shaft rotating means comprises spring means for biasing said shaft in one of said opposite directions of rotation to move said trip blocks away from said lever arm.

20. The printing press as defined in claim **18** wherein said eccentric shaft rotating means comprises:

a plurality of cam members on said blanket cylinder in radially angularly spaced relation with one another; and

a cam follower in the path of travel of said cam members and operatively connected to said eccentric shaft to be engaged and moved in one direction by each of said cam members as said blanket cylinder rotates to effect movement of said blanket cylinder to a print position thereof, and means biasing said cam follower in an opposite direction to effect movement of said blanket cylinder to a trip position thereof.

21. The printing press as defined in claim **20** and including, means for selectively locking said cam follower against movement in said opposite direction to maintain said blanket cylinder in the print position thereof.

22. The printing press as defined in claim **21** wherein said locking means comprises, an abutment wall formed on said cam follower, and an electric solenoid mounted on said frame and having a member movable into and out of engagement with said abutment wall upon energization and deenergization thereof.