United States Patent [19]

Huffman

[11] **3,715,981**

[45] **Feb. 13, 1973**

[54] **FLUID ACTUATOR AND LOCK FOR PRINTING PLATE CYLINDERS**

[75] Inventor: **Harold W. Huffman,** Hamilton, Ohio

[73] Assignee: **The Hamilton Tool Company,** Hamilton, Ohio

[22] Filed: **June 29, 1970**

[21] Appl. No.: **50,642**

[52] **U.S. Cl.** **101/415.1,** 137/625.6, 137/625.66

[51] **Int. Cl.** **B41f 27/12**

[58] **Field of Search**.101/415.1, 378, 382 R, 382 MV; 251/295; 137/625.6, 625.66, 625.68

[56] **References Cited**

UNITED STATES PATENTS

1,918,416	7/1933	Moussier	197/180
2,157,621	5/1939	Neilson	101/415.1
2,890,889	6/1959	Work	279/114
2,946,196	7/1960	Myers	60/54.5
2,961,951	11/1960	Nitchie	101/378 X
3,022,728	2/1962	Heller	101/415.1
3,032,065	5/1962	Jolley	137/625.68
3,047,257	7/1962	Chester	244/85
3,149,565	9/1964	Norlin	101/415.1
3,158,178	11/1964	Fiala et al.	251/295 X
3,215,163	11/1965	Henderson	137/625.68
3,329,159	7/1967	Herion	137/625.28
3,340,897	9/1967	Nevulis	137/625.6
3,456,588	7/1969	Brodie	101/415.1
3,529,629	9/1970	Cowan	137/625.6

Primary Examiner—Edgar S. Burr
Assistant Examiner—R. E. Suter
Attorney—J. Warren Kinney, Jr.

[57] **ABSTRACT**

The printing cylinder is provided with an internal inflexible clamp bar rockingly mounted, for movement selectively either to an operative plate-clamping position or to an inoperative plate-releasing position, by means of a foot-controlled valve for enabling the pressman to utilize both of his hands exclusively for accurate positioning of the printing plate upon the cylinder.

15 Claims, 7 Drawing Figures

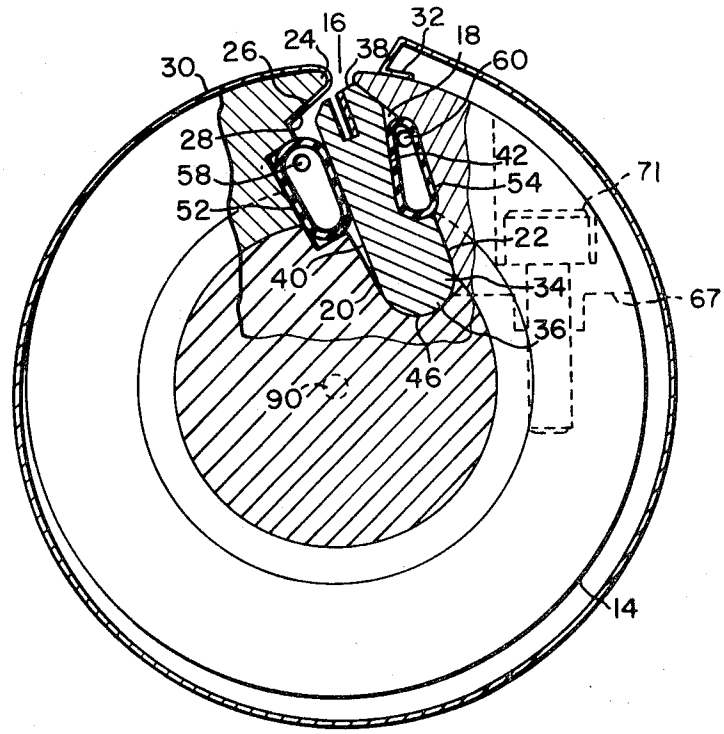


FIG-1

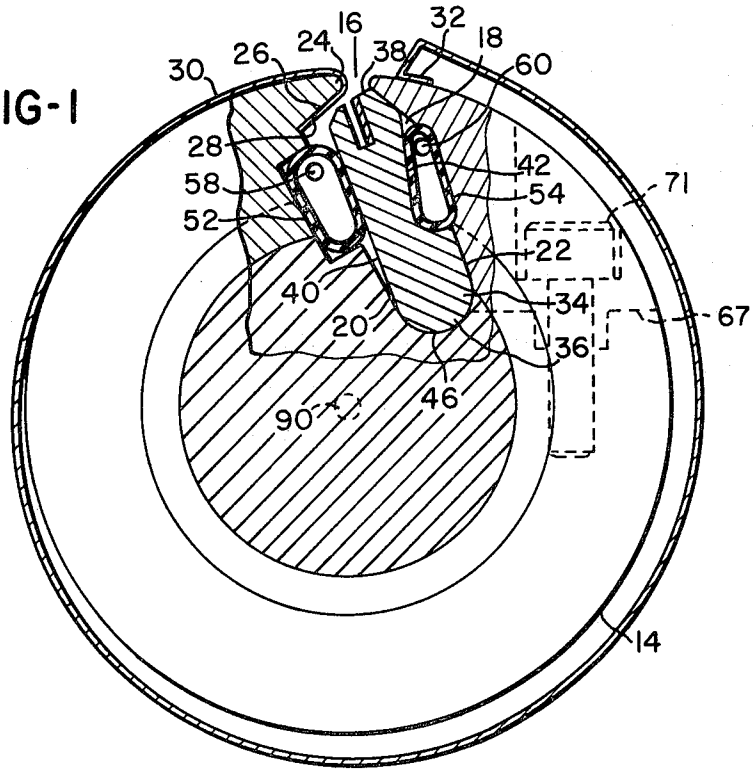
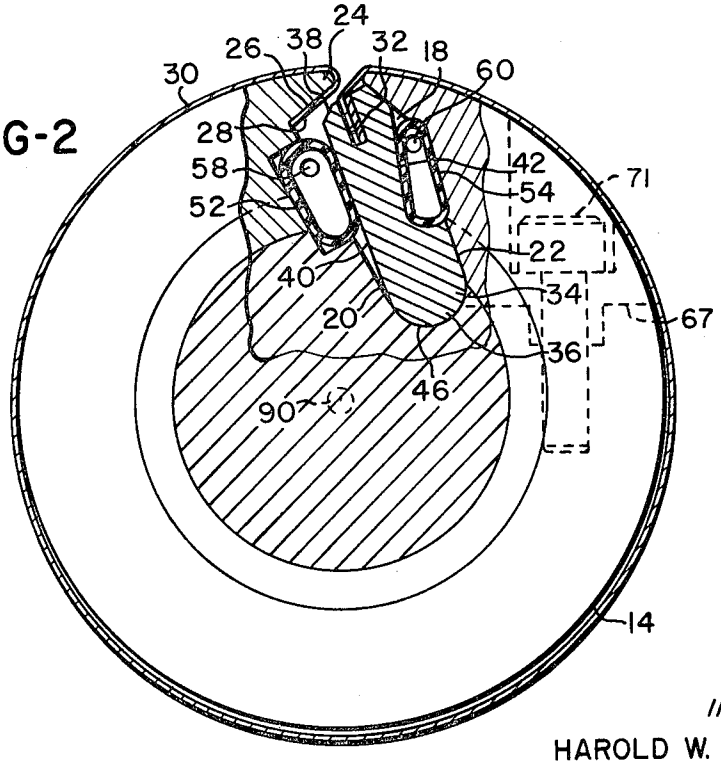


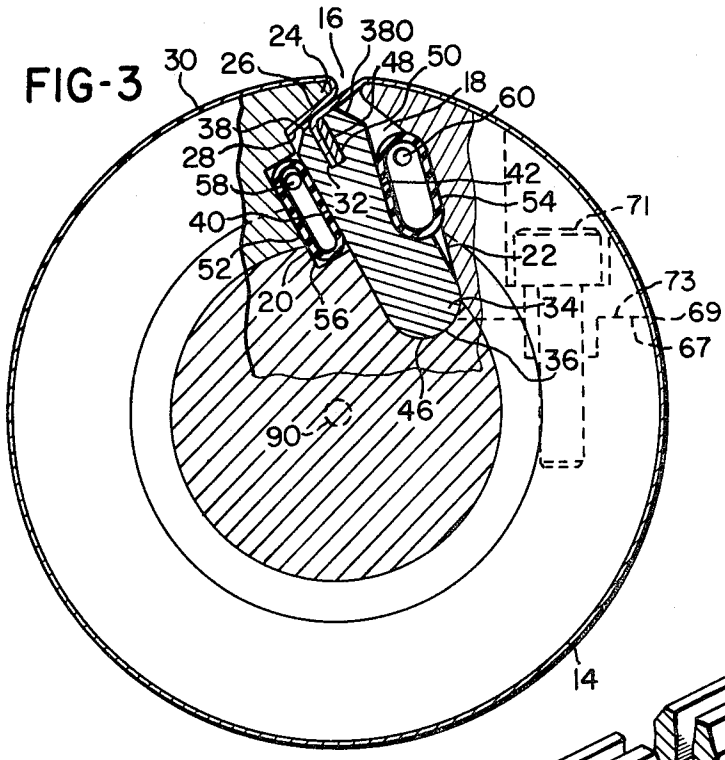
FIG-2



INVENTOR
HAROLD W. HUFFMAN

BY J. Warren Kinney, Jr.
ATTORNEY

FIG-3



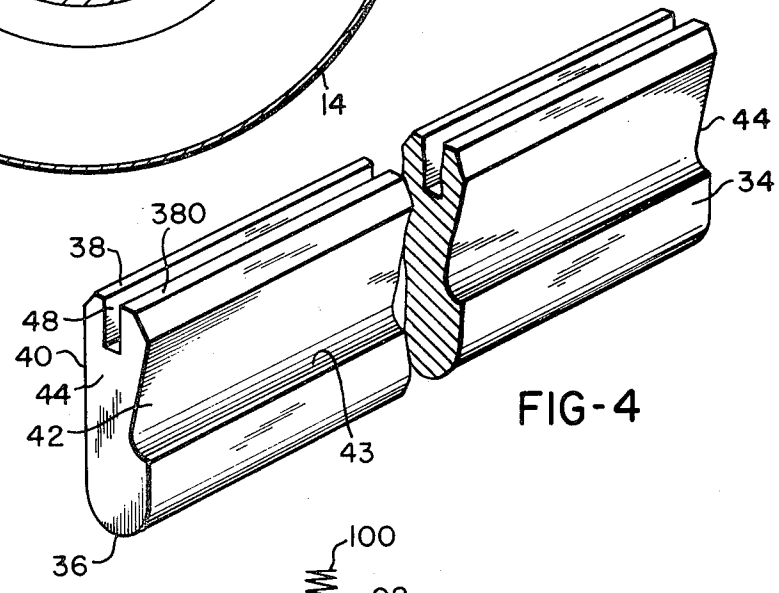


FIG-4

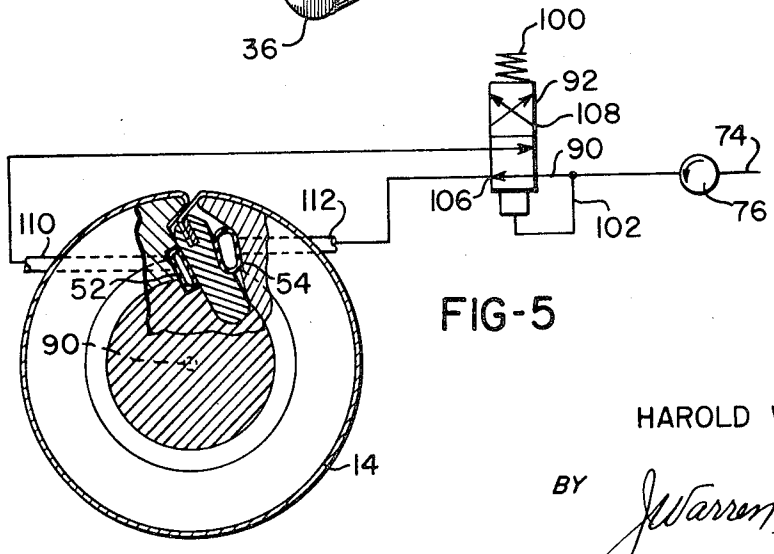


FIG-5

INVENTOR
HAROLD W. HUFFMAN
BY J. Warren Finney, Jr.
ATTORNEY

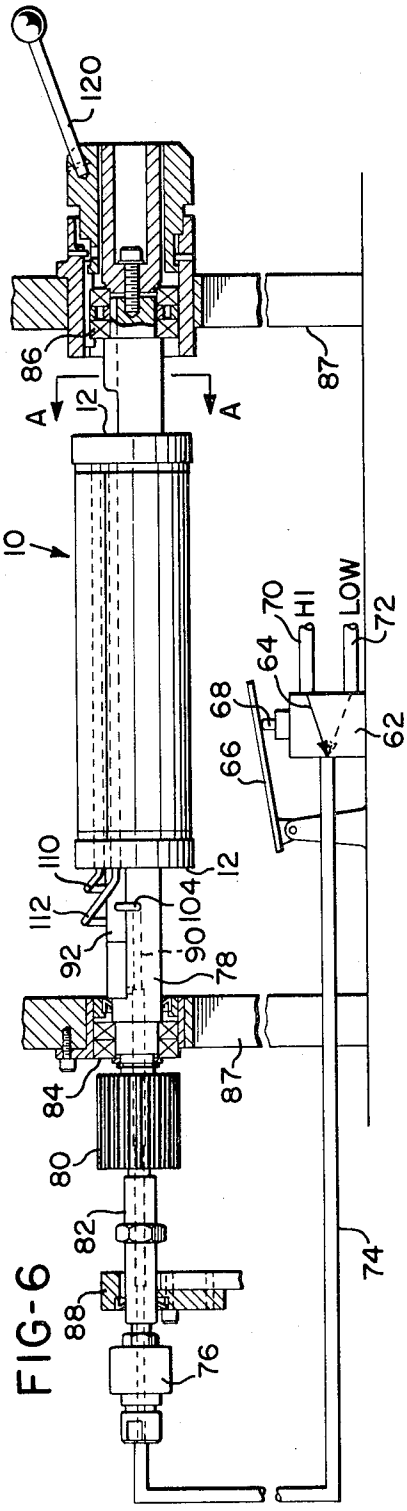


FIG-6

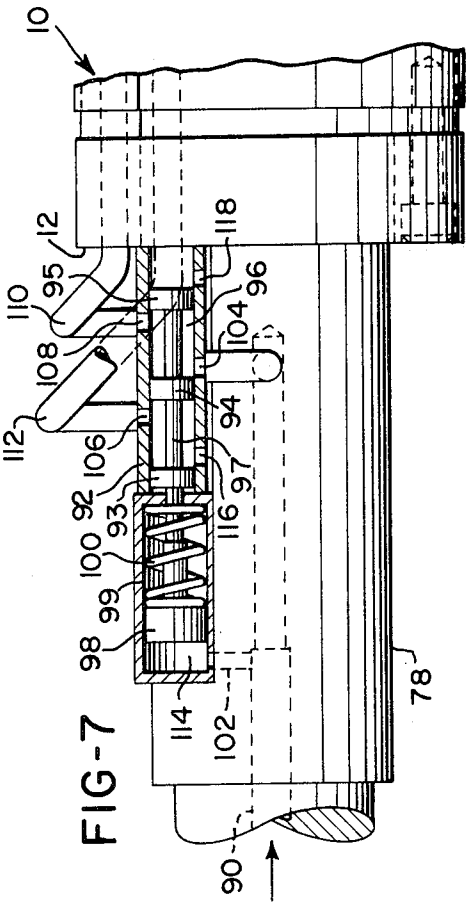


FIG-7

INVENTOR
HAROLD W. HUFFMAN
BY J. Warren Kinney, Jr.
ATTORNEY

FLUID ACTUATOR AND LOCK FOR PRINTING PLATE CYLINDERS

The present invention relates to a fluid actuator and lock for the clamp bar of a printing plate cylinder.

The plate supporting cylinder of a printing press is an elongate cylinder supported at its opposite ends in bearings which permit rapid axial rotation of the cylinder. A flexible printing plate, generally rectangular in form, is wrapped once about the circumference of the cylinder, and has its opposite ends clamped securely to the cylinder in order to avoid accidental release of the plate during a printing operation.

The opposite ends of the printing plate ordinarily are gripped and held by mechanical clamps, usually screw clamps, which are tightened and loosened by means of a wrench in the hands of the pressman. In manipulating the clamp wrench, the pressman finds that difficulty is often encountered in the effort to simultaneously position the printing plate upon the cylinder accurately and quickly preparatory to clamping. Accuracy of plate positioning and clamping is important to the performance of high quality printing and rapid production.

A primary object of the invention is to provide fluid actuated means in conjunction with the clamp bar of a printing plate cylinder wherein said means are selectively operable for moving the clamp bar to an operative plate-clamping position or to an inoperative plate-releasing position incident to manipulation of a valve under the control of the pressman. The fluid actuated means includes a pair of elongate inflatable tubular members disposed one each on opposite sides of the clamp bar whereby inflation of said members will impart a positive, uniform force to and along one face or side of the entire length of the clamp bar. Fluid actuating media at one or the other of two different pressures is introduced axially through a common conduit in an end of the printing cylinder to a pressure responsive valve on the cylinder which controls the flow of pressure media to and from said inflatable members.

A further object of this invention is to provide fluid pressure means for effecting plate lock-up upon a press cylinder with ease and despatch, and with a high degree of accuracy.

Another object of the invention is to provide an improved plate lock-up means which frees both hands of the pressman for accurately positioning the plate upon the cylinder, in the interests of saving time and labor, and producing high quality printing.

Another object of the invention is to provide an improved plate lock-up means which applies uniform clamp force automatically along the full length of a plate end margin, with improved printing results and production.

A further object is to ensure maintenance of a continuous clamping force upon the printing plate end margins during the entire course of a printing operation, to prevent loosening of the clamp means due to pull exerted thereon by a blanket cylinder rotating against the printing plate.

Another object of the invention is to provide a compact design of clamp for printing plate cylinders, which permits a reduction in the cylinder diameter.

The foregoing and other objects are attained by the means described herein and illustrated upon the accompanying drawing, in which:

FIGS. 1–3 are vertical sectional views taken on line A—A of FIG. 6, showing a printing plate cylinder embodying the teachings of the present invention and illustrating three sequential positions of the clamp bar incident to locking a printing plate onto the cylinder.

FIG. 4 is a perspective view of the clamp bar.

FIG. 5 is a diagramatic view of a control circuit for actuating the clamp bar.

FIG. 6 is a schematic side view, partly in section, illustrating, in general, but not to scale, a printing cylinder assembly embodying the teachings of the present invention.

FIG. 7 is an enlarged fragmentary view of the left end of the printing cylinder disclosing the pressure responsive distributor valve.

The reference character **10** indicates a printing press cylinder, which is elongate and has opposite ends **12, 12**. The cylinder has an outer curved surface **14**, which is interrupted by a narrow access slot **16** coextensive with the length of the cylinder. Slot **16** leads to a wide chamber **18** formed by a deep elongate groove which is parallel to the cylinder axis, and is defined by a pair of opposed spaced inner side walls **20, 22** disposed at an acute angle to one another.

An abutment lip **24** overhangs the inner wall **20** adjacent to slot **16**, and includes an interior clamp face **26**. A flexible sheet-like printing plate **30** having a hook or turned portion **28** at one end which hooks over the lip **24** and overlies the clamp face **26**. The printing plate is of such length that it may be wrapped once about the periphery of cylinder **14**. The plate has a second hooked or turned end margin **32** to be inserted into access slot **16** and anchored in a manner to be described.

Within chamber **18** is disposed an elongate substantially inflexible clamp bar **34** formed of steel or other rigid metal, whose length may approximate the length of slot **16**. Clamp bar **34** may be substantially rectangular of form, so as to include opposite side edges **36, 38** which are parallel to one another, and also a pair of opposite faces **40** which is substantially flat and, **42** having a depression **43** therein. Opposite ends of the clamp bar are denoted **44, 44**.

Means is provided to support the clamp bar for rocking movement about its inner side edge **36**. This may be accomplished by means of conventional pivots, or, in accordance with the example illustrated, the inner side edge **36** may fulcrum within a pocket **46** afforded by the base of chamber or groove **18** where the walls thereof meet. The clamp bar side faces **40** and **42** are exposed to the chamber or groove walls **20** and **22**, respectively, and will recede from or approach said walls **20** and **22** incident to rocking movements of the clamp bar.

The elongate outer side edge **38** of clamp bar **34** performs as an elongate swingable nose which is substantially coextensive with the length of the clamp bar, and said nose is arranged to substantially wipe or sweep against or engage the clamp face **26** of the abutment lip **24** during rocking of the clamp bar. The nose is denoted **380**, and is seen to include a narrow socket or slot **48** extending lengthwise of the nose to receive the hooked end margin **32** of printing plate **30**. the hook **32** has access to socket **48** through the narrow slot **16** of the groove or chamber **18**. A wear plate **50** may be in-

corporated in socket **48** engaging the hook **34** to hold the same therein until clamped by the nose **380**.

It is here noted that clamp bar **34**, may be moved toward or away from either of the chamber or groove walls **20** or **22**. When moved toward wall **22**, the nose and the socket **48** of the clamp bar are accessible through slot **16** for application or removal of the hooked margin **32** of plate **30** with respect to socket **48**. Also, in this position of the clamp bar the nose **380** will be withdrawn from the region of lip **24** and clamp face **26**, so as to free the hooked margin **28** of plate **30** for displacement from lip **24**, thereby permitting bodily removal of the printing plate from cylinder **14**. In the light of the foregoing, a rocking of clamp bar **34** toward wall **22** constitutes disposition of the clamp bar to an inoperative position at which the hooked ends of the printing plate are released.

When the clamp bar **34** is disposed to the inoperative position above mentioned, a printing plate may be wrapped about cylinder **14** and the opposite hooked ends thereof may be applied to lip **24** and nose socket **48** preparatory to lock-up or clamping. After the hooked ends of the plate are properly applied, the clamp bar may be shifted toward wall **20**, thereby causing the clamp nose **380** to firmly press and lock the plate ends with a camming force against clamp face **26**. So shifted, the clamp bar is said to assume the operative clamping or lock-up position.

Means is provided for very conveniently and efficiently shifting the clamp bar selectively or alternatively to the operative and inoperative positions aforesaid. Such means is fluid pressure operated, and may comprise a pair of flexible elongate clamp tubes **52, 54** each of which extends substantially the full length of the clamp bar, and either of which may be inflated with a fluid under pressure so as to impose lateral force against a side face of the clamp bar, for rocking said bar about the pivot or fulcrum at **46**. The flexible clamp tube **52** rests between the clamp bar face **40** and chamber wall **20**, in effect, said wall **20** being preferably channeled longitudinally at **56** to accommodate tube **52**. The clamp tube **54** rests between clamp bar face **42** and the face **22** of chamber or groove **18**.

In operation, one flexible tube is to be inflated while the other exhausts. The tubes when inflated expand laterally against the side face of the clamp bar, To rock the bar about the pivot or fulcrum at **46**, thereby to initially move and constantly maintain the clamp bar in either an operative or an inoperative position previously defined herein. The cylinder **14** may be provided with a pair of fluid transfer ports **58** and **60** having connection with the clamp tubes **52** and **54**, respectively, preferably at corresponding ends of the clamp tubes. The ports may have connections with a fluid pressure control valve **62**, to be foot operated for directing pressured fluid to one clamp tube or the other, selectively, for rocking the clamp bar to the operative and inoperative positions.

The foot operated pressure control valve **62**, FIG. **6**, may include a shiftable valving member **64** to be moved mechanically by means of pedal **66** and actuator **68**, from the normal full-line position shown, to the lowered position indicated by the broken line. The valving member may be spring-biased constantly to the full line position indicated, but may be moved and held in the broken line position as long as a downward force is applied to pedal **66**.

At **70** is indicated a high pressure fluid line, whereas **72** indicates a relatively low pressure fluid line. These fluid lines are connected to separate ports in the housing of valve **62**. Fluid supply line **70** normally supplies high pressure fluid to valving member **64**, which directs it into a delivery pipe **74**. When pedal **66** is depressed and held down by the foot of an operator, valving member **64** is moved to the broken line position at which low pressure fluid from supply line **72** is directed into delivery pipe **74**, while fluid from high pressure supply line **70** is cut off. Suitable high and low operating pressures of fluid may approximate 100 lbs. and 35 lbs., and both are constantly available at the supply lines **70** and **72**, respectively.

With further reference to FIG. **6**, the numeral **76** indicates a conventional rotary coupler connecting the stationary delivery pipe **74** with the rotary shaft **78** of cylinder **10**. Shaft **78** carries a fixed drive gear **80**, and a shaft extension **82** upon which the rotary element of the coupler is mounted. Suitable bearings **84, 86** of the machine frame uprights **87, 87**, support the shaft in conventional manner. At **88** is indicated one wall of a gear case containing lubricant for a drive gear train including gear **80**, this being conventional and of no importance to the present invention.

Fluid under pressure conveyed by pipe **74** and coupler **76**, enters a concentric elongate bore **90** of shaft **78** to actuate a distributor valve generally denoted **92**, said valve being a four-way, two-position pilot operative valve. Valve **92** is best illustrated by FIG. **7**, and may include a longitudinally shiftable spool having three discs **93, 94, 95** spaced apart on a common stem **97**, and adapted to slide within a cylindrical valve chamber **96**. Stem **97** has an extension carrying a piston **98** slidable in a cylinder **99**, the piston being normally biased to the left in FIG. **7** by a compression spring **100**.

Shaft bore **90** has a pilot port **102** and a main port **104**, both arranged transversely of bore **90**. Main port **104** leads to valve chamber **96** at a location intermediate two end ports **106** and **108** which are connected by means of tubes **110** and **112** to ports **58** and **60**, respectively, (FIG. **1**), of the clamp tubes **52** and **54**. Thus, as depicted by FIG. **7**, fluid under pressure conveyed by pipe **74** will enter bore **90**, and may flow into chamber **114** behind piston **98**, and into valve chamber **96** at **104**.

A low pressure fluid when conveyed by pipe **74** and bore **90**, will enter chamber **114** without advancing the piston **98**. Accordingly, such low pressure fluid will pass on to port **104** and into chamber **96** and port **108**, whence it will enter clamp tube **52** (FIG. **2**) through port **58**, to shift clamp bar **34** into the inoperative or release position of FIG. **2**. At the same time, clamp tube **54** will exhaust through ports **60, 112, 106** and **116**.

On the other hand, a high pressure fluid conveyed by pipe **74** and bore **90**, will enter chamber **114** with sufficient force to move piston **98** to the right in FIG. **7**, thereby to shift the spool and discs **93, 94, 95** to the extreme right; this resulting in a flow through ports **104, 106, 112** and **60** causing inflation of clamp tube **54** for shifting clamp bar **34** to the operative clamping posi-

tion of FIG. 3. This is the normal situation existing when the press is operating, and is depicted by FIGS. 3 and 6. As will be noted, pedal 66 is not under depression, and valving member 64 is supplying to delivery pipe 74 a constant supply of high pressure fluid from supply line 70. Accordingly, and as long as pedal valve 64 remains undisturbed, the printing plate 30 will be securely clamped as in FIG. 3, to perform its intended printing function.

Upon completion of the printing operation, the pressman may quickly release the printing plate from cylinder 10, by merely depressing the foot pedal 66 to deliver low pressure fluid through pipe 74 and into clamp tube 52, for inflating said tube 52 and rocking the clamp bar to the operative or release position of FIG. 2. Port 118, FIG. 7, serves to exhaust the clamp tube 54 while clamp tube 52 is under inflation.

At the right end of FIG. 6 is shown typical mechanism including a hand crank 120, for longitudinally shifting the cylinder shaft 78 relative to its bearings 84, 86 for purposes of alignment in printing. This mechanism is generally used on printing equipment, and warrants no detailed explanation so far as the present invention is concerned.

The flexible elongate clamp tubes 52, 54 are to be substantially coextensive in length with the length of the clamp bar, so that expansive force of the tubes will be equalized along the bar from end to end, thereby eliminating deflection or bending of the bar under clamping pressure. The resultant uniformity of clamping pressure acting along the full length of the printing plate end margins, ensures accurate and firm mounting and holding of the plate, which in turn assures maximum speed and quality of printing. By this means is eliminated any clamp bar deflection and variation of clamping force along the width of the printing plate, which so commonly occurs with the use of prior clamping methods involving hand clamping.

The flexible elongate clamp tubes may be formed of any suitable impervious material having the required flexibility and durability, examples of which include natural and artificial rubber, vinyl, and the various durable textiles or fabrics impregnated or coated to render them substantially impervious to air or fluid leakage. The tubes may possess also a measure of resiliency, if desired.

To facilitate information of the groove or chamber 18, and to provide for installation and servicing of the clamp bar and clamp tube assembly, the printing cylinder may be built up of a plurality of separable parts such as the displaceable insert 67 which extends from slot 16 to a parting line 69 on the face of the cylinder. The insert or part 67 may be detachably secured by means of screws or equivalent fasteners 71 upon a seat 73 formed on the main body portion of the cylinder. The length of seat 73 and insert 67 should approximate the length of cylinder 14.

The improved printing cylinder construction as herein disclosed greatly facilitates and expedites the application and removal of flexible sheet-type printing plates. By reason of the fact that lock-up or clamping of the plate may be performed pneumatically or hydraulically and without use of the pressman's hands, his hands may most effectively and advantageously be employed exclusively in accurately positioning the plate for lock-up, thereby ensuring great accuracy in plate positioning which results in high-quality high-speed printing. Quality and speed in the printing are enhanced also by the uniformity of clamping force applied to the plate end margins, made possible by the fluid pressure actuating means herein disclosed.

What is claimed is:

1. An elongate, rotatable printing cylinder having an exterior cylindrical surface, an elongate groove in one side of said printing cylinder extending parallel to the axis of said printing cylinder, said groove defining an elongate chamber having a single access slot thereto through the surface of said printing cylinder, a concave base at the bottom of said chamber, opposed, spaced apart side walls extending from said concave base and diverging from the bottom thereof at an acute angle to each other, said side walls having convergent portions at the tops thereof leading to the access slot, an elongate clamp bar pivotally mounted in said chamber for pivotal movement toward and away from the divergent side walls to locking and unlocking positions, said clamp bar having an oblong cross-sectional shape and opposite side faces and opposite edges, one of said edges comprising a convex curved base complementary in size and shape to the concave base of said chamber and being pivoted therein, the other of said edges comprising a clamping edge and having an elongate slot therein, one side face being flat and the other side face having a depression therein between the base and clamping edge, the bottom portions of the side faces being flat and parallel to one another and merging directly with said convex curved base, flexible expansible fluid operated means in said chamber on opposite sides of said clamp bar between said one flat side face and one side of said chamber and between the depression in the other side face and the other side of said chamber to pivot the bar to the locking and unlocking positions, and a flexible, sheet-like printing plate supported on the exterior surface of said printing cylinder and having opposite end margins received through said access slot, one of said end margins in overlying engagement with the convergent portion of one of the side walls of the chamber and the other end margin received in the slot in the clamping edge of said clamp bar, so that actuation of the fluid operated means on said other side of said clamp bar causes pivotal movement of said clamp bar toward said one side of said chamber into locking position and wedges and clamps the end margins of the printing plate between the clamping edge of the clamp bar and the convergent portion of said one chamber side wall.

2. The combination as defined by claim 1, wherein said fluid pressure operated means is foot-controlled, leaving the hands of the pressman free for accurately positioning said printing plate upon the cylinder.

3. The combination as defined by claim 1, wherein said fluid pressure operated means includes a pair of fluid inflatable flexible tubes disposed within said chamber at opposite side faces of the clamp bar, said tubes being alternately inflatable to alternately apply force against the opposite side faces of the clamp bar, for imparting said pivotal movements to said clamp bar.

4. The combination as defined by claim 3, wherein said inflatable tubes are elongate of form and substantially coextensive with the length of the clamp bar, for

effecting even distribution of expansive force along the length of the clamp bar.

5. The combination as defined by claim 4, wherein said fluid pressure operated means is foot-controlled, leaving the hands of the pressman free for accurately positioning said printing plate upon the cylinder.

6. The combination as defined by claim 5, wherein is included means for supplying pressured fluid to said inflatable tubes through said foot-controlled means.

7. The combination as defined by claim 1, wherein said cylinder is formed as a plurality of separable components one of which includes one of said chamber walls, said one separable component being bodily displaceable from the remainder of the cylinder to expose to view the clamp bar and the remaining chamber wall.

8. A press cylinder clamp means for the opposite hooked end margins of a flexible printing plate, comprising in combination: an elongate rotatable press cylinder having opposite ends and an outer curved surface, said curbed surface having formed therein a deep elongate chamber defined by a single elongate access slot parallel to the cylinder axis, said chamber having a concave base portion, a pair of opposed, spaced apart inner side walls extending from said concave base and diverging from their bottoms at an acute angle to one another; said inner side walls having convergent portions at the tops thereof leading to the access slot and one of said convergent portions defining an abutment lip overhanging one of said inner walls adjacent to said access slot and having a clamp face to support one hooked end margin of the printing plate; an elongate clamp bar extending lengthwise within said chamber, said bar having an oblong cross-sectional configuration and a pair of opposite side faces and an inner and an outer side edge extending lengthwise thereof in parallelism; the inner side edge being convex and complementary in size and shape to the concave base and pivoted in said base for supporting said bar for rocking movement about the inner side edge thereof, and toward and from said inner walls of the chamber between an operative clamping position and an inoperative release position of said bar, said opposite faces of the bar having flat, parallel bottom portions merging directly with said convex base and being exposed one to each inner wall of the chamber; the outer side edge of the clamp bar comprising an elongate pressure nose located to engage the clamp face of the abutment lip during rocking of the clamp bar to operative position; one of the side faces of the clamp bar having a depression therein between the base and pressure nose; fluid pressure operated means disposed at the opposite side faces of the clamp bar for rocking said bar selectively to said operative and inoperative positions within the cylinder chamber, the fluid pressure operated means on said one side of said clamp bar positioned between the depression and the adjacent side wall of the cylinder chamber; elongate slot means in said clamp bar nose and accessible through said access slot of the cylinder chamber receiving the remaining hooked end margin of the printing plate with said remaining hooked end overlying a portion of said nose, whereby rocking of the clamp bar to the operative position wedges said hooked end margins of the printing plate between the clamp bar nose and the clamp face of said abutment lip, and rocking of the clamp bar to the inoperative position displaces the clamp bar nose from clamping relation with said abutment lip clamp face to release and free said hooked end margins of the printing plate.

9. The combination as defined by claim 8, wherein said fluid pressure operated means is foot-controlled, leaving the hands of the pressman free for accurately positioning said printing plate upon the cylinder.

10. The combination as defined by claim 9, wherein is included means for supplying pressured fluid selectively to said fluid pressure operated means during rotation of the cylinder.

11. The combination as defined by claim 8, wherein said fluid pressure operated means includes a high pressure fluid source and a relatively low pressure fluid source; and means operative alternately to rock the clamp bar to one of said positions by high pressure fluid force, and to the other of said positions by force of the lower pressure fluid.

12. The combination as defined by claim 8, wherein said fluid pressure operated means includes a high pressure fluid source and a relatively low pressure fluid source, and a single delivery pipe for conveying alternatively a high pressure fluid or a low pressure fluid to said inflatable flexible tubes, for rocking the clamp bar to said operative and inoperative positions, at least a portion of which delivery pipe is substantially concentric with said cylinder axis.

13. The combination as defined by claim 12, wherein feed of high or low pressure fluids to said delivery pipe is under the control of a foot operated valve.

14. The combination as defined by claim 13, wherein said foot operated valve is constantly yieldingly biased to feed high pressure fluid to that inflatable flexible tube which rocks the clamp bar to the operative position.

15. The combination as defined by claim 14, wherein said inflatable flexible tubes are elongate of form and substantially coextensive with the length of the clamp bar, for effecting even distribution of expansive force along the length of the clamp bar.

* * * * *