Sept. 27, 1966 H. NAGEL 3,274,930

ROTARY PRINTING PRESS WITH MEANS FOR REVERSING CYLINDER ROTATION

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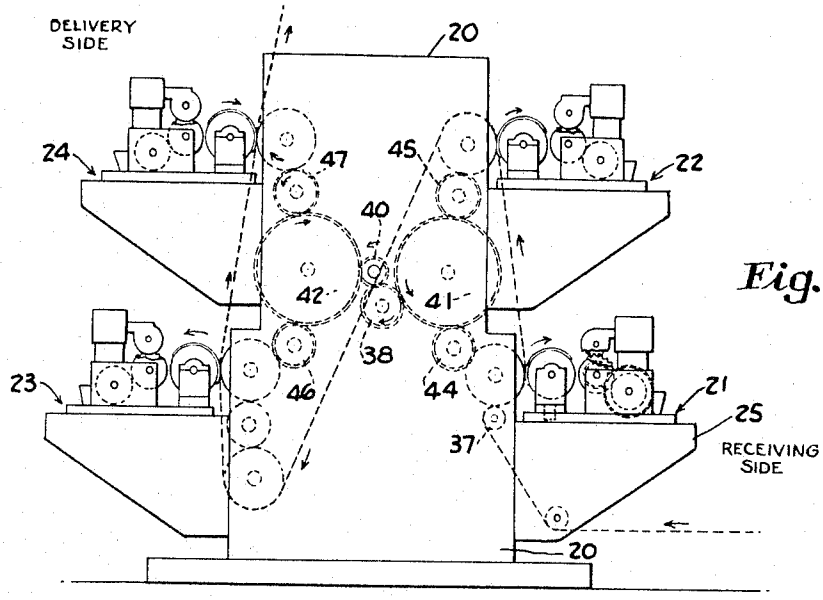


Fig. 1

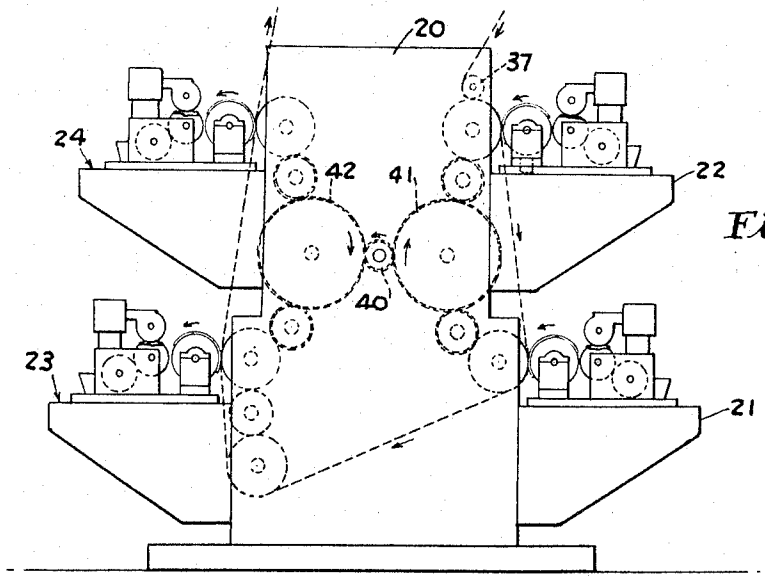


Fig. 2

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Filed Sept. 22, 1965 4 Sheets-Sheet 2

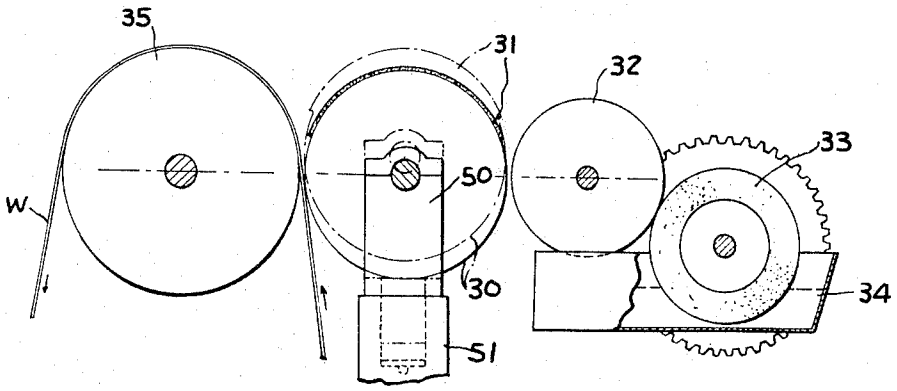


Fig. 3

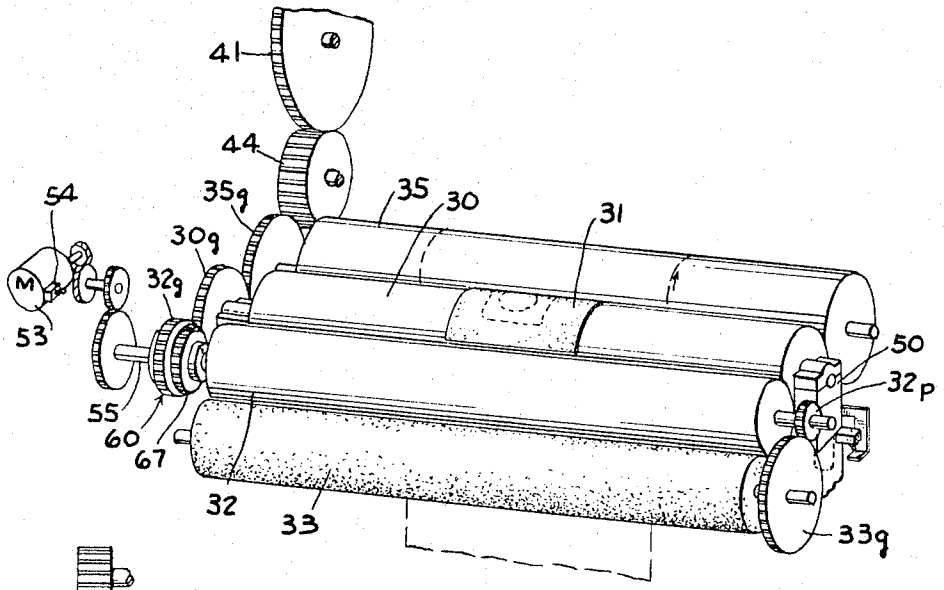


Fig. 4

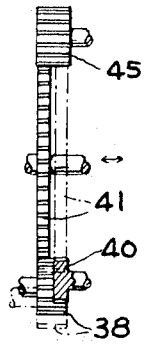


Fig. 1a

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ROTARY PRINTING PRESS WITH MEANS FOR REVERSING CYLINDER ROTATION

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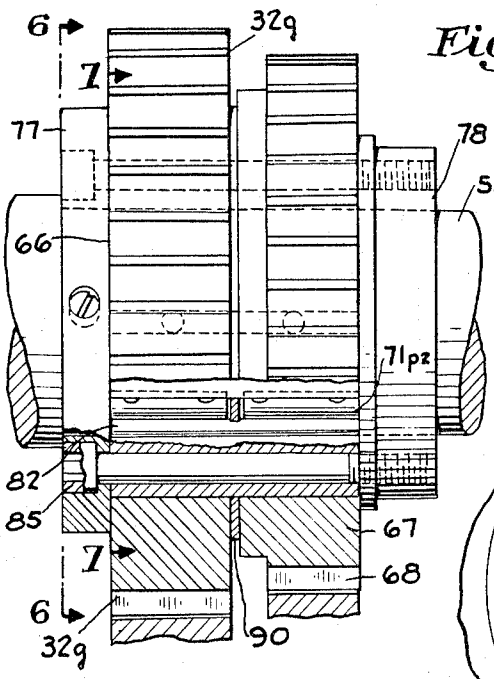


Fig. 5

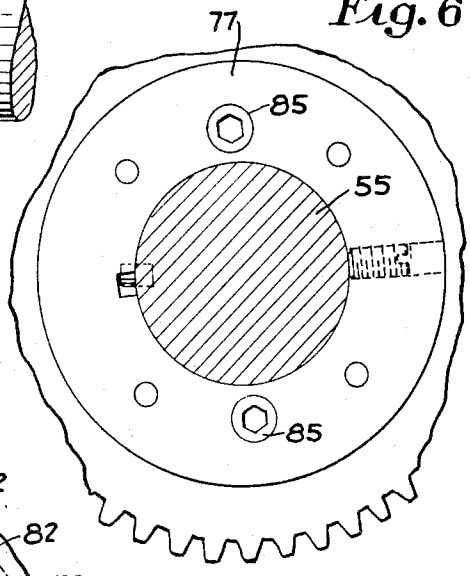


Fig. 6

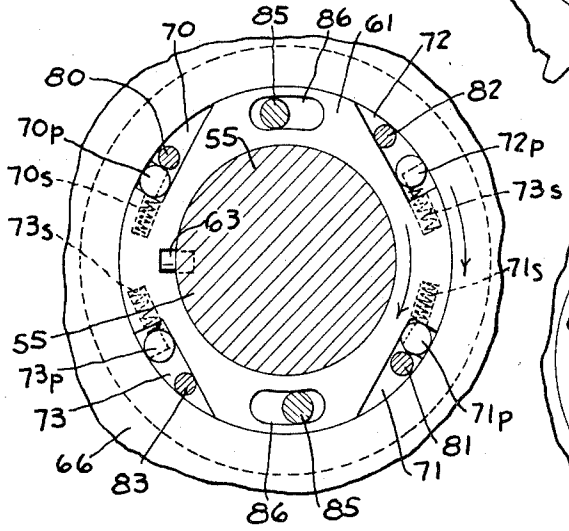


Fig 7

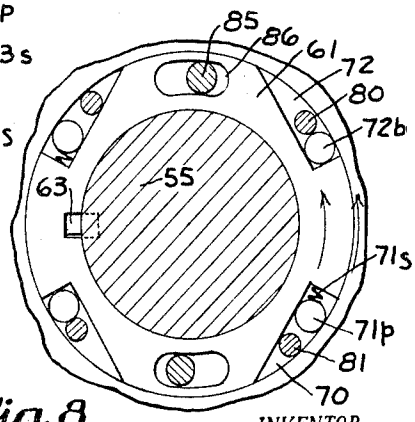


Fig. 8

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ROTARY PRINTING PRESS WITH MEANS FOR REVERSING CYLINDER ROTATION
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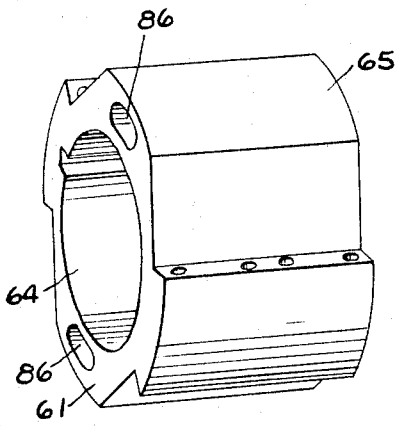


Fig. 9

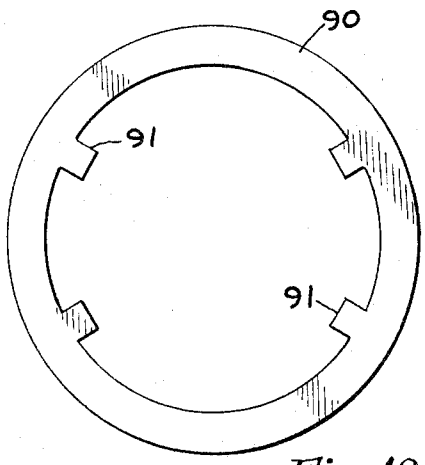


Fig. 10

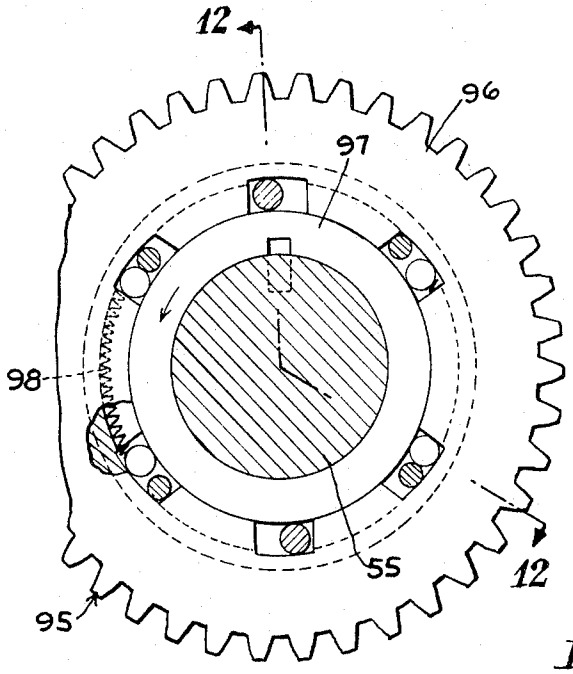


Fig. 11

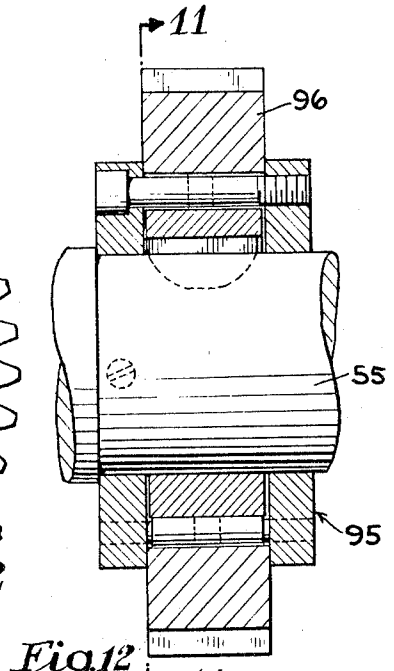


Fig. 12

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3,274,930

ROTARY PRINTING PRESS WITH MEANS FOR REVERSING CYLINDER ROTATION

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Filed Sept. 22, 1965, Ser. No. 489,293
6 Claims. (Cl. 101—180)

This invention relates to printing and more particularly to the branch thereof called "flexography," and to "flexographic" presses. The present application is a continuation-in-part of my co-pending applications, Serial No. 380,334, filed on July 6, 1964, for Rotary Printing Press; and, Serial No. 235,614, now Patent No. 3,218,969, filed November 6, 1962, for Rotary Printing Press.

The terms "flexography" and "flexographic" press have been adopted in the art within the last decade in place of the formerly used term "aniline" printing due to the wide expansion of the technique of such printing and its improvement to the point where the term "aniline" relating broadly to coal tar dyes ceased to describe or define this process accurately.

Flexographic presses are usually presses of the rotary type used for printing in one or more colors on a strip of material usually wound into a roll, which roll is unwound as it passes the press and it would again after the printing process is completed. Printing plates of such presses are usually made of rubber. Various materials may be printed with the use of such presses, particularly, this cardboard, paper, and plastic film either in a single roll layer or in the form of a tube presenting a two layer strip. The strip on which printing is done is termed in the art a "web." Some flexographic presses, particularly of larger and more expensive construction, may be used in combination with sealing and/or cutting means on their delivery side, to cut the printed web into pieces instead of rewinding it on a roll, and thus producing printed sheets in case of a single layer web; or bags, if a flattened tube is being printed. Similarly, instead of using rolls of plastic film, a film-producing machine, such as an extruder, may be provided on the receiving side of the press, to print the film as soon as it is produced by such machine.

In the latter type of combination, sometimes referred to as "in-line operation," it is important that the press be operated continuously irrespective of whether it is printing or not, since the extruder cannot be stopped without resulting complications. Printing on smooth non-absorbing plastic surfaces, generally requires the use of special inks, particularly alcohol-base inks. Such inks, unlike oil base inks used in printing on paper, are extremely fast drying. This particular factor creates a number of serious difficulties in the use of flexographic presses not met in the use of other presses, and some special problems in their construction.

The present invention has particular but not exclusive application to printing a flattened plastic tube such as polyethylene "lay flat sleeve," in which printing often has to be done either on one or on both sides of the running web. Presses of this nature may have as many as six color units, and therefore, may print up to six colors in the same run. If it is necessary to print on both sides of the web, all the colors on one side of the web are usually printed first, and thereupon one or more colors on the other side of the web are printed on a separate run. Obviously, such a method ties up the press for twice as long a period of time as is required for printing the web on one side only.

It has been proposed to print both sides of the web during the same run by resetting some of the color units of the press in such a manner that the rubber printing

plates inked to print on the other side come in contact with the other side of the web. It can be understood that in such resetting it is necessary to reverse rotation of the roller or cylinder of the color units which are to print on the other side. Such requirements necessitates the provision of means within the driving mechanism to effect such reversal. While such printing has been practiced, its application and efficiency have been greatly reduced by the fact that with flexographic presses using extremely fast drying inks, it is necessary to have its ink rollers run continuously, i.e., without stopping in order to prevent the printing ink drying up on such rollers. After the ink dries on the rollers, which may occur within 2–3 minutes, washing such rollers to remove the dry ink becomes necessary in order to prevent spoilage of considerable amount of material when printing is resumed. It may take as much as 100 feet of printing for the roller to dissolve the dried ink before acceptable printing is reached.

To permit such continuous running of the ink rollers when the web is not running and printing is stopped, means have been provided to disengage the driving connection between the plate carrying cylinder and the ink rollers and to permit the ink rollers to run idle and independently of the other rollers or cylinders as well as other components of the press in order to prevent drying of the ink. Such operation of the ink rollers is made possible by the use of a driving connection mechanism associated with the ink transfer roller, and usually referred to as a "clutch." Such "clutch" mechanism operates to drive the roller in one direction but to run idle in the opposite direction.

In the case of a press having, for example, four color units, should it be desirable to print two colors on one side and two colors on the other side, it would take only a few minutes to rethread the web on the two rollers which are to print on the other side and to reverse the direction of their rotation. However, great difficulty and serious problems arise because of the necessity to reverse also the clutch mechanism. Such reversing requires removing the ink transfer roller from the press, taking the clutch off the transfer roller shaft, turning it around, remounting it on the shaft, and putting the ink transfer roller with the clutch back in place. This process takes approximately two hours, not only tying up the press for such length of time but producing other serious difficulties.

In the first place stopping the ink rollers causes drying of the ink thereon producing difficulties explained above. Furthermore, the ink transfer roller or cylinder has an engraved surface to have thereon a large number of small ink-retaining indentations, usually as many as 160–180 per square inch, produced by photo-engraving process. Such rollers are heavy and difficult to handle. In removing such roller from the machine, there is danger of damaging the engraved surface. Even a slight nick on the engraved surface may make the roller unusable, since any such nick would be printed on the web, and produce a printing defect that may call for rejection of a large amount of printed web. Furthermore, there is no way of repairing the damaged engraved surface, and the damaged roller has to be replaced, or its entire engraved surface ground off and re-etched. Doing this in an emergency, particularly when engraving facilities are not available locally, may cause serious delay and financial loss. It is for these reasons that it has been often more efficient and less risky to print only on the other side of a flattened tube in a separate run and to bear the undesirable loss of time than to take the risks connected with disassembling portions of the color unit for setting the press for printing on both sides.

One of the objects of the present invention is to provide an improved multi-color unit flexographic press,

whereby the above difficulties and disadvantages are overcome and largely eliminated, and whereby the press can be selectively set or reset for printing on one or both sides of the web without the necessity of removing the clutch mechanism and partial disassembly of the color unit or removing the ink transfer unit from the machine and separating the clutch for reversal.

Another object of the invention is to provide an improved flexographic press of the foregoing character in which setting or resetting the press for printing on both sides after the press was printing on one side, or for printing all colors on one side after the press was printing on both sides, requires only a few minutes of time, with the limiting factor on resuming printing being not in reversing the clutch means but rethreading the web, with the latter operation presenting little or no difficulties.

A still further object of the invention is to provide an improved driving connection or clutch mechanism adapted to provide a driving connection between two shafts in one direction and to automatically eliminate such connection and permit independent running of the shafts in the opposite direction, with such mechanism being reversible by a very simple adjustment quickly made, and to provide after such adjustment a driving connection in the direction previously permitting free running and free running in the direction of previous driving.

A still further object of the present invention is to provide a clutch mechanism of the above character in which such adjustment can be made merely by rotating for a few degrees a collar provided therein and tightening it in another position, two of such positions being provided in the clutch.

A still further object of the present invention is to provide an improved clutch mechanism of the foregoing character which can be installed in various machines and devices requiring such reversal of operation, with the clutch mechanism having its adjustment means in such arrangement or position that their adjustment and reversing operation of the machine or device can be done safely, easily, and in only one or two minutes of time.

A still further object of the present invention is to provide an improved clutch mechanism of the foregoing character which is compact, simple and rugged in construction, is dependable in operation and relatively inexpensive to manufacture.

Further objects and advantages of this invention will be apparent from the following description and appended claims, reference being had to the accompanying drawings forming a part of this specification, wherein like reference characters designate corresponding parts in the several views.

FIG. 1 is an elevational side view of the flexographic press embodying the present invention, showing in a diagrammatic manner the press including four color units, with the web in position for printing two colors on each side thereof.

FIG. 1*a* is a diagrammatic view supplementing showing of the arrangement of gears for reversing color units on the righthand side (as appearing in FIG. 1) of the press.

FIG. 2 is a view similar in part to FIG. 1 but showing the web rethreaded to have the two units appearing on the righthand side in said figures printing on the same side of the web as the units on the lefthand side, thus having all four units of the press printing on the same side.

FIG. 3 is a diagrammatic elevational view illustrating the arrangement of the cylinders of one color unit.

FIG. 4 is a diagrammatic perspective view showing the cylinders of one color unit and the driving means therefor.

FIG. 5 is a front view partly in section of the two-way reversible clutch interposed in each color unit between the plate cylinder and the ink transferring cylinder thereof.

FIG. 6 is an end view, partly in section, taken in the direction of the arrows on the section plane passed through the line **6—6** of FIG. 5.

FIG. 7 is an end view, partly in section, taken in the direction of the arrows on the plane passed through line **7—7** of FIG. 5, with the pins of one set wedged in their respective recesses to drive the unit in the direction indicated in said figure by an arrow, while the pins of the other set are restrained by the fingers of the reversing cage member from wedging into their respective recesses.

FIG. 8 is a view similar in part to FIG. 7 but showing the adjusting collar of the reversing member moved to another position to reverse operation of the clutch by moving the fingers thereof to force the pins previously wedged in from such wedged-in position to their idling positions, and to release the pins previously held in their idling positions for wedging in and driving the unit in the opposite direction, i.e., in the direction as indicated by the arrow in FIG. 8.

FIG. 9 is a perspective view illustrating the inner rotatable member separately.

FIG. 10 is an end view illustrating the free wheeling spacer.

FIG. 11 is a view similar in part to FIG. 7 but showing a modified construction in which wedge recesses are provided in the outer rotatable member, rather than in the inner rotatable member as in the construction of FIGS. 5–10.

FIG. 12 is a sectional view taken in the direction of the arrows on the section plane passed through the broken line **12—12** of FIG. 11.

It is to be understood that the invention is not limited in its application to the details of construction and arrangement of parts illustrated in the accompanying drawings, since the invention is capable of other embodiments and of being practiced or carried out in various ways. Also, it is to be understood that the phraseology and terminology employed herein is for the purpose of description and not of limitation.

In the drawings there is shown, by way of example, a flexographic printing press embodying the present invention. Referring specifically to FIGS. 1 and 2, the press illustrated therein comprises a frame **20** having four color units generally designated by the numerals **21**, **22**, **23**, and **24**, operatively mounted on said frame **20** on brackets, such as bracket **25** of the unit **21**.

The frame **20** of the press is so constructed that it can receive any practical number of brackets such as the bracket **25** for mounting color units thereon, such as one, two, three, or four. Furthermore, the frame **20** is adapted to receive at its top an extension (not shown) on which, in turn, two additional color units may be mounted. Although six color units so produced represent constructions in which the present invention is still more advantageous, and which are manufactured in substantial proportion as compared with presses having a smaller number of color units, only a four color unit press is illustrated herein for the sake of simplicity. It will also be understood that a user of the press may purchase the same with a standard frame such as **20** but with only one or two color units, and then add unit by unit as his operations may require. By such a construction the necessity of scrapping or otherwise disposing of a single color unit press when a two unit press is required, or disposing of a two color unit press when a four color unit press is acquired, and so on, is eliminated.

It shall be understood that the present invention is not limited to multiple color unit presses but is applicable with equal success to a single unit press since it often becomes necessary to reverse operation of such a single unit.

Referring to FIG. 3, each color unit comprises a plate cylinder **30** carrying a printing plate **31** which is usually made of rubber or a suitable rubber-like material and cemented on the plate cylinder **30**. The thickness of

rubber plates is standardized, presently ⅛", for the reasons which will become apparent later. An ink transferring cylinder **82** is mounted adjacent the plate cylinder **30** to transfer ink in proper and even film on the rubber plate **31**. As shown in said FIG. 3, the centers of the shafts of said cylinders **35**, **31**, and **32** lie on the same straight line, which arrangement has a number of important advantages, particularly the direct or radial applicaton of pressure forces between the cylinders, without producing any tangential force components. Exerting pressure in such a manner is of particular importance with respect to the printing plate as ensuring clear printing without any tendency of smearing the ink. The ink tarnsferring cylinder **32** has its cylindrical working surface engraved by the use of a photo-engraving process to provide a large number of small ink-retaining indentations thereon, such as 160–180 indentations per square inch. The cylinder **32** receives ink from the lower ink cylinder **33** running in an ink well **34**. An impression cylinder **35** is mounted on the other side of the plate cylinder **30** in a fixed position. The web W is threaded over the impression cylinder **35** which provides support for the web W pressed upon by the rubber plate with the desired pressure attained with the aid of adjusting means in the cylinder **30**, whereby the rubber plate **31** exerts stronger or lighter pressure on the web.

The plate cylinder **30**, the impression cylinder **35**, and the ink transferring cylinder **32** have in operation the same or equal peripheral speeds in order to produce frictionless rolling between the cylinder surfaces, and to eliminate rubbing and smearing of the fresh imprints. This is attained by their driving gears, mounted on the shafts of their respective cylinders, having their respective pitch diameters equal to the respective diameters of their cylindrical surfaces. In other words, the pitch diameter of the gear **35***g* is the same as the diameter of the cylinder **35**, the pitch diameter of the gear **30***g* is the same as the diameter of the plate cylinder **30** plus double thickness of the rubber plate **31**, and the pitch diameter of the gear **32***g* is the diameter of the engraved cylindrical surface of the ink transferring cylinder **32**. On the other hand, it is desired that there be certain rubbing or wiping action between the photo-engraved surface of the cylinder **32** and the surface of the ink cylinder **33**. Accordingly, the gear **33***g* is considerably larger than the pinion **32***p*, thus insuring that the ink transferring cylinder **32** rotates much faster than the ink cylinder **33**; and, therefore, in spite of its having approximately the same diameter as the ink cylinder **33**, the surface of the ink transferring cylinder **32** overruns the surface of the lower ink cylinder **33**.

A pinch roller, such as indicated at **37**, cooperates with the impression cylinder of the unit which is the first to receive the web from the supply roll, such as the unit **21** in FIG. 1. In FIG. 2, such roller **37** is arranged in the unit **22**. The purpose of the pinch roller is to provide proper grip and tension on the web in unwinding it from the supply roll.

All of the color units of the press are driven from the central drive gear **40** and large intermediate driving gears **41** and **42**. The gear **41** meshes with the idler gear **44** driving the color unit **21**, and with the idler gear **45** driving the color unit **22**. The intermediate gear **42** meshes with the idler gear **46** driving the color unit **23** and with the idler gear **47** driving the color unit **24**. The gear **41** has single width. To reverse the color units **21** and **22** the gear **41** may be moved axially inwardly of the press to clear the main driving gear **40** also having single width, but to remain in mesh with gears **44** and **45** which have double width. To provide driving connection with the main driving gear **40** in such condition, a double width gear **38** mounted on an eccentric is brought into mesh with the gear **40** and **41**, as shown in FIG. 1*a*. Presuming that FIG. 4 illustrates the color unit **21**, the idler gear thereof is accordingly designated by the numeral **44** and the intermediate gear by the numeral **41**.

In FIG. 2 the central or main driving gear **40** is shown in direct mesh with the intermediate large gears **41** and **42** causing the same to be driven in the same directions as indicated (clockwise in FIG. 2). Such driving is necesasry when all four units print on the same side. On the other hand, when it becomes necessary to reverse the units **21** and **22**, the gear **41** is taken out of direct mesh with the gear **40** and connected therewith through the idler gear **38**, as mentioned, reversing rotation of the gear **41**, i.e., causing it to rotate counter-clockwise as indicated in FIG. 1 and thus reversing the direction of operation of the color units **21** and **22**.

For the sake of clarity of the drawings the gear **40** is shown in FIG. 1 at a distance from the intermediate gear **41** to make it clear that there is no direct meshing between the gear **40** and the gear **41** in the operation of the color units illustrated in said FIG. 1. On the other hand, in FIG. 2 the gear **40** is shown in direct contact with both gears **41** and **42**.

It will be understood from examination of FIGS. 1 and 2 that when it becomes necessary to cause a color unit to print on the opposite side from the side which it was printing before, it is necessary not only to reverse operation of the unit but also to rethread the web through the unit in such a manner that it would be moving in the direction opposite to that in which it was previously moved, such as down in units **21** and **22** in FIG. 2 instead of up as in FIG. 1. As can be seen from an examination of said FIGS. 1 and 2, rethreading the web has as its object passing the web through the unit in such a manner that its side previously in contact with the impression cylinder would be brought in contact with the plate cylinder. Use of the rollers, such as pinch roller **37** for such purpose is self-explanatory from an examination of said FIGS. 1 and 2.

Reversing the direction of operation of the units and rethreading the web do not present a particularly difficult or time-consuming problem. These operations can be performed within a period from 10 to 20 minutes and, therefore, they do not tie up the press for any substantial period of time. The main difficulty results from the necessity of disconnecting the ink transferring cylinder **32** from the plate cylinder **30** in order to continue rotation of the lower ink cylinder **33** and the ink transferring cylinder **32** while the plate cylinder **30** is at rest. Such disconnecting, which has to be done without losing the registry between the cylinders, is effected by raising the plate cylinder **30** together with its bearings **50**, preferably with the aid of hydraulic means (not shown) by causing the lower portion of the bearings **50** to move in the slide **51**. The cylinder **30** is raised only for such a distance as to cause it to lose contact with the adjacent cylinders but with its gear **30***g* remaining in half mesh with the gears **32***g* and **35***g*. If the meshing of these gears is not lost, moving the plate cylinder **30** down will return these gears in full mesh and into prior registry.

When the cylinder **30** is raised, the ink transferring cylinder **32** and the lower ink cylinder **33** are rotated independently of the plate cylinder from the electric motor **53** through a train of gears. The motor **53** is provided with a reversing switch **54** in order to cause rotation of the cylinders **32** and **33** in the desired direction. Since under such conditions, the gear **32***g*, which is a part of the clutch mechanism generally indicated by the numeral **60** described in detail below, is in mesh with the gear **30***g* of the plate cylinder **30** which is stationary, the shaft **55** on which the cylinder **32** is mounted must idle with the clutch mechanism **60**.

The direction of idling rotation of the ink transferring cylinder **32** is determined by the direction in which the plate cylinder **30** was rotating prior to its raising. However, when the rotation of the cylinder **30** is reversed for the purposes explained above, it becomes necessary to reverse also operation of the clutch mechanism **60** in

order that the same will drive in the opposite direction and permit free running in the direction opposite to the direction in which idling was taking place before.

In prior presses such reversing of the clutch required removal of the entire ink transferring cylinder such as **32**, which is a heavy unit, removing the motor such as **53** with its gears, removing the clutch **60** from the shaft **55**, disassembling it for reversing, reassembling it to reverse position of some of its components, and remounting the entire clutch on said shaft. Such operation in addition to inviting a number of serious difficulties explained above, such as subjecting the delicate surface of the cylinder **32** to the danger of irreparable damage, also requires approximately two hours of time for its completion, tying up the press for a considerable portion of the working day, and requiring the service of additional personnel of critical skill, which personnel may not be available at the printing plant and which must come from the outside.

In accordance with the invention construction of the clutch mechanism **60** is such that its reversal can be made in a matter of two or three minutes by the press operator and merely by loosening a set screw of the reversing member moving its adjusting color to a new position and tightening it therein, all without otherwise disturbing the clutch or the press.

The clutch mechanism **60** is constructed in accordance with the present invention to operate in two settings. Using the words "clockwise" and "counter-clockwise" for the purposes of description, the function of the clutch mechanism may be stated in the following manner. In one setting the clutch mechanism provides driving in the clockwise direction and free running in the counter-clockwise direction. In the other setting, the clutch mechanism provides driving in the counter-clockwise direction and free running in the clockwise direction.

Generally, the clutch mechanism **60** comprises two rotatable coaxially arranged members free to rotate one with respect to the other. Automatic means are provided adapted to lock these members for driving and to unlock them for free running. Since one such member is preferably arranged inside of the other, such members may be termed an outer rotatable member and an inner rotatable member. The inner rotatable member is usually secured on a shaft. If the outer rotatable member is driven by some extraneous means for the purpose of driving the shaft on which the inner rotatable member is mounted, locking or unlocking the rotatable members would cause driving the shaft or permit said shaft to run independently of the outer driving member.

Referring specifically to FIGS. 5–10, the clutch mechanism illustrated therein comprises an inner rotatable member **61** mounted on a shaft **55** and suitably secured thereto for rotation therewith, such as with the aid of slots-and-key means as indicated at **63**. The inner rotatable member **61** is of a hollow cylindrical shape as is best shown in FIG. 9. Into the cylindrical hollow **64** of the inner member **61** is fitted the shaft **55** of the ink transferring cylinder **32**, while over the outer cylindrical surface **65** of the inner member **61** is fitted the outer rotatable member **66**. On the periphery of the member **66** there is provided a plurality of gear teeth to form a gear **32***g* as mentioned above for the purpose of driving connection with gear **30***g* of the plate cylinder **30**.

In the embodiment of the invention illustrated in FIGS. 5–10, the outer rotatable member is of an articulated construction and includes the second outer rotatable member **67** having gear teeth **68** provided around its periphery. The member **67** is of a different diameter than the member **66**, thus providing, in effect, a second gear also operable by the inner member **61**. It will be understood, however, that the addition of the second gear portion in the clutch mechanism **60** is for the purpose of the press disclosed herein and that only one or more than two gear portions for purposes of other devices utilizing my improved clutch may be provided.

In the outer cylindrical surface **65** of the inner member **61** there are provided two sets of recesses, with the recesses of each set converging in the same direction but opposite to the direction in which all of the recesses of the other set converge. Referring particularly to FIGS. 7–9 recesses **70** and **71** converge or point in clockwise direction, while the recesses **72** and **73** converge or point in counter-clockwise direction. In the recesses **70** and **71** there are provided driving pins **70***p* and **71***p*, while driving pins **72***p* and **73***p* are provided in recesses **72** and **73**, respectively. Compressions springs **70***s*, **71***s*, **72***s* and **73***s* housed in the cylindrical recesses provided in the end walls of the respective wedge recesses operate to force their respective pins **70**, **71**, **72**, and **73** to roll and wedge in the converging recess, thereby locking the inner member **61** to the outer member **66** for rotation.

A reversing cage member includes front plate **77** and back plate **78** and two sets of fingers in between. One set comprises fingers **80** and **81** and the other set fingers **82** and **83**. The cage member is arranged to have said fingers pass through the wedging recesses, as illustrated. The cage member together with its plates **77** and **78** is free to rotate on the shaft **55** with respect to the inner member **61** as much as is permitted by the screws **85** passing through the elongated recesses **86** provided in the inner member **61**. By tightening the screws **85**, the cage member together with its fingers is fixed with respect to the inner member **61** in either of the two extreme positions, with the screws **85** being at one of the two ends of the recess **86**. The fingers **80** and **81** are so offset with respect to fingers **82** and **83** that when the fingers **80** and **81** bear on the pins **70***p* and **71***p*, pressing them in opposition to the springs **70***s* and **71***s* toward the back walls of the recesses **70** and **71** they prevent the pins **70***p* and **71***p* from wedging into said recesses and providing driving connection in the clockwise direction (see FIG. 7). At the same time, the fingers **82** and **83** are disposed away from the pins **72***p* and **73***p* permitting said pins to run and to wedge into their recess **72** and **73** to provide a driving connection between the members **66** and **61** for driving the member **61** and the shaft **55** in the clockwise direction. On the other hand, when the cage member is moved into the position illustrated in FIG. 8, the fingers **80** move forward toward the converging ends of the recesses **70** and **71** permitting the pins **70***p* and **71***p*, previously restrained, to run forward in their recesses and to form a driving connection between the members **66** and **61** to drive the member **61** and the shaft **55** in the counter-clockwise direction as shown in FIG. 8. At the same time, fingers **82** and **83** force the pins **72***p* and **73***p* toward the back walls of their recesses **72** and **73**, in opposition to springs **72***s* and **73***s*, making them ineffective and destroying the driving connection which they previously provided between the members **66** and **61** in the clockwise direction.

Since the clutch mechanism **60** illustrated in FIGS. 5–10 includes two outer members **66** and **67** both operable from the single inner member **61**, but for different purposes, each of the recesses of the inner member **61** is provided with two driving pins placed coaxially end to end as is best shown in FIG. 5 wherein one such additional pin is designated by the numeral $71p_2$. In order to provide a balanced construction, each pin is urged in the wedging direction by two springs. Thus, there are four springs in each recess. A separating collar **90** disposed between the outer members **66** and **67** is provided in order to prevent direct contact between said outer member. Lugs **91** projecting radially toward the center of the separating collar **90** engage the fingers of the cage member and, therefore, cause said separating collar **90** to rotate with the inner driving member **61**.

The clutch member illustrated in FIGS. 11 and 12 and generally designated by the numeral **95** is of a modified

construction. An important difference in the construction of members **60** and **95** is in the provision of wedge recesses in member **95** in the outer driving member rather than in the inner driving member, and in having only a single outer driving member **96**. The inner member **97** has unbroken outer cylindrical surface and is keyed to the shaft **55**. Operation of the driving pins and cage member as well as of the cage member adjusting means is similar to that of the construction of FIGS. 5–10. However, for the sake of simplicity two springs urging the driving pins in opposite direction, such as springs **70***s* and **73***s* of the construction of FIGS. 5–10, have been replaced in the construction of FIGS. 11 and 12 by a single spring **98** disposed in a groove formed in the outer member **96**.

It will now be seen in view of the foregoing that for the purposes of reversing operation of the clutch member such as **60** or **95** it is only necessary to loosen its set screw and move the cage through a small angle determined by the recesses such as **86** and tightening the cage member in a new position. After such an adjustment the clutch member will drive and afford free running in the directions opposite to those in which it operated prior to the adjustment.

By virute of the above disclosed constructions the objects of the present invention listed above and numerous additional advantages are attained.

I claim:

1. In a flexographic rotary printing press for printing a plurality of printing color images on a web, said press to be selectively set to print all of said images on one side of the web and to be selectively reset to print some of said images on the opposite side of the web and thus to print simultaneously on both sides of the web, a plurality of color printing units, each of said units including a plate cylinder carrying a printing plate, an ink transferring cylinder rotatable in either direction and adapted to transfer ink to said printing plate, an impression cylinder adapted to press the web against the printing plate of its respective unit only, the plate cylinder and the impression cylinder of a portion of the plurality of said color units being adapted to be rotated in both directions independently of the cylinders of the remaining units, driving means for rotating the cylinders of the units, means to selectively reverse the direction of rotation of said cylinders in said reversible color units only, roll means for rethreading the web on cylinders of reversible color units for adapting such color unit to print on the opposite side of the web with the other units to continue printing on the same side, clutch means operatively interposed between the plate cylinder and said ink transferring cylinder at least in the reversible color printing units, said clutch means including wedging-in elements adapted to provide driving connection between the plate cylinder and the ink transferring cylinder when the plate cylinder is driven in one direction, said wedging-in elements being responsive to reversing the direction of rotation of the plate cylinder by coming out of their wedge-in positions and thus destroying the driving connection and to provide for idling in the opposite direction, said clutch means being adapted to be manually reset, while remaining in its operative position, when the direction of rotation of its color unit is reversed and when so reset to provide similarly driving connection between said cylinders in the opposite direction and idling in the direction of previous driving.

2. The invention specified in claim **1** with the impression cylinder, plate cylinder and the ink transferring cylinder having gear connections therebetween to provide positive driving connection, and with all three of said cylinders being arranged to have their axes in the printing position of the cylinders disposed in the same straight plane, and means to move said plate cylinder in the direction substantially perpendicular to said plane to eliminate the surface contact between the printing plate carried by the plate cylinder and the ink transferring cylinder but to retain meshing of the driving gear connection between the plate cylinder and the impression cylinder and therefore to retain also the positive driving registry between said cylinders.

3. A flexographic rotary printing press for printing a plurality of printing color images on a web, said press to be selectively set to print all of said images on one side of the web and to be selectively reset to print some of said images on the opposite side of the web and thus to print simultaneously on both sides of the web, a plurality of color printing units with each of said units including a plate cylinder carrying a printing plate, an ink transferring cylinder rotatable in either direction and adapted to transfer ink to said printing plate, an impression cylinder adapted to press the web against the printing plate, gear means for driving the cylinders of said color printing units, reversing means interposable into said gear means to reverse the direction of rotation of the color printing units intended to be reversed for printing on the opposite side of the web, roll means to rethread the web in the printing units to be reversed for bringing the opposite side of the web in contact with the printing plates thereof, clutch means operatively interposed between said plate cylinder and said ink transferring cylinder in all of the color printing units to provide a driving connection between the plate cylinder and the ink transferring cylinder, said clutch means including a set of rolling elements adapted to wedge-in between two members rotatable relative to each other and thus to provide said driving connection in one direction and to respond to reversing the direction of rotation of the plate cylinder by coming out of their wedge-in positions and thus disabling the driving connection in order to provide idling rotation in the opposite rotation, the clutch means of the reversible units including a second set of rolling elements similarly operative in the opposite direction and a reversing member adapted to be manually reset when the direction of rotation of its color printing unit is reversed and while remaining in its operative position between said cylinders, to provide driving connection between said cylinders in the opposite direction and idling rotation in the direction of previous driving, slide means to move said ink transferring cylinder in each of the color printing units out of contact with the printing plate, electric motor means to drive said ink transferring cylinder when the same is out of contact with the printing plate, and reversing means for said motor means in the reversible color printing units.

4. The construction defined in claim **3**, the driving connection between the electric motor means and the ink transferring cylinder being in the form of gear mechanism forming a part of said clutch means.

5. In a flexographic rotary printing press, a color printing unit including a plate cylinder carrying a printing plate, an ink transferring cylinder adapted to transfer ink to said printing plate, and an impression cylinder adapted to press the web against the printing plate for receiving a printed impression, all of said cylinders being rotatable in either direction, gear means to drive said color units, reversing means interposable in said gear means to reverse the direction of driving of the unit, roll means to rethread the web through said printing unit for bringing the opposite side of the web in contact with the printing plate, and clutch means operatively interposed between said plate cylinder and said ink transferring cylinder to provide a driving connection between said cylinders in one direction and to provide for idling in the opposite direction, said clutch means including two sets of rolling elements adapted to operate similarly in opposite directions, with each set adapted to wedge-in between two members rotatable relative to each other to provide said driving connection in one direction and to come out of their wedged-in positions to provide for idling in the opposite direction and resetting means adapted to be manually reset, while remaining in its operative position between said shaft, when the direction of rotation of its color unit is reversed

and when so reset to provide driving connection between said cylinders in the opposite direction and idling in the direction of previous driving.

6. The construction defined in claim 5, with the color printing unit including slide means for moving the plate cylinder out of surface contact with the ink transferring cylinder but to retain the meshing engagement of the gear means therebetween, reversible electric motor means, gear driving connection between said motor means and said ink transferring cylinder, said driving connection being adapted to drive through the reversible clutch means in either direction, said ink transferring cylinder when the same is out of contact with the plate cylinder.

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