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INTAGLIO PRINTING MACHINE WITH COVER ASSEMBLIES AND REMOVABLE INK TROUGH

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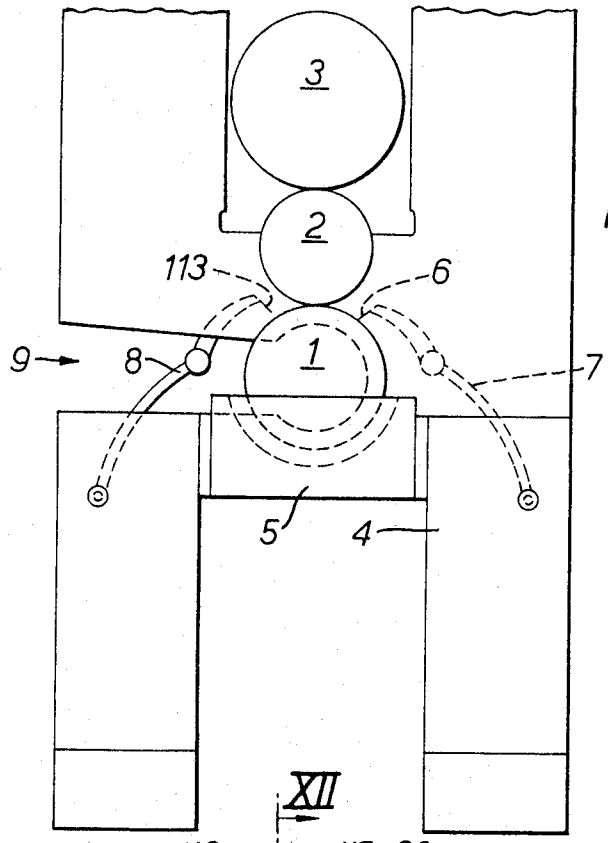

FIG. 1.

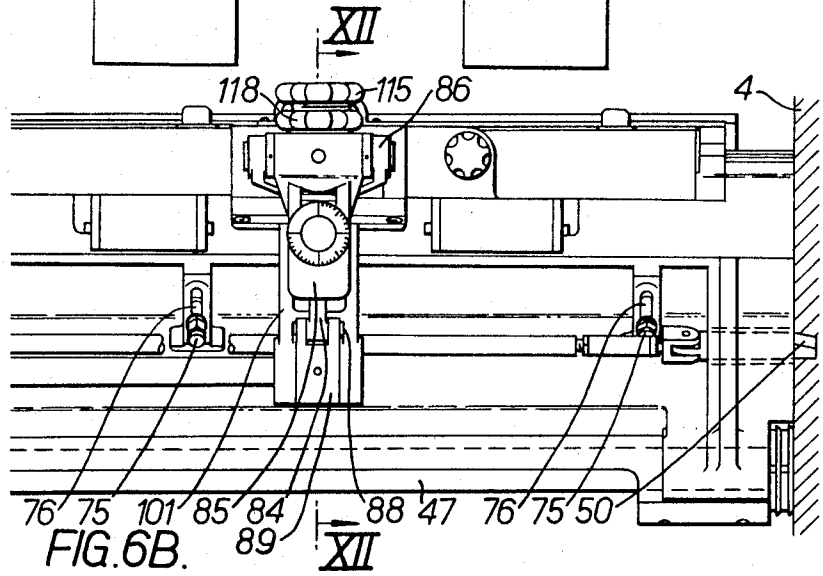

FIG. 6B.

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FIG. 2.

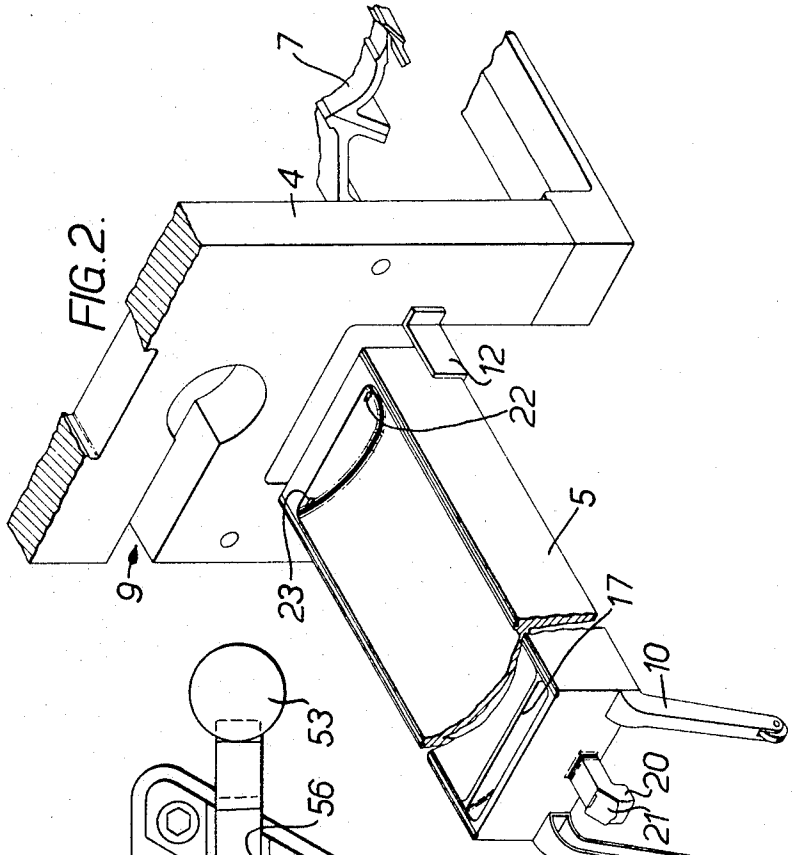

FIG. 8.

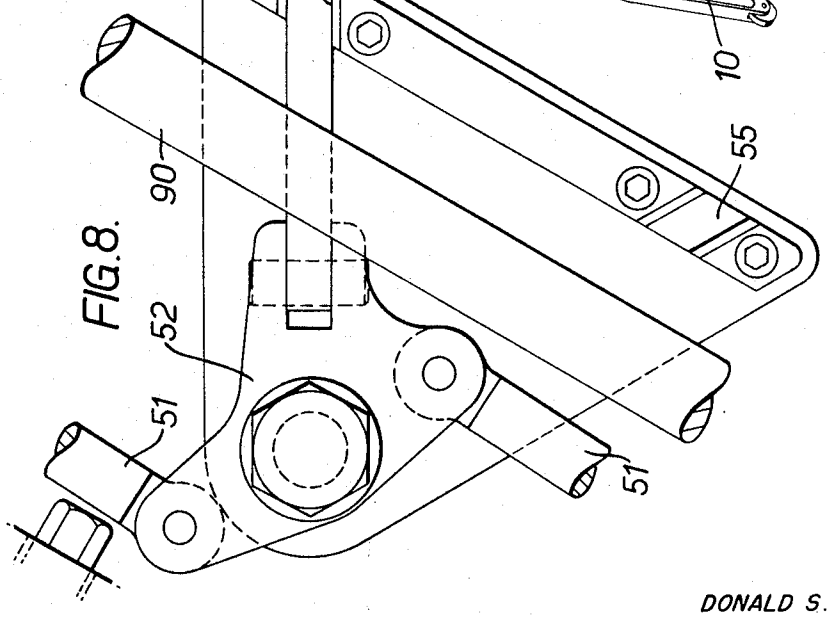

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FIG. 3.

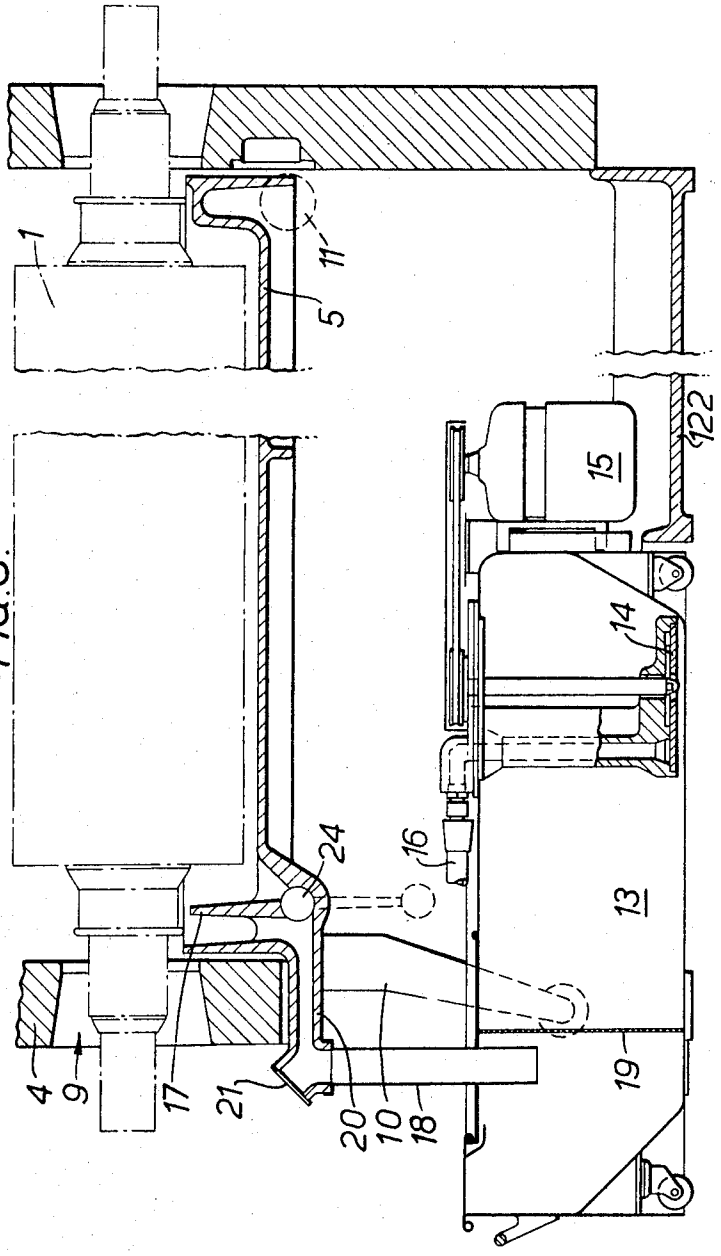

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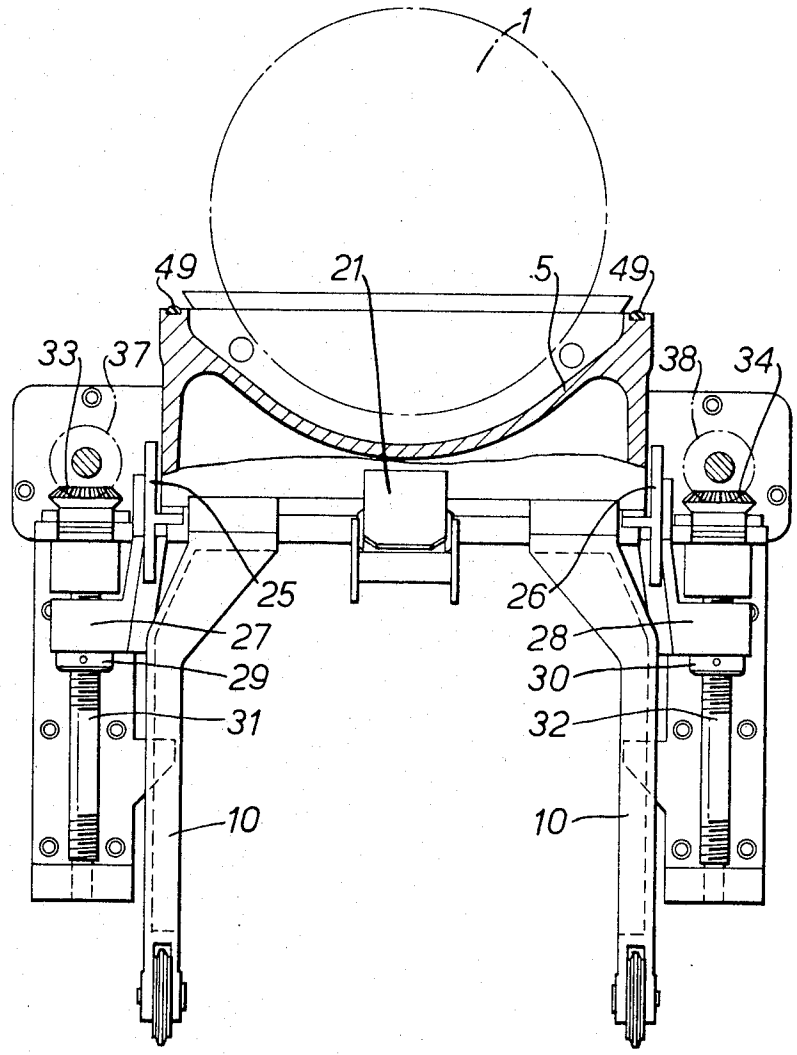
FIG. 4.



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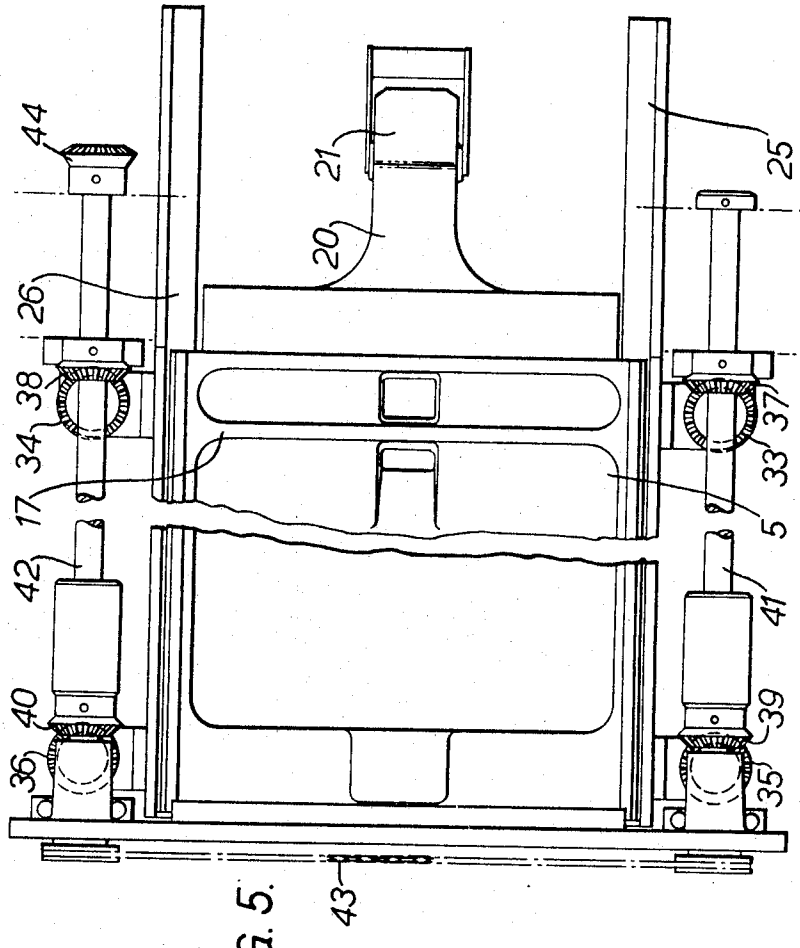

FIG. 5.

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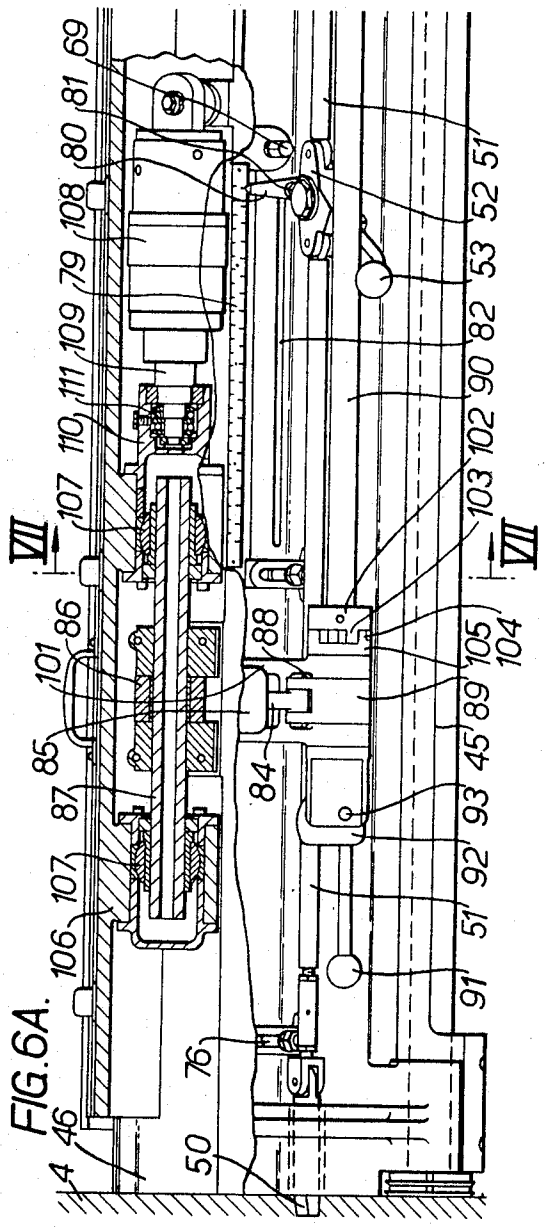

FIG. 6A.

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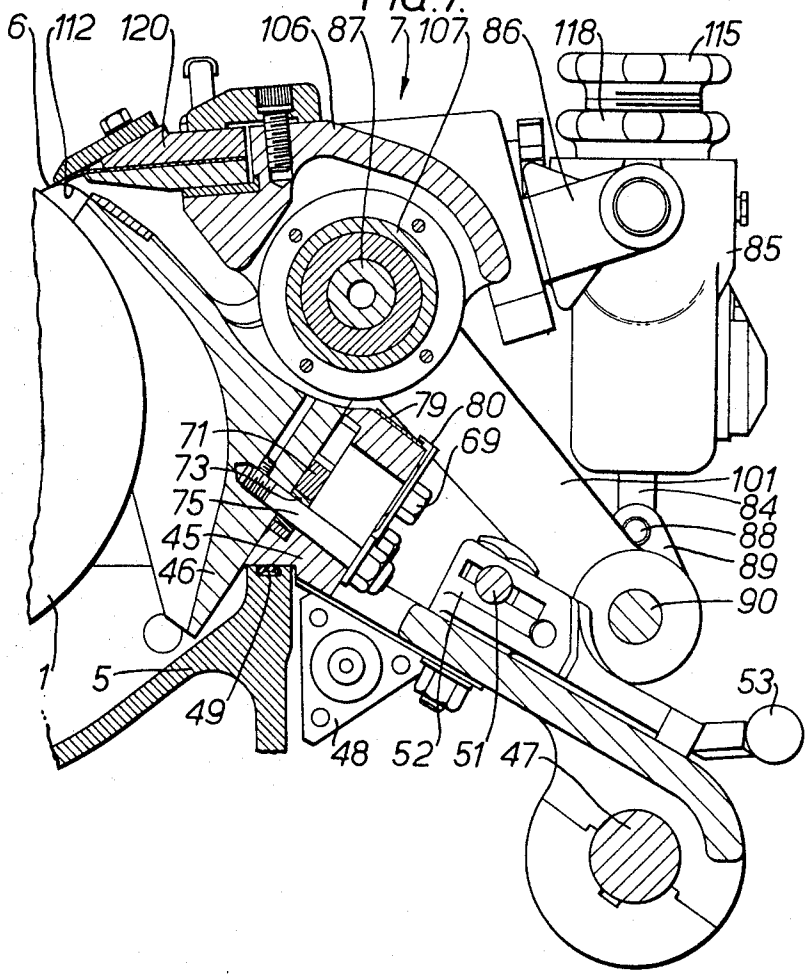
FIG. 7.



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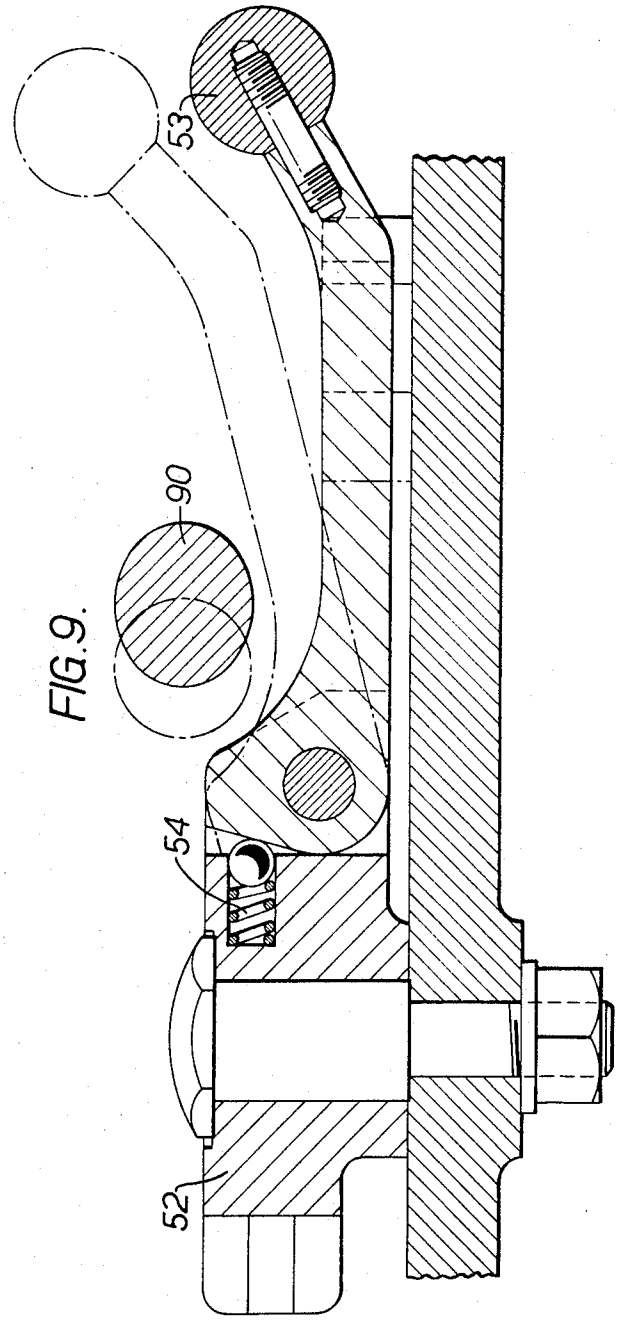

FIG. 9.

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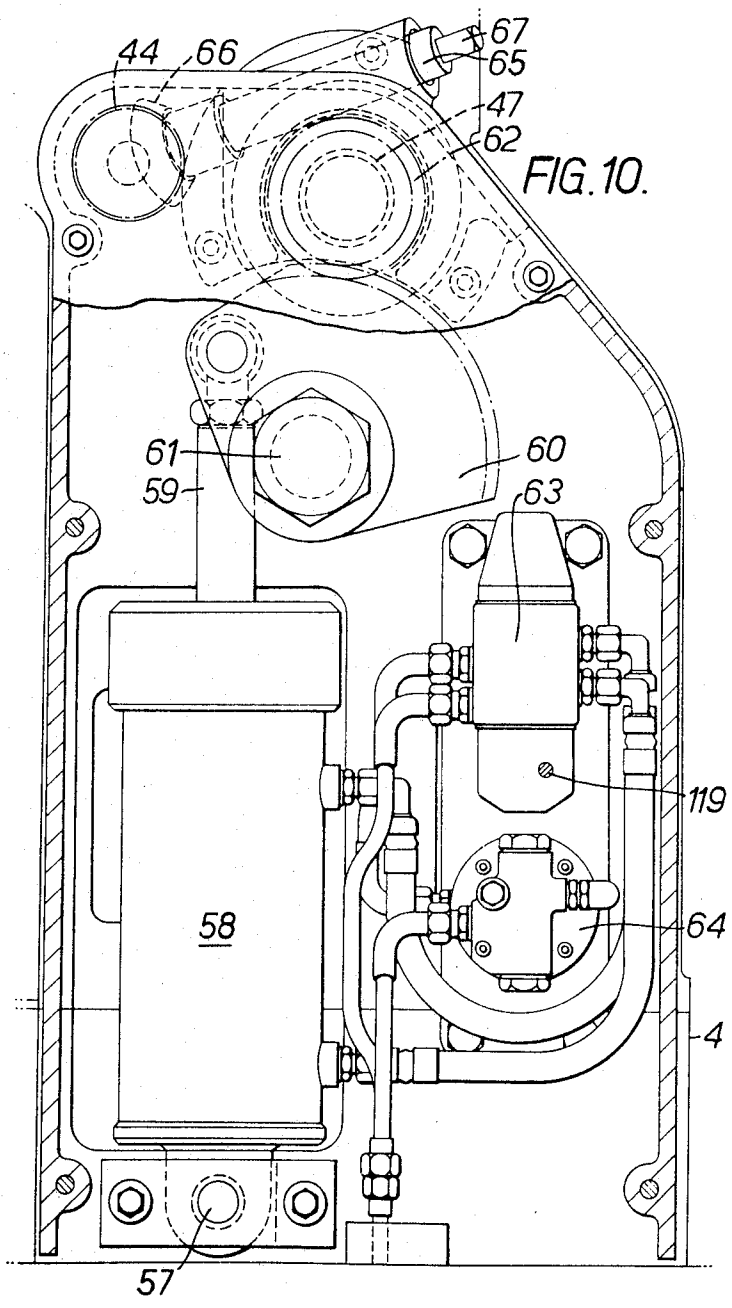

FIG. 10.

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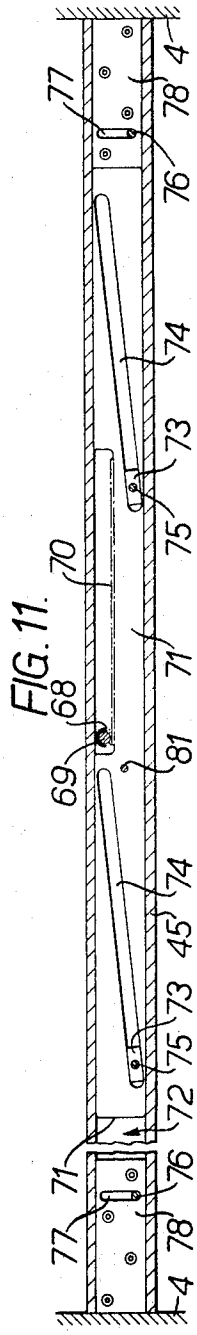

FIG. 11.

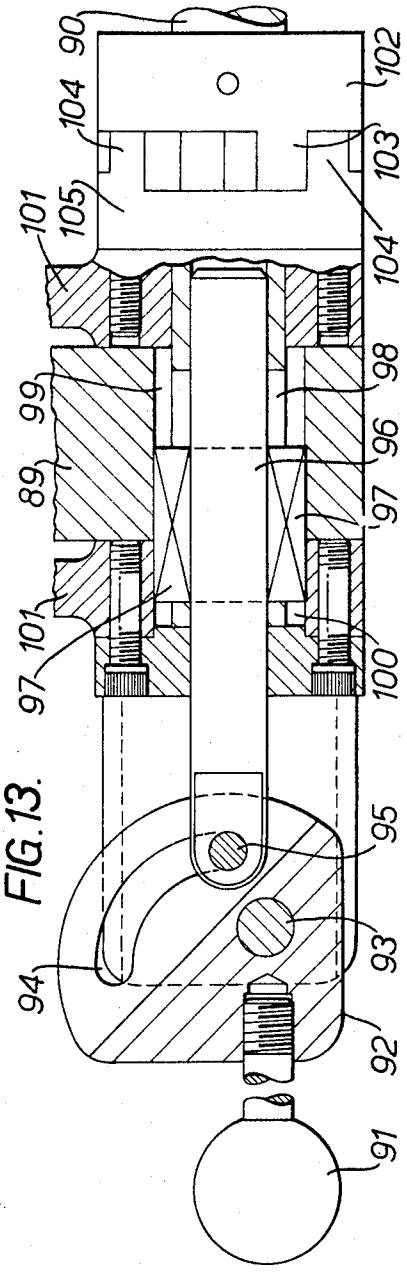

FIG. 13.

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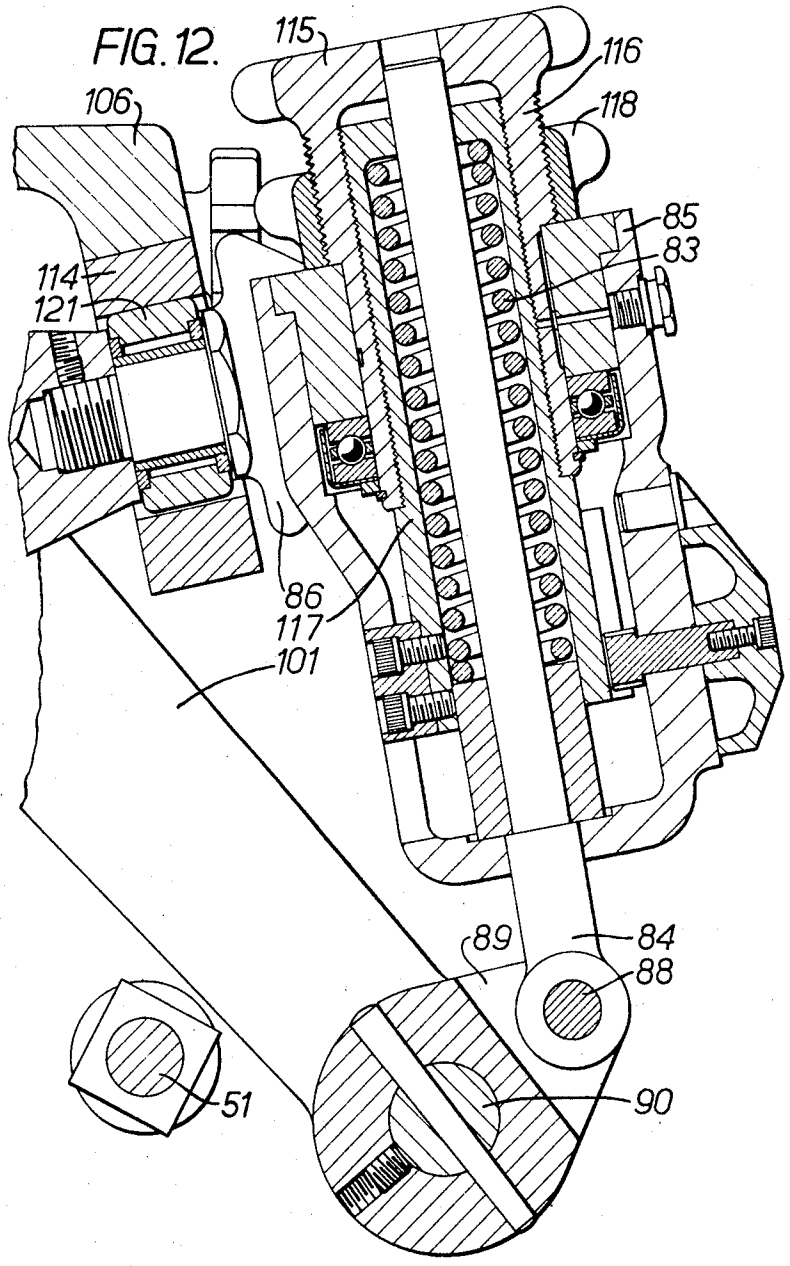
FIG. 12.



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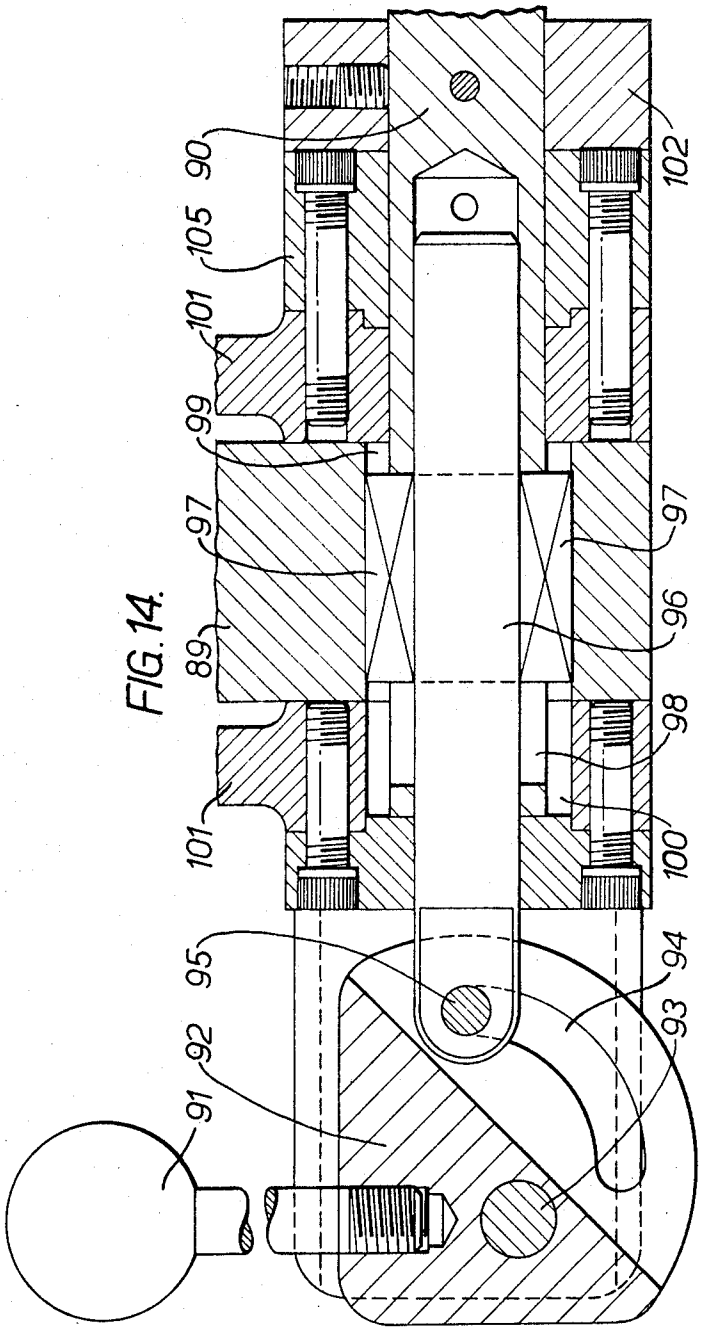

FIG. 14.

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United States Patent Office 3,267,849 Patented August 23, 1966

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INTAGLIO PRINTING MACHINE WITH COVER ASSEMBLIES AND REMOVABLE INK TROUGH

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Claims priority, application Great Britain, Nov. 27, 1962, 44,817/62
7 Claims. (Cl. 101—157)

This invention relates to rotogravure printing machines and in particular to such machines as are required to be adaptable to the production of a variety of printed work. One of the chief difficulties in designing such a machine is to provide means for readily changing the ink in any printing unit so as to enable it to do work of a different color, while at the same time providing for efficient and complete cleaning of the ink apparatus to prevent contamination of one ink by the remains of the other. It is also necessary to be able to reverse the rotation of the printing cylinder with consequent reversal of the position of the doctor blade, as well as to be able to accommodate a variety of printing cylinder diameters.

According to the present invention, there is provided a rotogravure printing machine in which the printing cylinder is provided with an enclosure in the form of two complementary pivoted covers which can be swung back to an open position, together with an ink duct which can be readily withdrawn from the interior of the machine.

An embodiment of the invention will now be described by way of example with reference to the accompanying drawings but it is clearly to be understood that the invention is by no means restricted to the details of this embodiment.

FIG. 1 is a diagrammatic elevation of the lower portion of a rotogravure printing machine;

FIG. 2 is a diagrammatic isometric view of the machine of FIG. 1 with certain components removed or withdrawn;

FIG. 3 is a longitudinal cross-section through the ink duct in position for printing;

FIG. 4 is a part-sectional end view of the ink duct showing the elevating mechanism therefor;

FIG. 5 is a plan view of the ink duct and its elevating mechanism;

FIG. 6 is a side elevation, partly in section of one of the pivoted covers;

FIG. 7 is a section on the line VII—VII of FIG. 6 but to an enlarged scale;

FIG. 8 is a plan view of the cover-locking handle;

FIG. 9 is a sectional elevation of the cover-locking handle;

FIG. 10 is a sectional elevation of the cover-moving mechanism;

FIG. 11 is a sectional elevation of part of FIG. 7 to show the interior mechanism thereof;

FIG. 12 is a part section on the line XII—XII of FIG. 6 but showing the mechanism in a different position from that of FIG. 7;

FIG. 13 is a sectional elevation on an enlarged scale of part of FIG. 6; and

FIG. 14 is a view generally similar to FIG. 13 but showing the mechanism in a different position.

Referring to FIG. 1, the invention in this embodiment is applied to a conventional rotogravure machine comprising three vertically superimposed cylinders, namely, an engraved printing cylinder **1**, an intermediate rubber-covered cylinder **2** and an impression cylinder **3**, all being journalled in a frame **4**. The printing cylinder **1** is immersed during printing in an ink duct **5** and surplus ink is removed from the cylinder surface by a doctor blade **6**. As is well known, it is important to enclose the printing

cylinder as much as possible to prevent evaporation of the solvent in the ink and the escape of solvent vapour. In this embodiment, the means of enclosure takes the form of two pivoted covers **7** and **8** of similar construction mounted on either side of the printing cylinder.

Turning to FIG. 2, the printing cylinder **1** has been assumed to have been withdrawn via a slot **9** in the frame and both covers **7** and **8** have swung back to permit cleaning of their interior surfaces to take place. The swinging back of the left hand cover **8** (not visible in FIG. 2) is, of course, also necessary to allow the printing cylinder to be withdrawn. The ink duct **5** is shown withdrawn for cleaning and it will now be more fully described with reference to FIGS. 2 and 3.

The ink duct comprises a trough of a size which is large enough to accommodate the largest printing cylinder and the ink-containing portion is preferably of polished aluminium for easy cleaning. The end of the duct on the operator's side of the machine (the left-hand end in the drawings) is provided with wheeled legs **10** and the opposite end is fitted with wheels or rollers **11** adapted to run on transverse rails of which an extension is shown at **12** in FIG. 2. As will be explained later, means is provided within the machine for raising and lowering the duct to and from the working position and the legs **10** are of such length as to contact the floor when the duct has been lowered to a position where it can be withdrawn at a convenient height for cleaning.

When in the working position, as shown in FIG. 3, the ink duct is supplied from an ink tank **13** which can be wheeled immediately below the duct as shown. In this tank is a pump **14** belt-driven by a motor **15**. This pump supplies ink to the duct by means of a flexible hose connection, part of which is shown at **16**, the ink entering the duct on the right of FIG. 3 and flowing across to a weir **17**. By this means a constant level of ink is maintained in the duct and the surplus ink returns to the tank **13** by means of a pipe **18**. A filter **19** is interposed between the tank inlet and outlet. The pipe **18** is attached by a bayonet-type joint, to a duct outlet **20**. An inspection cover **21** is provided in the outlet **20** so that the flow of ink can be inspected. In order to take account of the fact that the printing cylinder may rotate in either direction there are provided alternative inlets **22** and **23** to the duct as shown in FIG. 2, either of which may be connected to the ink tank by the hose **16**. Normally the inlet chosen is that disposed on the opposite side of the duct to the doctor blade. It will be appreciated that the constant movement of the ink across the duct ensures that any air bubbles are carried over the weir and not transferred to the printing cylinder.

By having a portable ink tank **13** it will be apparent that alternative tanks of different coloured inks may be disposed beneath the duct. When it is desired to drain the duct, this is done by operating a drain cock **24** (FIG. 3). This allows the contents of the duct to flow directly to the outlet **20** and pipe **18**, by-passing the weir **17**. When it is desired to withdraw the ink tank, the hose **16** and pipe **18** are disconnected. The bedplate of the machine is formed as a tray **122** to contain any ink accidentally spilled from the duct. The ink tank is formed with a lip to direct any overflowing ink into the same tray.

One means for raising and lowering the duct will now be described with reference to FIGS. 4 and 5. It has already been mentioned that the duct is adapted to run on rails in the machine and these rails are shown at **25** and **26**. To either end of each rail is attached a bracket of which two are shown at **27** and **28** respectively in FIG. 4. To each bracket is attached a nut such as **29** and **30**. Each nut is threaded on to a respective rotatable but axially-fixed screw such as **31** and **32**. It will be apparent that rotation of the four screws will result in the raising or lower-

ing of the brackets carrying the rails 25 and 26 and, hence, of the duct itself. Each of the four screws has fixed to it a bevel gear 33, 34, 35 or 36. These mesh respectively with four more bevel gears 37, 38, 39 and 40. Gears 37 and 39 are fixed to a shaft 41 and gears 38 and 40 to a shaft 42. Shafts 41 and 42 are connected together, in this case, by a chain 43 so that rotation of one shaft, say 42, will result in the simultaneous rotation of all four screws. In the embodiment shown, shaft 42 is provided with a bevel gear 44 to which a manual or other drive may be connected, as explained later. In order to adjust the level of the duct, the nuts such as 29 and 30 are capable of being rotated relative to their respective brackets such as 27 and 28 and then locked in the adjusted position.

It has already been explained that it is important to enclose the printing cylinder as much as possible and that for this purpose two pivoted covers 7 and 8 (FIG. 1) are mounted on either side of the printing cylinder. These covers are almost exactly alike and one of them will now be more fully described with reference to FIGURES 6 and 7 of the drawings. It can be assumed that this is the cover shown hinged back at 7 in the purely diagrammatic FIG. 2.

The cover 7 is formed in two portions 45 and 46. The lower portion 45 is carried on a shaft 47 and the two portions of cover together with the doctor blade 6 can be swung as an entity by rotation of the shaft 47. In its operative position as shown in FIG. 7, the cover assembly rests against a stop 48 and makes sealing engagement with the top of the duct 5 by means of a sealing member 49. In this position, the cover can be locked to the frame 4 by means of bolts 50. These are connected by rods 51 to a double crank 52 also shown in FIGS. 8 and 9. A handle 53 is pivotally connected to the double crank 52 and is acted on by a spring 54 so that it is constrained to lie in either of two notches 55 or 56. In FIG. 8 the bolts are assumed to be in the unlocked position so that the handle is in notch 56. To engage the bolts as shown in FIG. 6, it is necessary to lift the handle to the dotted position shown in FIG. 9 and then to move it until it can enter the notch 55.

As already mentioned, the whole cover assembly can be swung back by rotation of the shaft 47 and a preferred means for doing this will now be described with reference to FIG. 10. Pivotally mounted at 57 on the main frame 4 is a hydraulic cylinder 58 driving a ram 59. The latter is connected to a segmental rack 60 pivoted at 61 and meshing with a pinion 62 fixed to the cover shaft 47. The supply of hydraulic fluid to the cylinder 58 is controlled by two valves 63 and 64. Valve 63 is a directional control valve to determine whether the cover is moved in the opening or closing direction and valve 64 is a flow control valve to regulate the speed of movement. Valve 63 is preferably operated directly by a lever (not shown) on the valve spindle 119 which lever is at a position convenient for such operation. Valve 64 is preset or adjusted to give the required speed of operation.

Also shown in FIG. 10 is a shaft 65 carrying a bevel gear 66 meshing with the gear 44 (FIG. 5) driving the raising and lowering mechanism for the ink duct. This shaft has a squared end 67 to which a handle or the like can be attached so as to permit operation of this mechanism from outside the machine.

It has already been stated that the cover is formed in two portions 45 and 46. In order to adjust the cover to accommodate different sizes of printing cylinder 1, these two portions are made relatively movable and the plane of movement is parallel to the radius of the printing cylinder at its point of contact with the doctor blade 6. The means for effecting this adjusting movement will now be described with reference to FIGS. 6, 7 and 11.

A pinion 68 (FIG. 11) rotatable by means of a spanner or like tool applied to a hexagonally ended shaft 69 (FIG. 6) engages with a rack 70 forming part of a slider 71 and which is free to move transversely in a channel 72 formed in the lower cover portion 45. Rotation of the pinion 68 causes the slider 71 to move to the left in FIG. 11 and this in turn results in relative movement between the slider and the two blocks 73 which run in inclined slots 74 in the slider. The blocks 73 are pivotally mounted on bolts 75 which are fixed to the top portion 46 of the cover, and further bolts 76 also fixed to the top cover portion are free to slide in straight slots 77 formed in members 78 fixed in the channel 72. The slots 77 confine the bolts 76—and hence the top cover portion—to linear motion in the plane already referred to. Such linear motion results from the interaction between the slider 71, the sides of the channel 72, the inclined slots 74 and the blocks 73. Rotation of the shaft 69 thus provides an extremely simple but accurate method of adjustment of the relative positions of the two cover portions while preserving their alignment with each other. The degree of adjustment, which can be in terms of printing cylinder diameter or circumference, can be read off on a scale 79 with which co-operates a sliding pointer 80. The latter is bolted at 81 to the slider 71, the bolt passing through a longitudinal slot 82. It is to be noted that in the drawings the adjustment has been assumed to have been made to accommodate the smallest size of printing cylinder.

In accordance with the usual practice, the doctor blade is resiliently loaded to press it against the printing cylinder and, in this embodiment, this loading is applied towards either end thereof by respective springs of which one is shown at 83 in FIG. 12. Each spring acts between a push rod 84 and a spring housing 85. The latter is connected to the doctor blade assembly by means of a forked arm 86. The doctor blade assembly is capable of pivoting about a pair of spindles of which one is shown at 87, it being understood that immediately ensuing description is applicable to either end of the doctor blade. The push rod 84 is pivotally connected at 88 to a crank 89 and both cranks are connected to each other by a cross shaft 90. By rotation of this cross shaft anticlockwise the doctor blade 6 can be brought to bear on the printing cylinder as shown in FIG. 7, while rotation in the opposite direction to the position shown in FIG. 12 brings the doctor blade back from the cylinder. In order to effect such rotation and to lock the cross shaft in either of its extreme positions, mechanism is provided which will now be described with particular reference to FIGS. 13 and 14.

A handle 91 is fixed to a quadrant 92 pivoted at 93. The quadrant 92 has a cam slot 94 in which runs a cam follower 95 and the latter is connected to a sliding shaft 96. The shaft 96 fits into the end of the cross shaft 90 and has fixed to it a pair of keys 97 sliding in slots 99 in the cranks 89. Thus, whatever the axial position of the shaft 96 it is always rotatably engaged with the crank 89 at the left-hand end (FIG. 6) and through the cross shaft 90 with the crank 89 at the other end. In the position shown in FIG. 13, the keys 97 are received in slots 100 in arms 101 fixed to the upper cover portion 46. By this means, the cross shaft 90 and the cranks 89 are locked against rotation and it will be apparent that two sets of slots 100 are provided in the arms 101 to correspond with the two extreme positions of the cross shaft and cranks. In order to move the cross shaft and cranks from the locked position shown in FIG. 13, it is necessary to rotate the handle 91 through a right angle to the position shown in FIG. 14. Not only does this position the handle perpendicularly to the axis of rotation but it causes the shaft 96 to move to the right and disengage the keys 97 from one set of slots 100. The handle can then be rotated until the opposite angular position is reached and the mechanism locked as before. Rotation of the cross shaft 90 is limited in both directions by a collar 102 fixed to the latter and carrying dogs 103 co-operating with limit-

ing dogs **104** formed from a collar **105** fixed to one of the arms **101**.

As is customary, the doctor blade **6** is reciprocated along its length and the means for doing so will now be described with particular reference to FIGS. 6 and 7.

The doctor blade assembly comprises the doctor blade **6** and its holder **120**. The latter is secured to a carrier **106** rotatably mounted by bearings **107** on the spindle **87**. These bearings are free to slide on their spindle so as to permit the doctor blade assembly and carrier to reciprocate. A hydraulic cylinder **108** has a piston rod **109** carrying a cross head **110** mounted on ball bearings **111**. Reciprocation of the piston rod **109** is thus effective to reciprocate the doctor blade while the doctor blade assembly and carier are still free to rotate relative to the cylinder **108** about the axis of the spindle **87**. The hydraulic fluid supply to the cylinder **108** may be derived from a pump driven by the shaft driving the printing cylinder. Other means of reciprocation could, of course, be adopted if preferred.

In order to form a vapour-tight seal between the doctor blade and the cover, a sealing blade **112** is mounted on the top cover portion **46** and is adapted to press against the underside of the reciprocating doctor blade, in known manner as shown in FIG. 7. In order to complete the vapour-sealing properties of the cover, provision is made for the mounting of a "dummy doctor" blade **113** on the edge of the cover **8** on the opposite side of the printing cylinder (on the left of FIG. 1). This blade does not actually contact the surface of the printing cylinder but its edge is sufficiently near to it to prevent the escape of the evaporated solvent. When it is desired to reverse the rotation of the cylinder, the positions of the doctor blade assembly and the dummy doctor blade **113** are interchanged. The blade **113** may be made of plastic material if desired.

The spring-loading from the spring housing **85** is applied to the doctor blade carrier **106** by means of a roller **121** carried on the forked arm **86** pressing against a bearing surface **114** on the carrier (FIG. 12). Thus the pressure can be maintained even while the doctor blade and its carrier are reciprocating. The pressure exerted by the spring **83** may be adjusted by rotation of a knob **115** forming part of a rotatable, inwardly internally threaded sleeve **116**. Threadedly engaged in the sleeve **116** is a spring-housing abutment **117** which is free to move axially but not to rotate relative to the housing **85**. Thus, rotation of the knob **115** results in axial movement of the spring abutment **117** and thus varies the spring-loading on the doctor blade. A second knob **118**, coaxial with the knob **115**, acts as a locknut on an externally threaded portion of the sleeve **116** so as to prevent unwanted movement of the spring abutment.

It will be apparent that the arrangements according to the invention not only permit of rapid and complete cleaning of the inking mechanism but also provide for speedy alteration of the mode of operation of the printing machine.

I claim:

1. In a rotary intaglio printing machine having a printing cylinder rotatably supported on a frame and means for rotating said cylinder in opposite directions, an ink trough having a cavity disposed below said cylinder with the lower portion of said cylinder immersed in ink in said cavity, means supporting said trough for selective vertical displacement between a raised position where the lower portion of said cylinder is immersed in the ink in said cavity and a lowered position where said trough is removable from said machine, said trough having upwardly facing surfaces on opposite sides of said cavity and said cylinder and extending longitudinally of said cylinder, means cooperating with said trough for enclosing said printing cylinder during operation comprising two similar multi-part cover assemblies disposed one on each side of said cylinder and each having (a) upper and lower parts and (b) means mounting said upper part on said lower part, means pivotally mounting the lower part of each of said cover assemblies on parallel axes on said frame for movement of said cover assemblies toward and away from said printing cylinder, means mounting a reciprocal doctor blade on the upper part of one of said cover assemblies, the upper parts of both said cover assemblies facing and radially spaced from the periphery of said printing cylinder in partially peripheral surrounding relation thereto when said cover assemblies are pivoted to cylinder closed positions, said upper part of at least said one assembly being adjustable in a direction that is substantially parallel to a radius of said cylinder in the line of contact of said cylinder and doctor blade, the lower parts of said cover assemblies each having longitudinal surfaces facing downwardly in opposing relation to respective ones of said upwardly facing surfaces when said trough is in said raised position and when said cover assemblies are closed, and means engaged between opposing ones of said upwardly and downwardly facing surfaces when said cover assemblies are closed to provide fluid tight seals on opposite sides of said cylinder.

2. The rotary intaglio machine defined in claim **1** wherein said sealing means comprises a groove-seated, elongated member carried on each of said upwardly facing surfaces of said trough.

3. The rotary intaglio printing machine defined in claim **1** wherein the lower portions of said upper parts of both of said cover assemblies extend into said cavity.

4. The rotary intaglio machine defined in claim **1** wherein said trough is removable in its lowered position axially with respect to the rotational axis of said cylinder.

5. The rotary intaglio printing machine defined in claim **4** wherein said means supporting said trough comprises track means and wherein means are provided for raising and lowering said track means.

6. The rotary intaglio printing machine defined in claim **1** wherein said doctor blade is pivotally mounted on the upper part of said one assembly and wherein crank means are provided for swinging said doctor blade into and out of operative association with said cylinder without opening said cover assemblies

7. The rotary intaglio machine defined in claim **6** comprising resilient loading means interposed between said crank means and said doctor blade and being effective to preset the pressure of said doctor blade on said cylinder when said doctor blade is in its operative position.

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