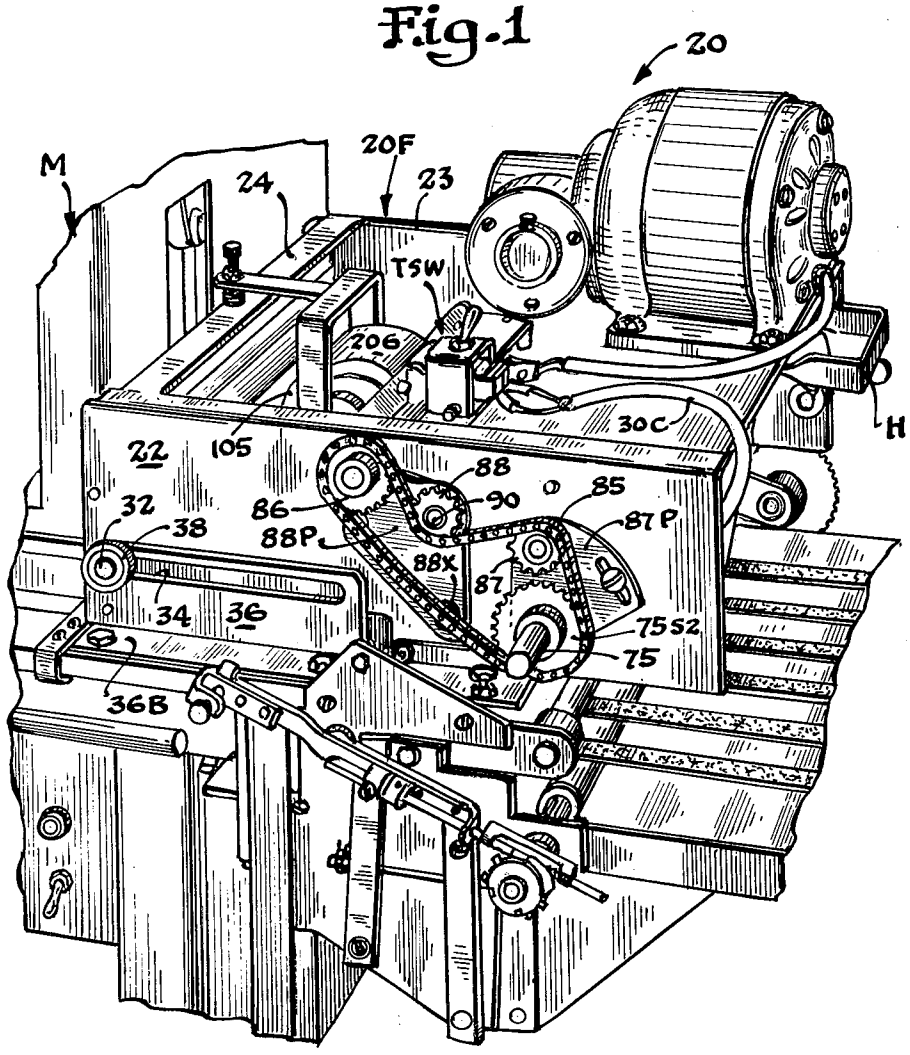
June 4, 1963 J. H. GRUVER 3,092,021

PRINTING MACHINES

Filed April 25, 1960 10 Sheets-Sheet 1

Fig. 1



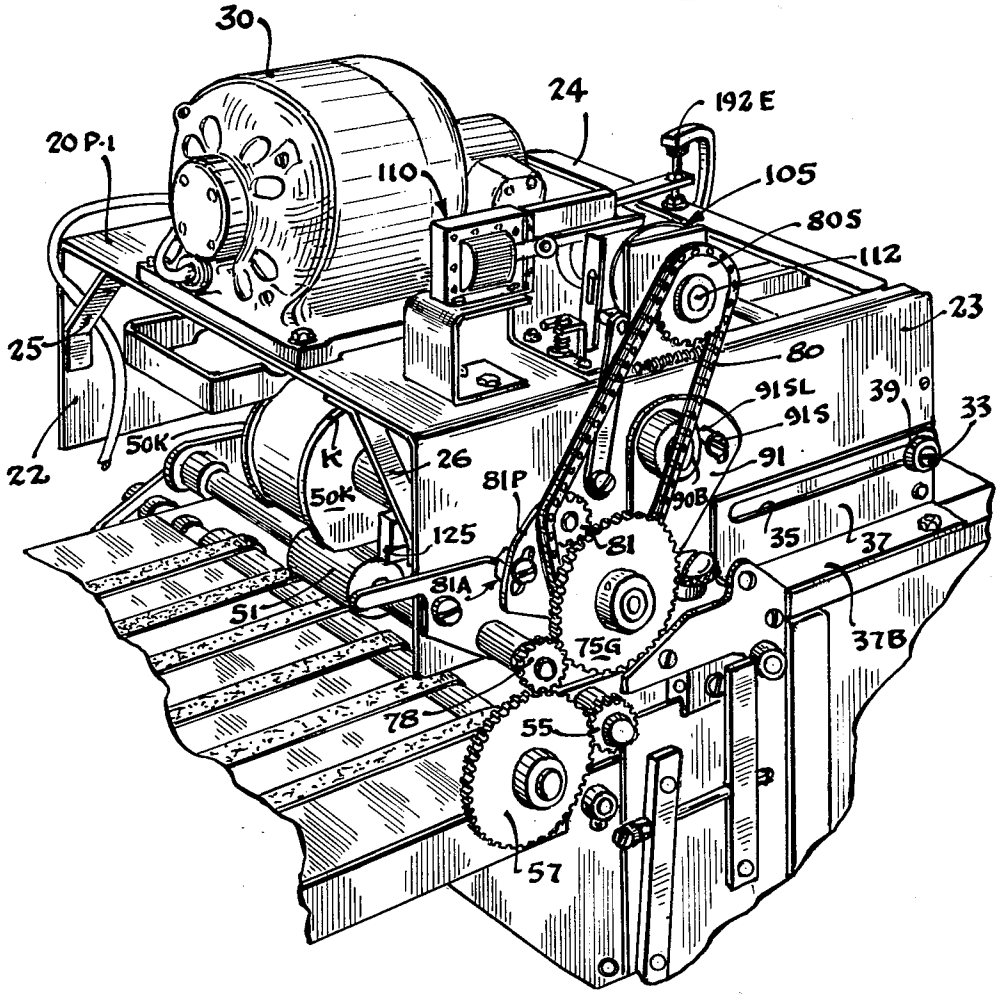
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June 4, 1963 J. H. GRUVER 3,092,021

PRINTING MACHINES

Filed April 25, 1960 10 Sheets-Sheet 2

Fig. 2



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June 4, 1963 J. H. GRUVER 3,092,021

PRINTING MACHINES

Filed April 25, 1960 10 Sheets-Sheet 3

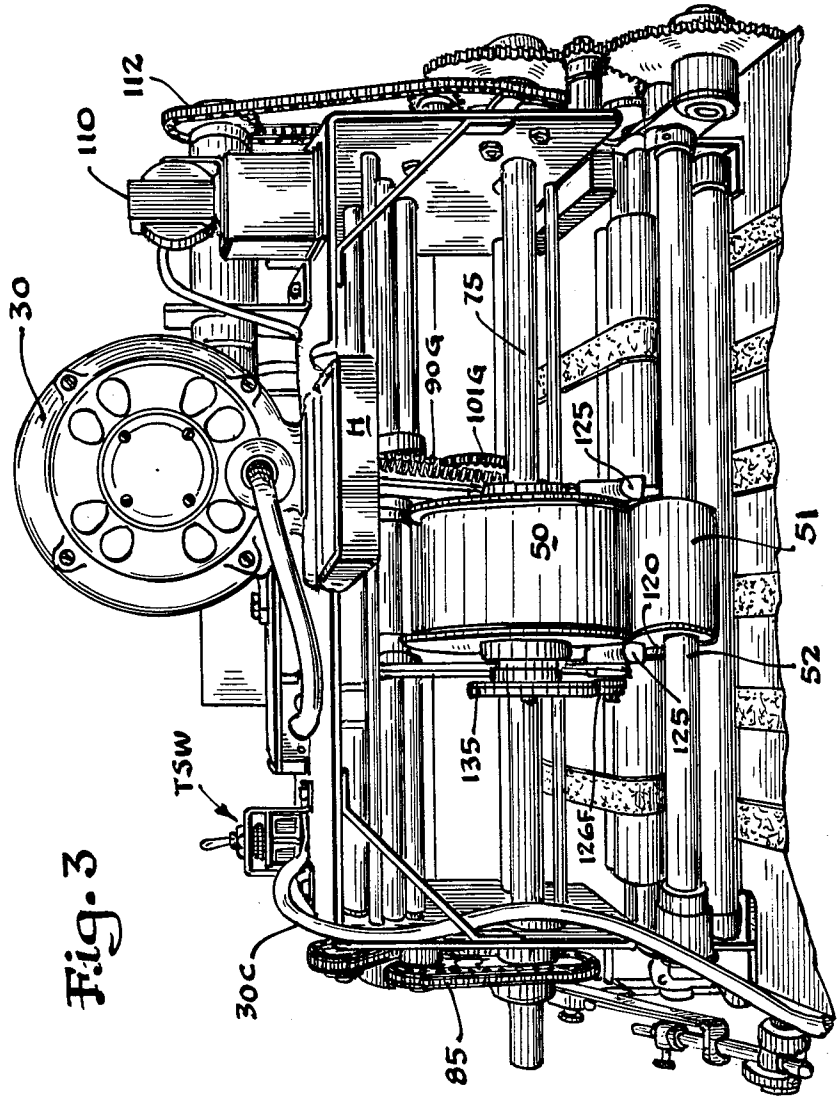


Fig. 3

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June 4, 1963 J. H. GRUVER 3,092,021

PRINTING MACHINES

Filed April 25, 1960 10 Sheets-Sheet 4

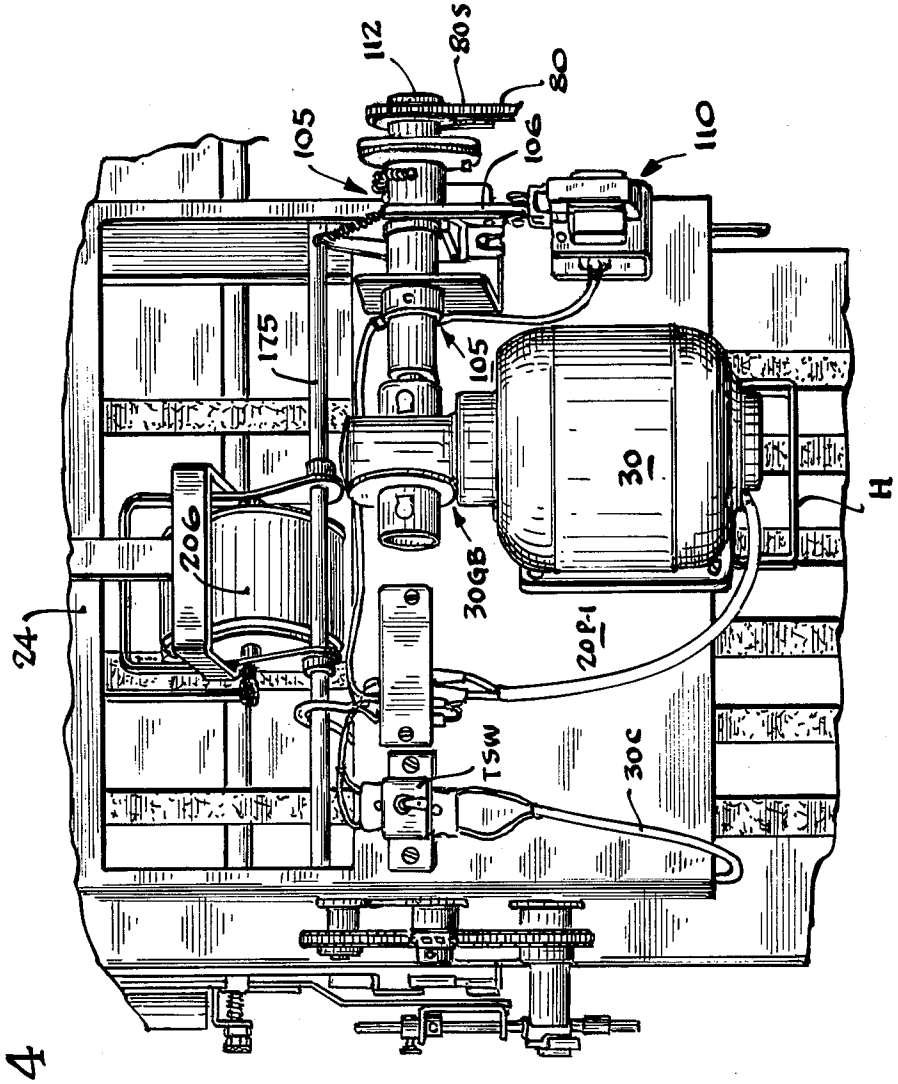


Fig. 4

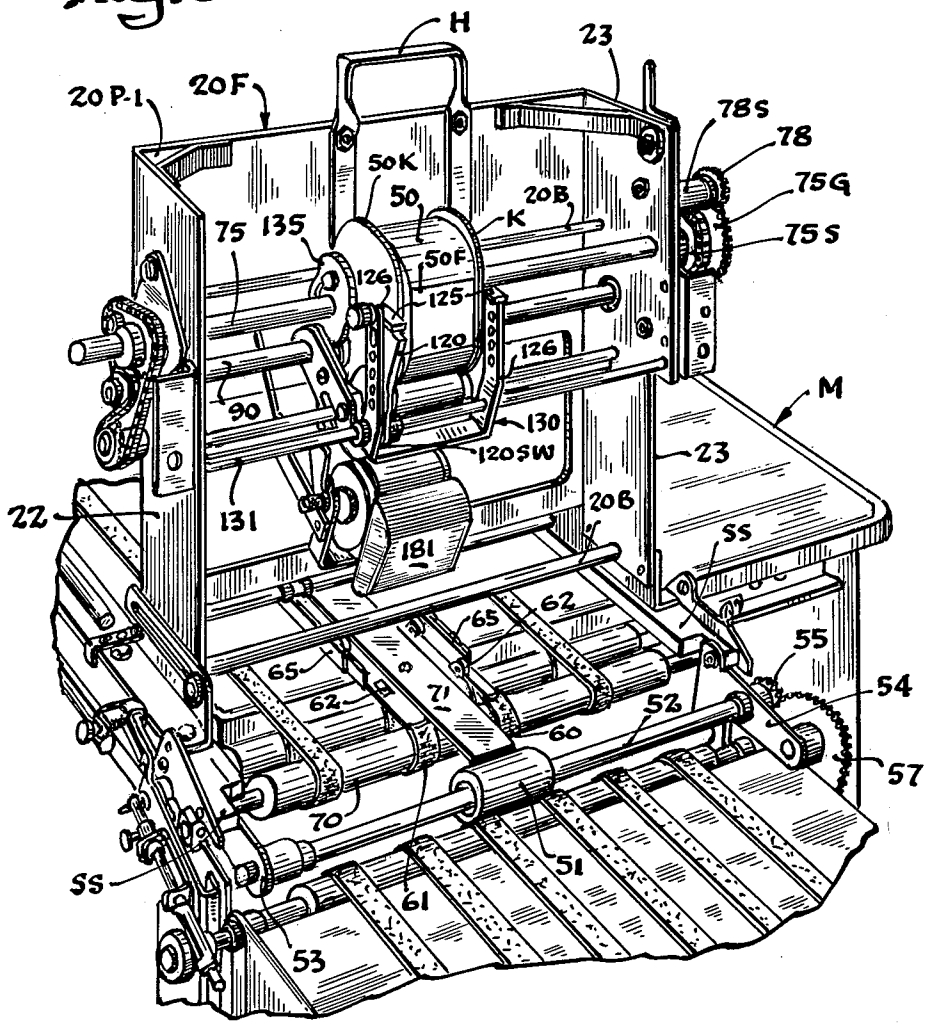
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June 4, 1963 J. H. GRUVER 3,092,021

PRINTING MACHINES

Filed April 25, 1960 10 Sheets-Sheet 5

Fig. 5



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June 4, 1963 J. H. GRUVER 3,092,021

PRINTING MACHINES

Filed April 25, 1960 10 Sheets-Sheet 6

Fig. 7A

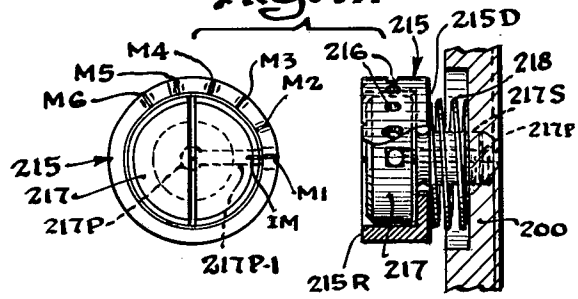


Fig. 6

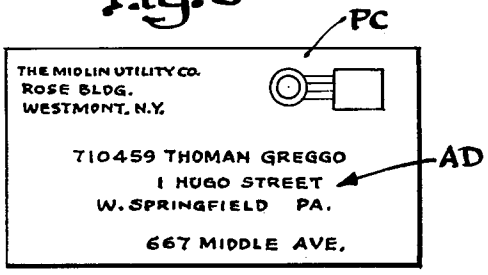


Fig. 6A

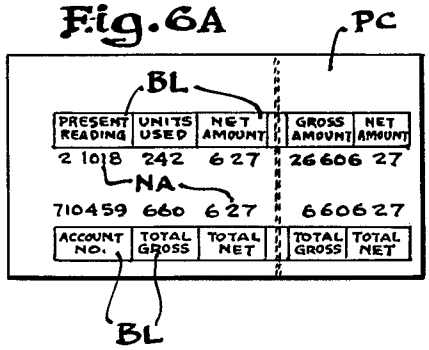


Fig. 7

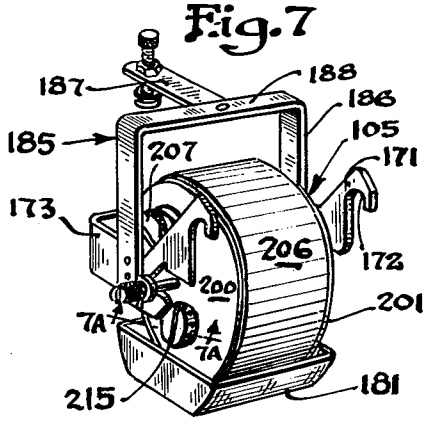
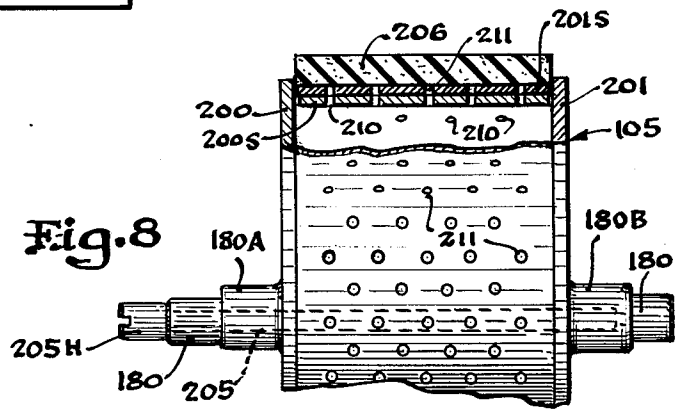


Fig. 8



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June 4, 1963 J. H. GRUVER 3,092,021

PRINTING MACHINES

Filed April 25, 1960 10 Sheets-Sheet 7

Fig. 9

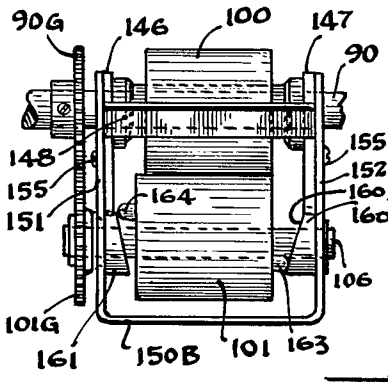


Fig. 10

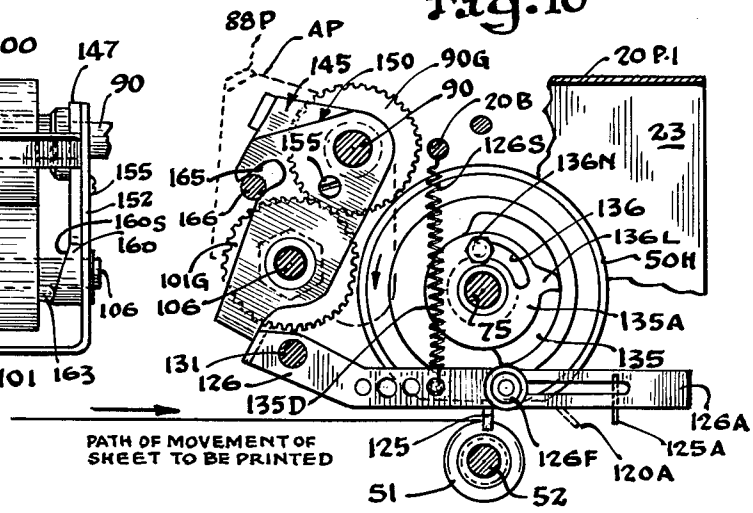
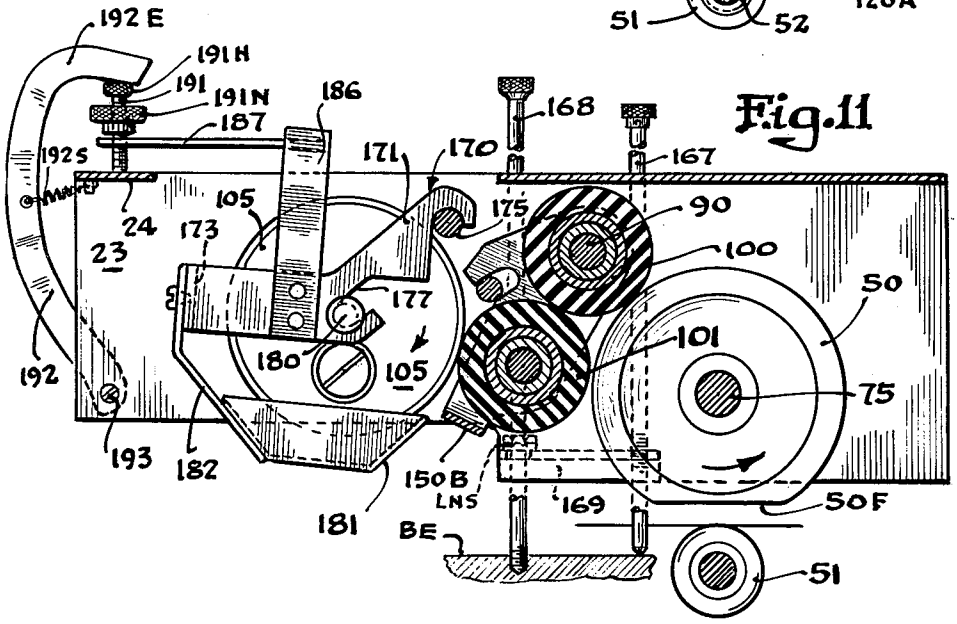


Fig. 11



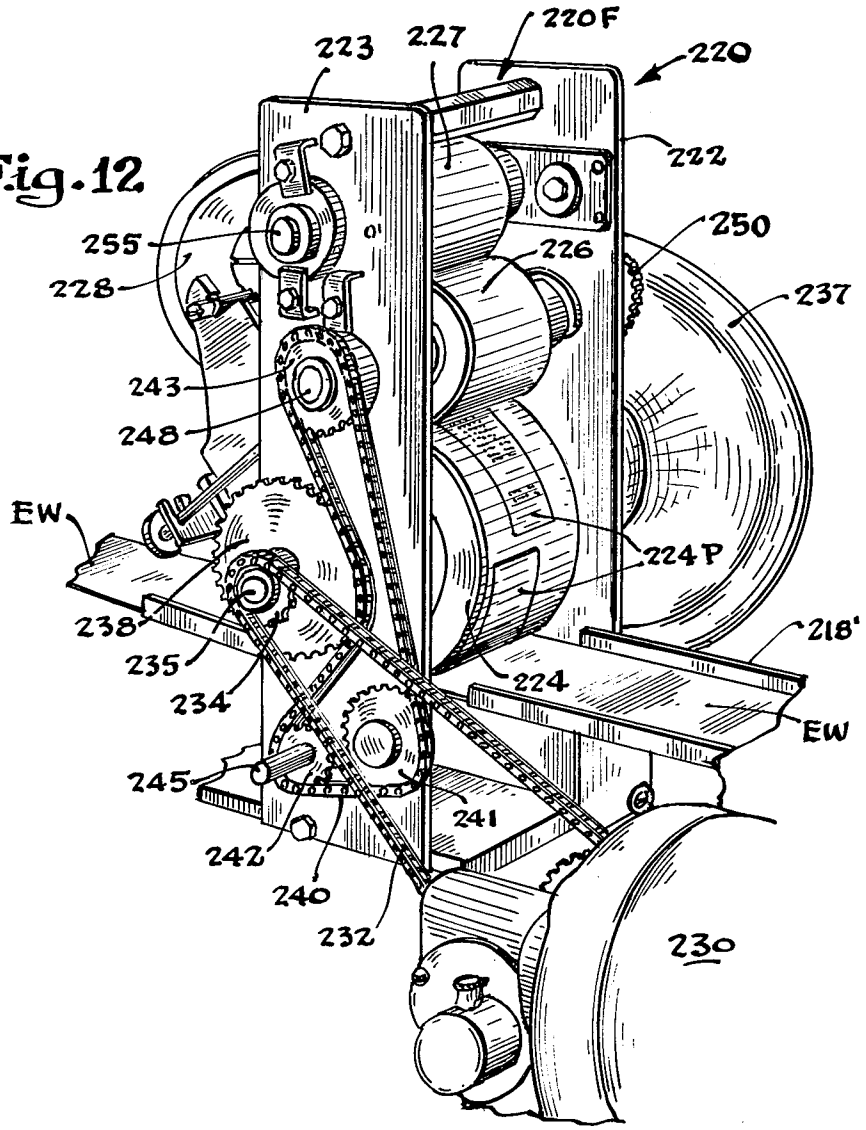
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June 4, 1963 J. H. GRUVER 3,092,021

PRINTING MACHINES

Filed April 25, 1960 10 Sheets-Sheet 8

Fig. 12



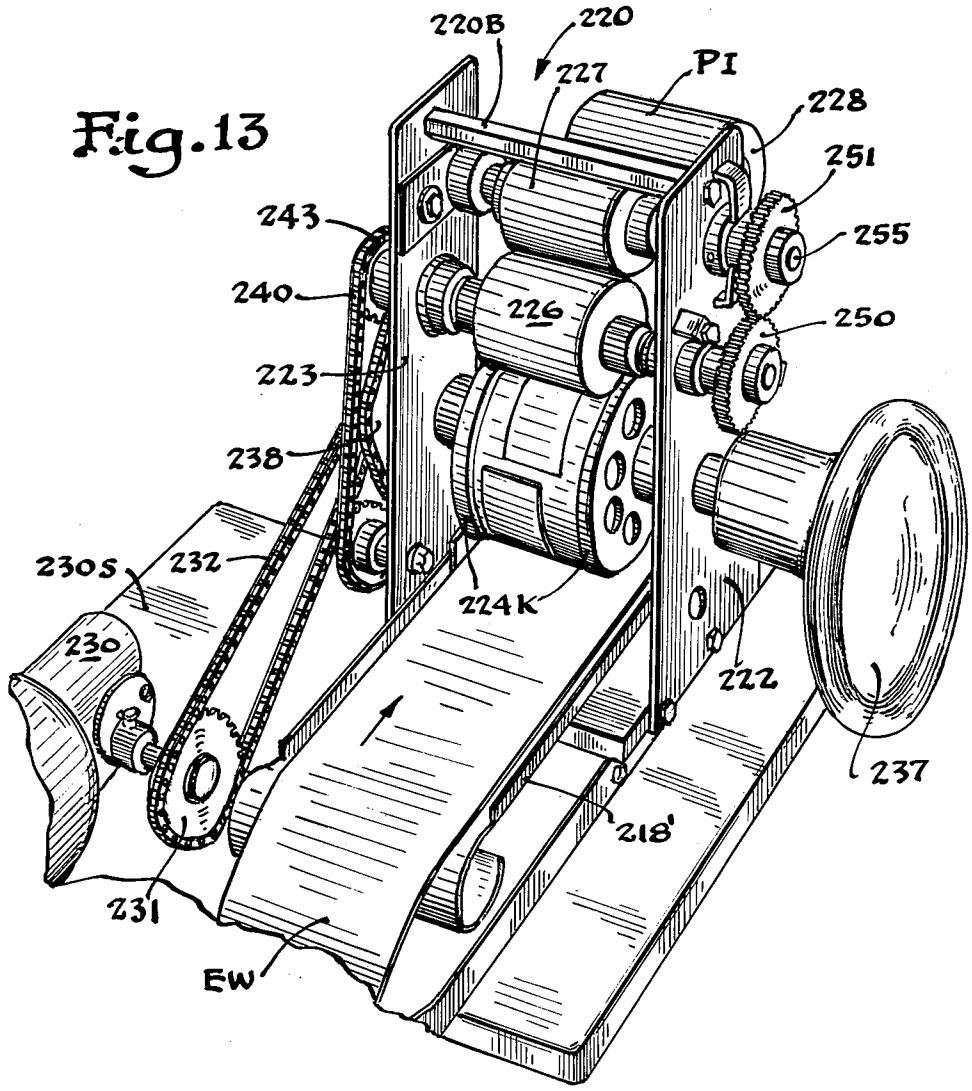
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June 4, 1963 J. H. GRUVER 3,092,021

PRINTING MACHINES

Filed April 25, 1960 10 Sheets-Sheet 9

Fig. 13



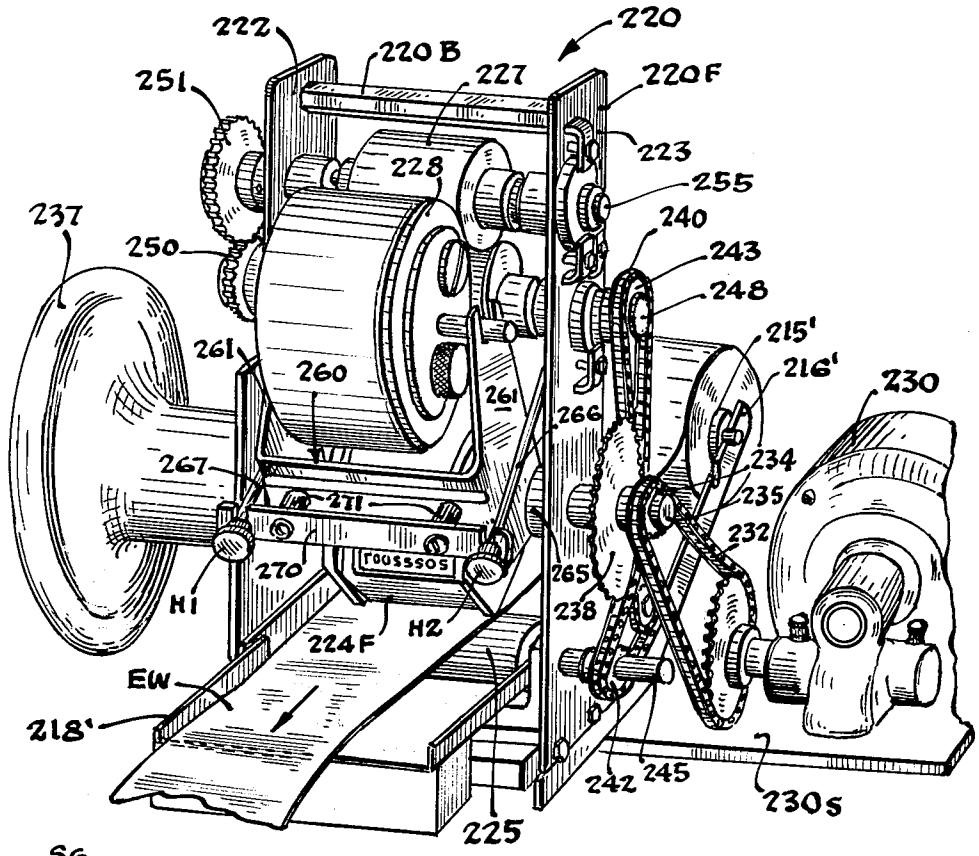
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June 4, 1963 J. H. GRUVER 3,092,021

PRINTING MACHINES

Filed April 25, 1960 10 Sheets-Sheet 10

Fig. 14



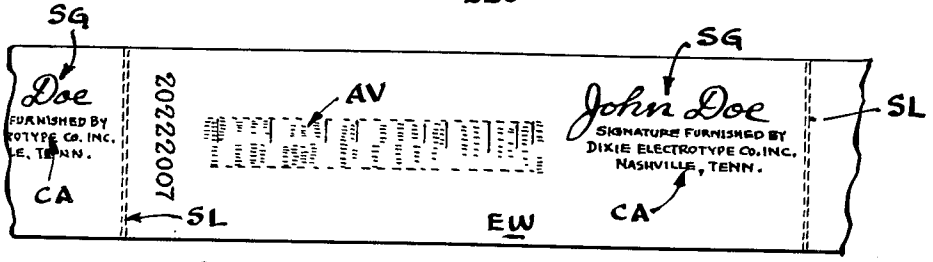


Fig. 15

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United States Patent Office 3,092,021 Patented June 4, 1963

3,092,021

PRINTING MACHINES

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Filed Apr. 25, 1960, Ser. No. 24,346
2 Claims. (Cl. 101—216)

This invention relates to a printing machine and in particular to a rotary printing machine adapted for high speed operation.

There are many instances where forms or sheets are processed in business machines which operate at a high speed and usually, where these forms are to be printed with additional information standard for all, the common practice has been to transfer the forms to an auxiliary printing machine where the fixed or predetermined standard data are to be printed at a designated area on each sheet or form. Such transfer entails a great deal of lost time, and auxiliary printing apparatus as heretofore employed usually operate at much slower rates of speed in comparison to high speed machines in which such forms might be initially produced. In many respects, this problem of low rate of production with auxiliary printing apparatus has been partly due to the lack of an ink train capable of transferring amounts of ink in quantities commensurate with the speed at which it is desired to rotate the plate cylinder, and this is particularly true of rotary printing machines operating with relief printing plates as distinguished from rotary offset machines employing the lithographic principles of reproduction.

In view of the foregoing, the primary object of the present invention is to enable a relief-type rotary printing machine operating independently or as an attachment, to be effectively operated at high speeds, and to accomplish this by having resort to a porous ink fountain cylinder of such construction that this cylinder can be rotated at high speeds to force ink into a porous outer surface thereof without apprehension of throwing excessive amounts of ink. Related objects of the present invention are to so construct the fountain cylinder as to permit the quantity of ink passed thereby to be accurately controlled; to permit the machine to stand idle over-night during interruption of a printing run without apprehension of weak or non-uniform inking conditions at the commencement of the next phase of the printing run the following morning; and to enable effective relay of ink to the plate cylinder to be achieved with a minimum number of intermediate rollers.

Printing apparatus constructed in accordance with the present invention can be used either for printing individual form sheets that are separately passed through the machine, or for repeatedly printing an endless web sheet ultimately separable into individual forms. Thus, the sheets to be printed can be individual forms or an endless web, and in the instance of printing separate forms it is important that these be accurately aligned with respect to the printing plate prior to being printed. Accordingly, another object of the present invention is to enable such alignment to be effected while maintaining a high rate of production.

Another object of the present invention is to enable printing apparatus constructed along the foregoing lines to be compactly associated as an individual printing machine capable of a wide variety of uses and which can be removably attached to machines of known construction for producing business instruments or the like.

Another object of the present invention is to enable printing apparatus constructed along the foregoing lines to be compactly associated in an individual printing machine attachment capable of a wide variety of uses. Thus,

as will be explained in detail hereinafter, printing apparatus constructed in accordance with the present invention can be associated as a complete unit or machine capable of functioning alone as an individual printing machine or as an attachment to an existing or known business machine which produces business instruments that are further to be processed by the present apparatus incidental to printing the forms or sheets, produced in such a business machine, with standard or fixed data common to all the sheets. The accuracy and speed of operation of the machine of the present invention is further enhanced by providing the printing cylinder with discs having knurled edges which engage the face of the sheet to be printed and force the same, during printing, through the printing station in cooperation with an opposed surface engageable by the rear or reverse face of the sheet being printed, and this opposed surface can be either that afforded by a platen roller or a fixed planar surface. Such cooperative structure represents the achievement of another object of the present invention.

Other and further objects of the present invention will be apparent from the following description and claims and are illustrated in the accompanying drawings which, by way of illustration, show preferred embodiments of the present invention and the principles thereof and what is now considered to be the best mode contemplated for applying these principles. Other embodiments of the invention embodying the same or equivalent principles may be used and structural changes may be made as desired by those skilled in the art without departing from the present invention and the purview of the appended claims.

In the drawings:

FIGS. 1 to 5 inclusive are perspective views of one form of printing apparatus or machine constructed under the present invention and shown as attached to one end of a known machine for producing business instruments;

FIGS. 6 and 6A are views illustrating opposite sides of a post card adapted to be printed in accordance with the present invention;

FIG. 7 is a perspective view of the fountain cylinder and associated parts;

FIG. 7A is a composite view taken substantially on the lines 7A—7A of FIG. 7, on an enlarged scale, and additionally showing the vent cap in elevation;

FIG. 8 is a fragmentary view, partly in section, showing details of the sleeve construction of the fountain cylinder;

FIG. 9 is an end elevation of the oscillating and form rollers associated with the apparatus of FIG. 1;

FIG. 10 is a side elevation, partly in section, showing certain drive relationships;

FIG. 11 is a sectional view showing the relationship of the various elements of the ink train and the plate cylinder;

FIGS. 12 to 14 are perspective views of another embodiment of the present invention; and

FIG. 15 is a view of another kind of sheet adapted to be printed under and in accordance with the present invention.

One form of the present invention is illustrated in FIGS. 1 to 11 of the drawings as embodied in printing apparatus 20, FIG. 1, adapted to function as a unitary printing machine or as an attachment to a known kind of machine for producing business instruments or the like. Thus, in illustrating the versatility of the apparatus 20, it is shown in FIGS. 1 to 5 removably mounted at one end of a machine M, FIG. 1, adapted to produce individual business instruments such as tabulating cards, post cards or the like printed with variable data in the machine M. Thus, the machine M may be of the kind disclosed in co-pending application Serial No. 842,292, filed September 25, 1959, now U.S. Patent No. 3,018,723,

wherein opposite sides of a post card such as PC, FIGS. 6 and 6A, are printed with variable data such as an address AD on one side as shown in FIG. 6, and data such as numerical amounts NA printed on the opposite side may pertain to utility billing amounts, premium notices or the like. In accordance with the present invention, such individual forms or sheets emitting from the machine M are adapted to be rapidly printed one by one with data that are to be constant for each such form, and exemplary of such constant or invariant data are the block legends BL, FIG. 6A, which identify the nature of the numerical data NA.

The printing apparatus **20** is so constructed as to enable the same to be removably associated with that end of the machine M where the instruments or sheets produced in the machine M emit, and to this end the printing apparatus **20** includes a stamped frame **20F**, FIGS. 1 and 5, affording a pair of generally rectangular side plates **22** and **23** which are disposed in vertical planes. The side plates are braced by transverse tie bars as **20B**, FIG. 5, and integral spaced top plates **20P–1** and **24**, FIG. 4, respectively located at the fore and aft ends of the frame. The top plate **20P–1** is further braced by a pair of brackets **25** and **26**, FIG. 2, which at their lower ends have ears respectively spot welded to the inside faces of the side plates **22** and **23**. In addition to the ears joined to the side plates **22** and **23**, the brackets **25** and **26** have upper ears disposed in horizontal planes and spot welded to the underside of the horizontally disposed cross plate **20P–1** which serves as a support for a drive motor **30** and related parts to be referred to in more detail below.

The stamped frame **20F** is provided at the end adjacent the machine M with a pair of pivot screws **32** and **33**, FIGS. 1 and 2, adapted to fit in horizontally disposed slots **34** and **35** formed in a pair of spaced vertically oriented mounting plates **36** and **37** which, as shown in FIGS. 1 and 2, have brackets **36B** and **37B** securely fastened to the main frame of the machine M which is adjacent the rotary printing apparatus **20**. As will be apparent from FIGS. 1 and 5, the relationship is such that lower edges of the frame **20F** manually rest on solid shoulder surfaces afforded by beams at the end of the machine M, and this in effect establishes a cantilevered relationship between the auxiliary printer **20** and the output end of the main machine M. The ends of the pivot screws **32** and **33** which project through the associated slots **34** and **35** are provided with retainer collars **38** and **39** and these are adapted to be tightened or loosened as the case may be to enable the printing attachment **20** to be properly positioned with respect to the output of the machine M. The frame **20F** including the parts supported thereby can be slid fore or aft as the case may be in the slots **34** and **35**, and can be lifted to the position shown in FIG. 5 via handle H at the fore end of the top plate **20P–1**.

The printing position or station for the machine **20** in the present instance is defined by the location of a plate cylinder **50**, FIGS. 5 and 11 at the forward end of the frame **20F**, and a cooperating platen roller **51**. The platen roller **51** is fixed on a shaft **52** which, as shown in FIG. 5, is supported by a pair of arms **53** and **54** secured to supporting elements that are a part of the machine M. The platen roller shaft **52** has a pinion gear **55** at one end thereof disposed outward of the arm **54**, and this gear is meshed with a transmitting gear **57** driven in a manner to be explained hereinbelow. Thus, the platen roller is driven in a positive fashion, and the gear ratios are such that the peripheral speed of the platen roller **51** will correspond to the peripheral speed of the plate cylinder **50**.

The sheets or the like to be printed are advanced from a guideway in the machine M into printing position between the plate cylinder **50** and the platen roller **51**, and the means for so feeding the individual sheets as PC includes cooperating feed bands **60** and **61**, FIG. 5, and skid rollers **62**. The path along which each sheet moves toward printing position is defined by a pair of spaced channel plates **65** as shown in FIG. 5, such being in accordance with the sheet feed means disclosed in United States Patent No. 2,359,852.

It will be noted further in FIG. 5 that the tapes or feed bands **60** and **61** are played around a shaft **70** spaced slightly rearwardly of the platen roller **51** against which the sheet will be pressed while undergoing printing. The sheet to be printed is, therefore, guided toward the platen roller **51**, free of contact with the shaft **70**, by a plate **71** which is disposed between the aforesaid feed bands and guide flanges **65**. As will be explained hereinafter, the sheet or other form to be printed in the present instance is temporarily halted at printing position to enable accurate alignment with respect to the plate cylinder to be effected prior to printing.

As shown in FIGS. 3, 5 and 11, the plate cylinder **50** is fixed for rotation on a driven shaft **75**. One area of the cylindrical surface of the plate cylinder **50** is flattened at **50F**, FIGS. 5 and 11, to enable a sheet to be fed to printing position between the plate cylinder and the platen roller. A flexible printing plate such as rubber or the like, bearing in relief the image to be printed, is to be firmly adhered to the plate cylinder. This flexible plate bearing the relief image for printing is typified by a rubber plate as **224P**, FIG. 12, to be referred to hereinafter in connection with another embodiment of the present invention. The printing plate or plates will be so dimensioned as to have the edges thereof spaced inwardly of a pair of discs **50K** which are part of the plate cylinder and which have knurled edges K, FIG. 5, which are adapted to press the sheet as PC undergoing printing firmly into contact with the platen roller **51** to prevent slippage or skidding of the sheet during the time it is being printed. The dimensioning is such that the knurled edges K are spaced a few thousandths of an inch inward of the face of the relief printing characters, and this enables the relief image to assist in feeding the sheet while printing the same. This provision of a knurled drive contributes to the achievement of higher speeds of operation, and as will be evident in FIGS. 5 and 10, the discs **50K** are flattened coextensive with the flattened face **50F** of the plate cylinder to enable a sheet to be advanced to the threshold of printing position.

The shaft **75** which carries the printing cylinder **50** has ends disposed outwardly of the side plates **22** and **23** of the frame **20F**, and the shaft **75** is supported for rotation in bearing elements which in turn are supported by the aforesaid side plates. The right-hand end of the shaft **75** as viewed in FIG. 5 has a sprocket **75S** affixed thereto, and a gear **75G** is affixed to the shaft **75** outward of the sprocket **75S**. Gear **75G** is meshed with a pinion gear **78** supported for rotation on a stub shaft **78S** affixed to the side plate **23** so as to project outward therefrom as viewed in FIG. 5, and when the frame **20F** is lowered and properly positioned, gear **78**, as shown in FIG. 2, is meshed with gear **57** to drive the latter which in turn drives the platen roller drive gear **55**.

The sprocket **75S** is driven by a chain **80**, FIG. 2, and this chain in turn is driven by a main drive sprocket **80S**. The drive sprocket **80S** is carried by the output shaft of a one-revolution clutch assembly which receives its drive from the main drive motor **30**, and the role of the one-revolution clutch under the present invention will be described hereinafter.

In the present instance, rotary parts of the machine M thus described are to be driven cyclically through the one-revolution clutch. Thus, a positive drive is imparted to the drive shaft of the printing cylinder and this positive drive is transmitted by gears to the drive shaft for the platen roller **51**, and as explained above, the gear ratios are such that the printing cylinder and platen roller are driven at the same peripheral speed, such assuring proper

feeding of the form or sheet to be printed through the printing position or station defined by the associated printing cylinder and platen roller. Advantageously, the tension of the drive chain **80** is selected by means of an idler sprocket **81**, FIG. 2, carried on a plate **81P** which is pivotally mounted on the outer side of the side plate **23**, and the adjusted position on the plate **81P** is held and maintained by a locknut and screw arrangement **81A**.

Referring to FIGS. 1 and 5, it will be noted that shaft **75** which carries the plate cylinder also projects outwardly of the side plate **22**, and a sprocket **75S2** is affixed thereto. A chain is trained around the sprocket **75S2**, around a fixed idler sprocket **86**, around an adjustable idler sprocket **87**, and around a drive sprocket **88**. The idler sprocket **87** is carried on a plate **87P** which is adjustable in the manner of the sprocket adjusting plate **81P**. The sprocket **88** is fixed to the end of a form roller drive shaft **90** to impart a positive drive thereto. Inasmuch as the form or inking roller is adjustable toward and away from the plate cylinder to vary the degree of pressure contact between the form roller and the printing plate as will be explained, the sprocket **88** is carried on an adjustable plate **88P**, FIG. 1, pivotally mounted at **88X** on the outer face of the side plate **22** in the manner of the adjusting plates **81P** and **87P**. The opposite end of the drive shaft **90**, as shown in FIG. 2, is supported in a bearing **90B** carried by an adjusting plate **91**, FIG. 2, pivotally mounted on the outer face of the side plate **23**, this of course to enable both ends of shaft **90** to be shifted simultaneously to an adjusted position.

The form roller referred to above is identified at **100** in FIG. 11, and as has been explained, this roller is driven in a positive fashion by a shaft **90** which has the sprocket **88** affixed to one end thereof. An oscillating roller **101** is supported, in a manner to be explained, to be in contact with the form roller **100** as shown in FIG. 11 and in contact with the porous surface of a fountain roller **105**. A direct gear drive, as will be explained, is transmitted from the form roller drive shaft **90** to the oscillating roller, and the oscillating roller in turn is used to frictionally drive the fountain cylinder **105**. Such drive relationships are established by a gear **90G**, FIGS. 3 and 10, which is fixed to the form roller drive shaft **90** inside the frame **20F**, and a gear **101G** meshed therewith and which is fixed to a shaft **106**, FIG. 10, which carries the form roller **101**. The manner in which adjustments of selected of these rotary parts are afforded, the manner in which oscillation of the oscillating roller **101** is effected, and details of the construction of the fountain cylinder will be described hereinbelow, but the cyclical drive including the one-revolution clutch and control thereover will now be described.

Thus, power for the motor **30** and for the various electrical control elements to be referred to hereinafter is afforded by a cord **30C**, FIG. 3, and a toggle switch TSW is mounted on the top plate **20P–1** adjacent the motor **30** for cutting the power in and out. The drive output of the motor **30** is transmitted through a gear box **30GB**, FIG. 4, to the input shaft (not shown) of a one-revolution clutch assembly **105**, FIG. 4. The one-revolution clutch **105** is of a known kind, and the elements thereof to be coupled in a driving relationship are normally held disengaged by an arm **106** under control of a solenoid **110**, FIGS. 2 and 4, mounted atop plate **20P–1** adjacent the motor **30**. When this solenoid is energized in a manner to be explained, the arm **106** is actuated to free the clutch elements, permitting the clutch **105** to engage, and as a consequence of this the clutch elements are coupled and impart a drive to the driven shaft **112**, FIG. 2, of the clutch. This shaft carries the drive sprocket **80S**. At the end of one 360° cycle of the driven shaft **112**, the clutch is disengaged, and in the meantime the rotary parts referred to above are each turned through 360°. Thus, it will be seen that the rotary parts of the printing machine **20** in the present instance are cyclically driven rather than continuously driven, and this is in accordance with individual advancement of the sheets to be printed to the printing position. Therefore, sensing means are afforded to detect the arrival of the sheet to be printed at the threshold of the printing station, and this sensing means when actuated is adapted to close a normally open switch which controls operation of the solenoid **110**.

Thus, referring to FIG. 5, a sensing finger **120** in the form of a leaf spring is positioned adjacent the plate or printing cylinder, and this finger, when the frame **20F** is lowered to normal position as shown in FIG. 3, is disposed in the path of a sheet being advanced forwardly into printing position, and as the sheet to be printed thus advances into printing position, the finger **120** is tripped or shifted upwardly to close an associated normally open switch indicated generally at **120SW**, FIG. 5. The switch **120SW** is interposed in the energizing circuit for the solenoid **110** and hence in effect is the ultimate control for the one-revolution clutch. Thus, when the sheet to be printed trips the sensing finger, this clutch is conditioned to engage and rotary parts are conditioned for one cycle of rotation. To assure that the sheet to be printed is accurately aligned with respect to the path of rotation of the plate cylinder, a pair of stop fingers **125**, FIG. 5, are disposed adjacent the outer sides of the two knurled discs **50K**. These fingers **125** are normally disposed in vertical planes as will be apparent in FIG. 3, and the left-hand one as viewed in FIG. 3 directly overlies the sensing finger **120** in a non-interfering position.

The stop fingers **125** are at the ends of respective arms **126**, FIG. 5, which are part of a yoke member **130** supported pivotally for vertical motion on a transversely extending support shaft **131**. Each arm **126** is formed with a plurality of spaced openings in alignment as will be evident in FIG. 10. A coil spring **126S** has one end hooked into a selected one of the openings in one of the arms **126** and the opposite or upper end of this spring is anchored on the cross-tie bar **20B**, FIG. 10. For quite long forms, the arms **126** can be extended at **126A** with provision for adjusting the stops at selected more forward positions **125A**. Also for long forms, switch **120SW** can be held engaged by a switch finger **120A** until after the long form has passed the forwardly adjusted stop **125A**.

Thus, the stop finger yoke **130** is spring-biased in a counter-clockwise direction as viewed in FIGS. 5 and 10 (clockwise as viewed in FIG. 2) so that the tendency is to dispose the stop fingers **125** out of the path of the sheet to be printed. However, the yoke **130** is normally held in a position such as to dispose the stop fingers **125** in the path of the oncoming sheet to be printed as mentioned above, and this is accomplished by a cam **135**, FIG. 5, which bears against a cam follower **126F**, FIG. 3, carried by the left-hand one of the arms **126** of the yoke **130** as viewed in FIGS. 3 and 5. As shown in FIGS. 5 and 10, the cam **135** has a rather long lobe and dwell, and will be used in the instance of short forms to be printed. When the rise or lobe of the cam **135** passes off the follower **126F** during the course of rotation of the plate cylinder drive shaft **75**, the yoke **130** is free to be snapped upwardly by the aforesaid spring which is connected between the yoke **130** and the tie bar **20B**. In this connection, it should be pointed out that flat face of the printing cylinder **50F**, at the commencement of a cycle, is disposed opposite the platen roller **51** in the relationship shown in FIG. 11. Under this condition, the printing plate which is fixed to the plate cylinder is free of contact with the form to be printed. This being so at the beginning of a cycle, the feed means, which move the sheet to be printed to printing position, merely slip on the underside of the sheet to be printed.

At the commencement of a cycle, the cam dwell **135D** is out of phase with the follower **126F**. In other words,

the timing is such that prior to the commencement of a cycle, the sheet to be printed is skidded into contact with the stop fingers **125** to assure the proper registry therewith, and at a selected time after commencement of a cycle, depending upon the configuration of the cam as **135**, the dwell **135D** turns past the follower **126F** whereupon the stop fingers are snapped upwardly out of the path of the sheet to be printed substantially at the time the printing plate turns into position to bear on the upper face of the sheet to be printed. Thereafter, the sheet to be printed is fed rapidly through the printing station by the cooperative action of the printing plate on the plate cylinder, the knurled edges K of the discs **50K** and the platen roller **51** which bears on the underside of the sheet undergoing printing.

Another cam, **135A**, FIG. 10, is associated with cam **135**. Cam **135A** is formed with an arcuate slot **136**, aligned with a stud associated with cam **135**, and a nut **136N** is mounted and tightened on this stud to clamp cam **135A** in a predetermined relationship. Cam **135A** has a snap action lobe **136L**, and by loosening the nut **136N**, lobe **136L** can be positioned on the circumference of the lobe of cam **135** to extend or retard the action of cam **135** thereby enabling further time selections to be attained. Furthermore, and particularly for long forms to be printed such as twelve-inch sheets, cam **135A** can alone be used, that is, disassociated from cam **135**, to solely control the follower **126F**. In this event, the holding and aligning action of the sheet stop fingers **125** will be momentary and just sufficient to effect alignment of the sheet to be printed.

In considering adjustments in regulating the degree of pressure contact between the inking roller **100** and the surface of the printing cylinder, it will be recalled that the drive shaft **90** for the inking roller is supported by a pair of plates **88P**, FIG. 1, and **91**, FIG. 2, which are located on the outside of the main frame elements **22** and **23** of the machine. Each such plate is pivotal about an axis as **88X**, FIG. 1, and additionally each such plate is formed with an elongated slot as **91SL**, FIG. 2, in which the shank of a screw as **91S** is located, such screw being threadedly anchored in the related side frame member. By loosening the screws **91S**, the two plates **88P** and **91** can be shifted about their pivotal axes simultaneously as a unitary frame along the arcuate path indicated by dashed arrows at **88P** in FIG. 10, and as will be apparent froms FIGS. 10 and 11 such movement will result in varying degrees of pressure contact between the members **50** and **100**.

Pressure contact between the inking roller **100** and the oscillating roller **101** can be adjusted, and this is independent of the above described pressure regulation. To this end, a support bracket **145**, FIG. 10, is hung on the inking roller drive shaft **90** in such a manner as to permit free rotation of the latter relative to the support bracket **145**. The bracket **145** includes a pair of left and right hand arms **146** and **147** which depend below the shaft **90** as shown in FIG. 9, and these arms are connected by a cross brace **148**.

A yoke or frame **150**, FIG. 10, for supporting the oscillating roller includes a pair of arms **151** and **152**, FIG. 9, respectively outward of the bracket arms **146** and **147** on shaft **90**. The yoke arms **151** and **152** depend below the lower ends of the bracket arms **146** and **147**, and the lower ends thereof are joined by a bight portion or yoke web **150B**. It will be noted that the oscillating roller **101** is housed within the yoke **150**.

Screws **155** in effect join the yoke **150** to the bracket **145**, and slots are afforded to enable the yoke **150** to be shifted slightly relative to the bracket **145** upon loosening the screws **155**. Since the oscillating roller **101** is supported by the yoke **150**, such shifting movement will be manifest in a variation in the degree of pressure contact between the rollers **100** and **101**.

As will be evident from FIG. 9, the oscillating roller is supported on shaft **106** driven by gear **101G** that is meshed with the gear **90G**, the usual bearings for the shaft **106** being carried by the yoke members **151** and **152**. Cams **160** and **161**, FIG. 9, are mounted on the inside face of the yoke legs **151** and **152**, and the faces of these cams disposed adjacent the sides of the oscillating roller **101** are sloped as indicated at **160S**. The oscillating roller has a pair of followers **163** and **164** affixed to the ends thereof in position to follow the cam surfaces **160S**. The cam surfaces **160S** supplement one another such as to produce continuous axial shifting of the oscillating roller **101** relative to the form roller **100**.

As shown in FIGS. 10 and 11, the legs of the bracket **145** and the legs of the yoke **150** are provided with arcuate slots **165** which embrace fixed guide pins **166** to assure accuracy in pressure regulating movements which, incidentally, are of minor extent and do not interfere appreciably with gear drives.

To vary the printing pressure, two rods **167** and **168**, FIG. 11, are used. Rod **167** passes through a threaded opening in a bracket **169**, and its lower end rests on the stationary base member BE. Rod **168** passes through a clearance hole in bracket **169** and its lower end is threaded in the member BE. By loosening lock nuts LNS on rod **168**, rod **167** can be turned to cause the entire unit in FIG. 11 to move slightly closer or further from roller **51**, the lock nuts being thereafter tightened to maintain the adjusted position.

The porous fountain roller **105**, FIGS. 7 and 11, is suspended by a yoke frame **170** which includes a pair of spaced arms **171** having hook slots **172** at the free ends thereof opposite the ends that are joined by a transverse web or bight **173** of the yoke **170**. The slots **172** are adapted to embrace a suspending pin **175**, FIG. 11, which is extended to and supported by the side plates **22** and **23**. Additional slots **177** are formed in the yoke arms **171** substantially at the medial areas thereof, and these slots serve as journal supports for the axle elements **180**, FIG. 8, which are a part of the porous fountain roller **105**. A pan **181** is located beneath the fountain roller **105**, and this pan is affixed to the lower end of the bent leg of an attaching bracket **182**, FIG. 11, which in turn is affixed to the web portion **173** of the yoke **170**.

Means are afforded to regulate the degree of pressure contact between the surface of the fountain roller and the surface of the oscillating roller **101**. Additionally, a night latch is provided to enable the fountain roller **105** to be shifted to an overnight position wherein the fountain roller **105** is held disengaged from contact with the oscillating roller **101**. Thus, referring to FIGS. 7 and 11, it will be noted that a substantially U-shaped bracket **185** has the opposite legs **186** thereof fastened at their lower ends to the yoke **170** just rearward of the slots **177**. The bight portion **188** of the bracket **185** is located well above the fountain roller **105**, and a rearwardly extending adjusting and manually operable arm **187** is affixed at one end thereto. The opposite end of arm **187** overlies the top cross plate **24**, FIGS. 1 and 11, which extends between the side plates **22** and **23**.

An adjusting screw **191** is threadedly mounted in a tapped opening at the free end of arm **187**, and as shown in FIG. 11, the lower end of the adjusting screw engages the upper surface of plate **24**. This condition is maintained by engaging the knurled head **191H** of the adjusting screw **191** by the upper end **192E** of a night latch arm **192**, FIG. 11, which is pivoted at its lower end at **193** to the frame of the machine. By varying slightly the extent to which the lower end of the screw **191** extends below the arm **187**, accompanying variations in the degree of pressure contact between the fountain roller and the oscillating roller can be determined, a lock nut **191N** being provided to hold constant the particular pressure relationship once established.

By releasing the latch arm **192** rearwardly or to the

left as viewed in FIG. 11, arm 187 can be grasped and lifted clockwise as viewed in FIG. 11, thereby pivoting the yoke or cradle 170 in a like direction and disengaging the porous roller and the oscillating roller. Arm 192 is then allowed to return to normal position under the influence of its spring 192S, FIG. 11, to underlie arm 187, thereby maintaining the aforesaid disengagement.

Under the present invention, uniform inking for prolonged printing runs, irrespective of an overnight interruption, and high-speed operation without causing throwing of ink are achieved by a unique construction of the fountain roller now to be described.

Thus, referring to FIGS. 7, 7A and 8, and in particular FIG. 8, the interior of the fountain roller is hollow, such construction being attained by telescoping a pair of complementally related drums respectively having closed sides 200 and 201 of circular shape. Additionally, these drums have nestable circular sleeves 200S and 201S having a fit just loose enough to enable one sleeve to be turned relative to the other. Each drum thus afforded includes bosses 180A and 180B respectively, and these bosses are reduced to afford the axle elements 180 referred to above.

The boss 180B associated with the right-hand drum member of the fountain roller as viewed in FIG. 8 is internally tapped and a long pin 205 is accordingly threaded at one end to fit therewith. The pin 205 opposite the threaded end is formed with a kerfed head 205H, and by applying a screw-driver thereto the two drums can be pulled inward on one another to establish the desired hollow housing part of the porous fountain cylinder.

A porous rubber sleeve 206, composed substantially in accordance with United States Patent No. 2,763,208 is carried by the outer drum sleeve 201S, and such affords a porous ink-holding and feeding surface for the fountain roller. Preferably, the hardness of this rubber sleeve is 80–98 durometer. Ink is to be fed centrifugally thereto in a controlled fashion during rotation of the fountain cylinder, as will be described immediately below, and in this connection, the cylinder 105 is to be filled by removing a plug 207, FIG. 7.

As shown in FIG. 8, the sleeves 200S and 201S are formed with circumferential and axial rows of openings 210 and 211 respectively. These openings are circumferentially spaced approximately 15° from one another. Additionally, these openings are so formed that the circumferential rows are in alignment with one another when the cylinder drums are properly telescoped. Hence, by shifting the sleeves 200S and 201S one relative to the other, the openings 210 and 211 can be fully aligned or selectively misaligned to a certain degree thereby regulating the effective size of an opening extending from the inside surface of sleeve 200S to the outer surface of sleeve 201S. This will determine the rate of flow of ink outward through the openings 210 and 211 into the porous member 206, and is one of the modes under the present invention by which the supply of ink used for printing can be regulated.

The supply of ink fed by the porous cylinder is also regulated by affording an adjustable vent for the interior of the porous cylinder. The settable vent means under the present invention includes a knurled knob 215, FIGS. 7 and 7A, and the periphery of this knob is provided with plurality of openings 216 of variant diameter. The knob 215 is in the form of a cup such that the outer face is open except for the rim 215R, FIG. 7A, and this rim is provided with marks M1 through M6 which are scribed on the rim to identify the largest to the smallest opening 216 in that order. Disposed within the hollow of the knob 215 is a vent boss 217, and this boss is provided with a threaded stud 217S which fits in a tapped opening in the drum side member 200.

The adjustable knob 215 includes a disc 215D which has an opening therein through which the threaded stud 217S projects, and a coil spring 218 is arranged concentrically about the stud 217S so as to apply an outward holding force to the disc portion of the adjusting knob 215, in effect holding the knob 215 in firm contact with the boss 217.

An elongated vent passageway 217P is formed axially through the stud 217S so as to communicate with the interior of the porous fountain cylinder. This passageway at is other end communicates with a right-angularly related extension 217P–1 which extends radially outwardly through the boss 217 to open at the periphery thereof. The opening thus provided is identified by an index mark IM on the face of the related boss 217 as shown in FIG. 7A, and when a mark as M1 on the settable knob 215 is aligned therewith the associated opening 216 on the knob 215 is registered with the passageway in the vent boss 217 to thereby establish a predetermined degree of venting of the interior of the porous cylinder to the ambient atmosphere.

The form of the present invention illustrated in FIGS. 12 and 13 is one wherein the printing machine is arranged for continuous operation incidental to printing a sheet in the form of an endless web EW, FIGS. 14 and 15, repeatedly with the same data such as a signature SG, a company address CA, or advertising AV, and so on. The web EW is supplied from a spool 215', FIG. 14, rotatably supported by arms 216', and the sheet is pulled, in a manner to be described, along a channeled horizontal guide plate 218'. As in the foregoing embodiment the related apparatus, 220 in this instance, is of such construction as to enable the same to be operated as an individual printing machine or as an auxiliary attachment to a known machine. To this end, the machine includes a frame 220F afforded by a pair of spaced, vertically oriented side plates 222 and 223 which are rigidly interconected by transverse tie members including a tie bar 220B. If the apparatus 220 is to be used as an attachment to another machine, attaching brackets for accomplishing this will be affixed to the frame 220F at appropriate locations.

The rotary parts of the machine are supported by and between the side plates 222 and 223, and these include a plate cylinder 224 having rubber printing plates 224P adhesively secured to the periphery thereof, a platen roller 225, FIG. 14, which cooperates with the plate cylinder in advancing the sheet undergoing printing, a form roller 226, FIG. 12, engageable with the printing plates on the plate cylinder, an oscillator roller 227 which engages the form roller, and a fountain cylinder 228, FIG. 14, which is engaged by the oscillator roller. Inasmuch as the fountain cylinder 228 is identical to the construction of the fountain cylinder described above, this description will not be repeated, but it should be mentioned that a somewhat different arrangement is resorted to insofar as selecting an adjusting position for the fountain roller 228 is concerned, and this will be described in detail hereinbelow. Further, the plate cylinder, FIG. 13, is equipped with knurled rims 224K which are to press the sheet firmly against the platen roller during printing, and these rims are flattened at one area, as shown in FIG. 14, to be coextensive with a flattened area 224F on the plate cylinder. Consequently, while the rotary parts are continuously driven, the aforesaid flattening will account for an intermittent feed of the sheet EW to be printed, and this intermittent feed, together with the knurled rims 224K, assures continuous registry between the plate cylinder and the successive areas of the sheet EW which are to be printed. The knurled rims are a few thousandths of an inch inward of the relief type characters so that the relief image assists in sheet feeding.

The sheet as EW to be printed in this instance may take various different forms depending upon the ultimate use. For example, the sheet EW could be one provided with score lines SL as shown in FIG. 15 enabling the same to be ultimately separated into individual forms such as labels, wrappers and the like, or the sheet EW could be in the form of a master strip to be used for duplicating

purposes such as that disclosed in the aforesaid copending application, in which event the fountain cylinder would be filled with whatever form of ink is necessitated by the particular duplicating operation.

The rotary parts in the machine thus afforded are adapted to be continuously driven by means including a main drive motor **230** supported on a base plate **231** in an outboard relation with respect to the side plate **223** as shown in FIG. 14. The drive shaft of the motor **230** has a sprocket **230S** affixed thereto, and this sprocket drives a chain **223** which in turn is trained around a relatively small driven sprocket **234** carried by a stub shaft **235** rotatably supported in bearings which in turn are supported by the side plate **223**.

The shaft **235** carries the plate cylinder **224**, and hence the latter will be driven in a positive fashion when the motor **230** is energized, but the end of the shaft **235** opposite its driven sprocket **234** has a hand wheel **237** affixed thereto outward of the side plate **222**, and hence the rotary parts can be indexed by hand if necessary.

Shaft **235** has a relatively large drive sprocket **238** affixed thereto inward of the driven sprocket **234**. Sprocket **238**, as shown in FIG. 12, is meshed with a chain **240** which is trained around an idler sprocket **241** and a pair of drive sprockets **242** and **243** all of which are rotatably supported on the outer face of the frame side plate **223**. The drive sprocket **242** is affixed to a shaft **245** which extends transversely through the machine and which carries the platen roller **225** on the portion thereof that is disposed between the side plates **222** and **223** as will be evident in FIG. 14. On the other hand, the drive sprocket **243** is affixed to a shaft **248** which is supported between the side plates **222** and **223** in a rotative fashion, and shaft **248** carries the form roller **226**. It will be seen from this that the plate cylinder, the form roller and the platen roller are all driven in a positive fashion. The same sort of positive drive is transmitted to the oscillator roller, and this is accomplished by a pair of meshed gears **250** and **251**, FIG. 13, that are outward of the frame side plate **222**. Gear **250** is affixed to the end of the form roller drive shaft **248** opposite the sprocket **243**, and gear **251** is affixed to one end of a shaft **255** on which the oscillator roller **227** is mounted. Conventional means are utilized in effecting oscillation of the oscillator roller **227**.

The channeled guide plate **218'** along which the sheet EW advances is discontinuous at the platen roller as will be evident in FIG. 14 and this enables the knurled rims on the plate cylinder and the printing plate or plates thereon to pull the sheet forward in cooperation with the platen roller during printing.

As in the foregoing embodiment, the fountain cylinder is rotated as a result of contact with the oscillator roller. The fountain roller **228** is mounted in the frame **220F** for movement toward and away from the oscillator roller **227**, and this enables the degree of contact pressure between the porous surface of the fountain roller and the surface of the oscillator roller to be selectably adjusted.

To this end, the elements affording the axle for the fountain cylinder are supported rotatably in an auxiliary frame **260** in the form of a yoke having a pair of bifurcated or slotted arms **261** in which the aforesaid axles are journalled as will be evident in FIG. 14. The arms **261** are pivotally mounted at the ends opposite the bifurated ends on studs (not shown) associated with spacers as **265**, FIG. 14, which are supporting on the inside faces of the side plates **222** and **223**.

A pair of adjusting rods **266** and **267** are afforded, FIG. 14, to selectively position the fountain cylinder. The outer ends of these rods have knurled caps **H1** and **H2** which are located outwardly of a retainer plate **270** which is rigidly connected to the frame **260** by means including spacers **271**. The ends of the adjusting rods **266** and **267** opposite the thumb heads are threadedly mounted in nut members (not shown) mounted on the inside faces of the side plates **222** and **223**. As will be evident in FIG. 14, the weight and disposition of the fountain cylinder and its frame **260** normally tend to drop this assembly toward the observer, but this is resisted by the heads or caps **H1** and **H2** of adjusting rods **266** and **267**. Hence, the degree of pressure contact between the porous surface of the fountain cylinder and the opposed surface of the oscillator roller can be controlled merely by turning the aforesaid adjusting rods "in" and "out" as the case may be.

It will be seen from the foregoing that under the present invention there is afforded rotary printing apparatus operating on the principle of rotary relief printing, and high speed operation is made possible under circumstances where the primary source of ink is contained interiorly of a rotatable fountain cylinder. Accurate control of the amount of ink relayed from the fountain to the printing plate is achieved by centrifugally forcing ink within the interior of the fountain cylinder through peripheral openings in the fountain cylinder. These openings connect with a porous outer sleeve on the fountain cylinder, and the rate of flow is primarily controlled by adjusting the effective sizes of the aforesaid openings in conjunction with a predetermined degree of venting of the fountain cylinder to the ambient atmosphere. By having resort to this construction and the particular nature of the porous sleeve, the apparatus can be allowed to stand overnight during interruption of a printing run, without apprehension of the lower or nadir area of the aforesaid porous sleeve being overly saturated at the commencement of the printing run the next morning. Additionally, the fountain cylinder can be operated at various speeds without any fundamental effect on the rate of ink fed, and without objectionable ink foaming, and as a consequence of this it is possible to restrict the remaining or intermediate ink rollers to an oscillator roller and a form roller.

High speed operation is further accommodated by equipping the plate cylinder with knurled discs which are to bear against one face of the sheet being printed to hold the same in firm contact against the platen roller whereby skipping or slippage is prevented. In this same connection, the machine in one form is to be cyclically driven under control of a one-revolution clutch and under circumstaces where assurance is had that each form to be printed will be accurately aligned prior to being advanced through the printing station.

Printing apparatus constructed in accordance with the present invention is capable of a wide variety of uses, independently as a unitary printing machine especially either independently as a unitary printing machine, especially in the form illustrated in FIGS. 12 to 14, or in any event as an auxiliary attachment to a machine wherein tabulating cards or the like are to be at least partially processed. In achieving this high degree of flexibility in use, all rotary parts and essential control elements are neatly confined to a frame that can be affixed to existing equipment for producing business instruments, and hence while I have illustrated and described preferred embodiments of my invention, it is to be understood that these are capable of variation and modification, and I therefore do not wish to be limited to the precise details set forth, but desire to avail myself of such changes and alterations as fall within the purview of the following claims.

I claim:

1. Rotary printing apparatus comprising a rotatable plate cylinder adapted to carry a printing plate, said plate cylinder being disposed opposite a support member for a sheet or the like to be printed, a rotatable intermediate form roller engageable with said printing plate to roll ink on to the printing plate, a frame supporting said form roller and being adjustable toward and away from the plate cylinder to vary the pressure contact between the form roller and the plate on the plate cylinder, an inter-

mediate oscillating roller engaged with the form roller, another frame supporting the oscillating roller and being adjustably shiftable to vary the degree of pressure contact between said rollers independently of the adjustment between the form roller and the plate cylinder, said intermediate rollers being geared one to another to rotate in unison, and a freely rotatable fountain cylinder of hollow construction in engagement with the oscillating roller for relaying ink contained within the interior thereof to said oscillating roller, means for imparting a positive drive to one of said intermediate rollers whereby the plate cylinder and the fountain cylinder are driven thereby, said fountain cylinder comprising an inner sleeve formed with a predetermined pattern of openings which communicate with the interior of said fountain cylinder, a separate outer sleeve telescoped over said inner sleeve and formed with a pattern of openings arranged to register substantially with the first-named openings, means affording an ink absorptive porous member on said outer sleeve, said sleeves being circumferentially adjustable one relative to the other to vary the extent to which said openings are in registry and thereby the rate of feeding ink to said porous member, variantly settable vent means carried entirely by said fountain cylinder including an angled passageway for disclosing to a variable extent the interior of said fountain cylinder to the ambient atmosphere, said fountain cylinder being carried by a pivotally supported frame, and means to vary said frame on its support to thereby vary the degree of pressure contact between the fountain cylinder and the oscillating roller.

2. Apparatus according to claim 1 including means for holding the fountain cylinder in a disengaged position with respect to said oscillating roller.

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