# United States Patent

**Southam et al.**

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[54] **DISCONNECT ARRANGEMENT FOR MULTI-UNIT PRINTING PRESS**


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[52] **U.S. Cl.** .....**101/183,** 101/248, 101/426

[51] **Int. Cl.** .....**B41f 7/06**

[58] **Field of Search** .....101/136–145, 152–157, 101/174, 183, 184, 185, 216–218, 232, 248, 409, 410, 426



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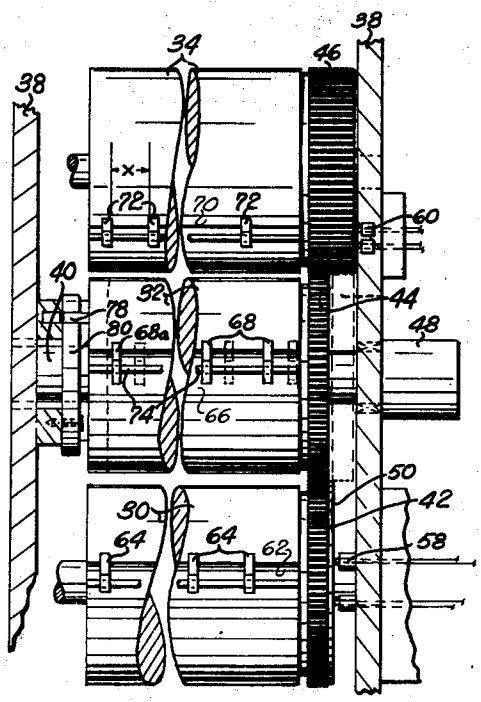
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[57] **ABSTRACT**

A disconnect arrangement for a multi-unit sheet fed press in which one of the transfer cylinder gears is shifted axially out of mesh with the gear on an adjacent cylinder while remaining in mesh with the gear on another adjacent cylinder thereby interrupting the press drive train and permitting individual operation of the units. The cylinders associated with the gears which have been disengaged are so dimensioned and arranged that they may be individually rotated without the grippers on either cylinder interfering with the other cylinder.


**8 Claims, 5 Drawing Figures**



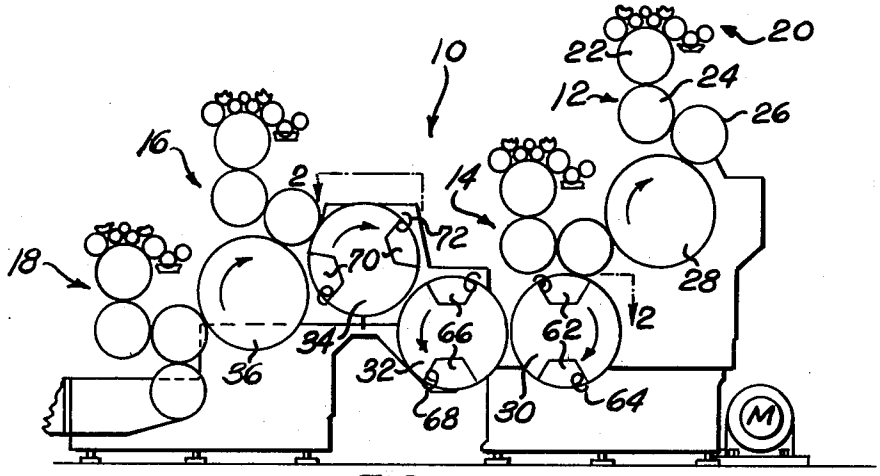



FIG. 1

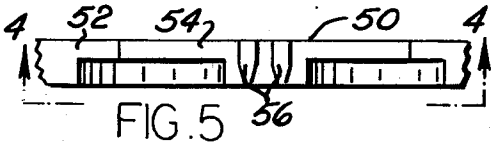
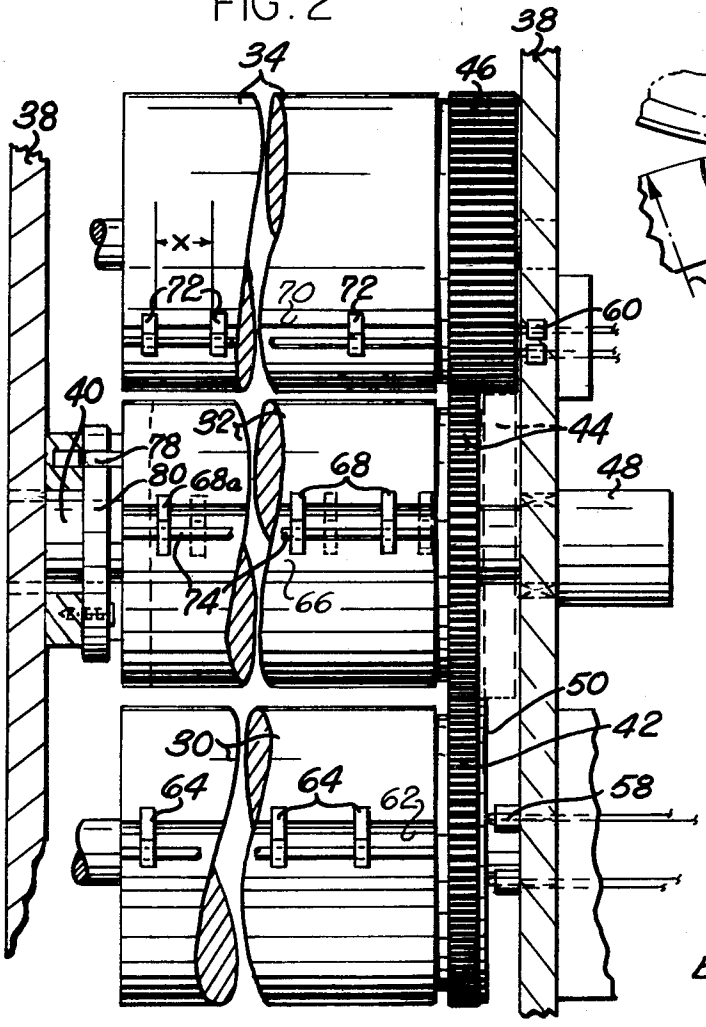



FIG. 5

FIG. 2



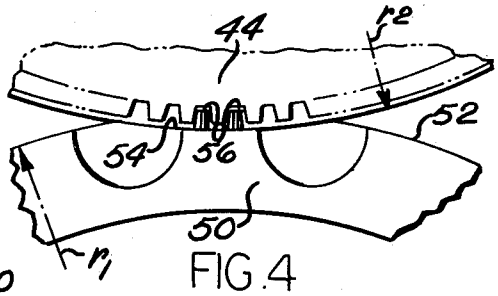




FIG. 4

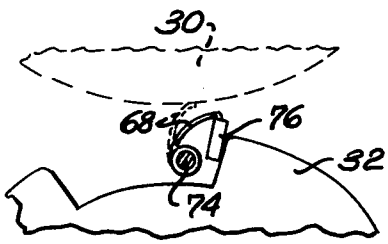



FIG. 3

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# DISCONNECT ARRANGEMENT FOR MULTI-UNIT PRINTING PRESS

This invention relates to a multi-unit sheet fed rotary printing press and, more particularly, to a disconnect arrangement in which a transfer cylinder gear is shifted out of engagement with a gear in the press drive train to permit individual rotation of the press units.

Although the invention will be described with particular reference to a multi-unit three cylinder offset sheet fed press in which a plurality of transfer cylinders are used to transfer a sheet from one unit to the next, it will be appreciated that the invention may be used with any press in which it is desired to disconnect an intergeared cylinder from adjacent cylinders having interdigitated gripper fingers.

In operating multi-unit printing presses, it frequently is necessary or desirable to operate the individual units of the press independently and various disconnect mechanisms have been proposed for this purpose. However, several factors must be considered in designing a suitable disconnect arrangement, among which are the desirability of driving solely through meshing gear teeth during normal printing operation, the need for proper retiming of the units upon reconnect and the avoidance of gripper interference during individual operation of the printing units.

It is an object of this invention to provide a disconnect arrangement for a sheet fed multi-unit printing press having a plurality of individual printing units with a train of drive gears for the press, a sheet transfer cylinder having a gear at one end constituting a portion of the drive train, a pair of adjacent cylinders angularly spaced around the transfer cylinder gear and sets of interdigitating sheet grippers on each cylinder for successively transferring sheets by means of the grippers from one cylinder to the next with each set of grippers being supported on its associated cylinder for pivoting movement between a radially outward position and a radially inward position. In accordance with the invention, actuator means are provided for shifting the transfer cylinder gear axially out of mesh with the gear on one of the other cylinders thereby interrupting the drive train and disconnecting the printing units from each other with the two disengaged cylinders being so dimensioned and arranged that the radially outer position of the grippers on each cylinder clears the periphery of the other cylinder whereby the cylinders may be rotated independently without gripper interference.

In accordance with the preferred form of the invention, one of the adjacent cylinders has a gear which is double the width of the gears on the other adjacent cylinder and the transfer cylinder whereby axial shifting of the transfer cylinder gear maintains that gear in mesh with the double width gear while breaking mesh with the gear on the other cylinder. The preferred embodiment of the invention further contemplates that the transfer cylinder and its grippers will be shifted axially as a unitary assembly with the transfer cylinder gear and that the spacing of the grippers in each of the sets of grippers will be such that the grippers on the transfer cylinder will be interdigitated with the grippers on the adjacent cylinders both before and after axial shifting movement of the transfer cylinder.

Referring now to the drawings wherein like reference numerals indicate like parts in the various views:



FIG. 1 is a schematic illustration in side elevation of a typical multi-unit press in which the principles of this invention may be used;

FIG. 2 is a sectional view taken generally along line 2—2 of FIG. 1;

FIG. 3 is a schematic illustration of the grippers on one of the cylinders and the required clearance to avoid gripper interference;

FIG. 4 is a fragmentary view illustrating the relationship of the transfer cylinder gear with a keeper ring on an adjacent gear;

FIG. 5 is a fragmentary top plan view of the keeper ring.

Referring now more in detail to the drawings, FIG. 1 illustrates a four-color multi-unit sheet fed press, indicated generally by the reference numeral **10**, and which includes individual printing units **12, 14, 16** and **18**. As is conventional, each of the units includes an appropriate inker mechanism and dampener mechanism indicated generally by the reference numeral **20** together with a plate cylinder **22**, a blanket cylinder **24** and impression cylinder **26**. A first transfer cylinder **28** is positioned between the impression cylinders of the two units **12,14**. A second transfer unit comprising three transfer cylinders **30, 32, 34** is operative to transfer sheets from the second unit **14** to the third unit **16** while another transfer cylinder **36** transfers the sheets between units **16, 18**. The transfer cylinders **28** and **36** are conventional in construction and operation so further description of these cylinders is believed unnecessary.

As is conventional, all of the cylinders in the press **10** are intergeared so that a single main drive motor M may be used to drive the first transfer cylinder **28** and thereby all of the other cylinders in the press. The intergeared relationship of the transfer cylinders **30, 32, 34** is illustrated in FIG. **2** wherein it will be seen that each of the cylinders is supported for rotation between a pair of vertical side frames **38**. Cylinder **32** is supported in the side frames **38** by a shaft **40** which in turn is supported by suitable bearings at either end thereof. The shaft **40** and the bearings supporting the shaft are slidable in the side frame so that the cylinder **32** may be shifted axially, as will be described hereinafter.

Secured for rotation with each of the cylinders **30, 32, 34** are gears **42, 44, 46**, respectively. As is apparent from FIG. **2**, the gear **46** is double the width of gears **42** and **44** but the gears otherwise lie in a common plane.

It is contemplated that the transfer cylinder **32** will be disconnected from the press gear drive train thereby dividing the press into two separate pairs of printing units. Disconnect of the transfer cylinder **32** is accomplished by shifting the gear **44** axially out of mesh with gear **42** while remaining in mesh with gear **46**. The shifting movement of the gear **44** may be accomplished by various actuator means. One suitable actuator is a double acting hydraulic cylinder, schematically illustrated at **48**, which is connected to the shaft **40**. Selective actuation of the actuator **48** shifts the shaft **40** to the right, as viewed in FIG. **2**, thereby displacing the gear **44** to a position out of mesh with the gear **42**. Thereafter, units **12** and **14** may be driven independently of printing units **16** and **18** by separate motors, not shown.

To reconnect the units in the proper timed relationship it is necessary that the gear **44** be brought back into mesh with gear **42** at precisely the same position it occupied upon disconnect. To this end, the gear **42** is provided with a keeper ring **50** on the axial outer face thereof. The keeper ring comprises a generally flat annular plate having a generally circular periphery **52** formed at a radius $r_1$. The radius $r_1$ is at least large enough to interfere with the mating gear **44** but is normally axially offset from the teeth of that gear. As shown, the radius $r_1$ actually corresponds to the outside radius of the gear **42**. It will be appreciated that the keeper ring with the radius $r_1$ radially overlaps the teeth on the gear **44** at the point of mesh between the gears **42,44** and thereby precludes axial shifting movement of the gear **44**.

To permit shifting of the gear **44** axially, notwithstanding the radially overlapping relationship between the keeper ring and the gear, there is provided on the periphery **52** a short arcuate interrupted segment **54** which is formed on a radius $r_2$ and which is slightly greater than the radius of the addendum circle of the gear **44**. When the gears **42,44** have been rotated to a position in which the meshing engagement between the two gears precisely corresponds with the arcuate interrupted segment **54**, as shown in FIG. **4**, the gear **44** may be shifted axially with the teeth of the gear passing through the space provided by segment **54**. For a more detailed disclosure of the keeper ring and the manner in which it cooperates with the gears during connect and disconnect, reference may be had to copending application Ser. No. 130,708, filed Apr. 2, 1971, and assigned to the assignee herein.

To facilitate angular alignment of the gear **44** with the arcuate segment **54**, each of the gears **42,46** is provided with sensing blocks, not shown, which may be of a conventional construction and which are adapted to cooperate with a pair of sensing probes **58,60**. The sensing blocks and probes comprise a part of a conventional proximity switch sensing head. The angular position of the sensing blocks and the probes is such that when the gear **44** and the keeper plate **50** are in the position shown in FIG. **4**, the proximity switch sensing mechanism will indicate that the cylinders are in a disconnect or reconnect position. An appropriate circuit may be employed with the switch sensing head so that actuation of the cylinder **48** is prevented except when the proximity switches indicate the cylinders are in the proper rotational position.

In the preferred form of the invention, it is contemplated that the cylinder **32** will be shifted axially as a unit with the gear **44**. Accordingly, provision must be made both for avoiding interference between the sets of adjacent gripper fingers on adjacent cylinders as the cylinder **32** is shifted axially and interference between the grippers and the periphery of the adjacent cylinder as the cylinders are individually rotated. As is conventional, the cylinder **30** has a pair of angularly spaced gaps **62** in which sets of grippers **64** are positioned. Similarly, cylinder **32** has a pair of gaps **66** in which grippers **68** are positioned while cylinder **34** has a pair of gaps **70** with grippers **72** positioned therein. FIG. **3** illustrates the manner in which the grippers, for example, grippers **68** are supported on a pivotable shaft **74** whereby the grippers pivot between a radially inward position where they are in engagement with gripper pads or posts **76** and a radially outer position where they are radially spaced from the gripper pads. Each set of grippers is controlled in its movements by spring means, not shown, and a cam and follower arrangement. One such cam and follower arrangement for the grippers **68** is schematically illustrated in FIG. **2** wherein a cam follower **78** is adapted to cooperate with a stationary cam **80** secured to the side frame **38**. A similar cam and follower arrangement would be provided for each of the sets of grippers on the other cylinders **30,34**.

As is apparent from FIG. **2**, the grippers **68** are axially spaced along the cylinder **32** in such manner that they are offset from and interdigitated with the grippers **64** and **72** on the adjacent cylinders **30,34** during normal press operations. As the cylinder **32** is shifted axially, it is necessary that interference between grippers **68** and grippers **64** and **72** be avoided. This may be accomplished by spacing grippers **64,72** an amount $x$ sufficient to accommodate the axial shift of the grippers **68**. Thus, gripper **68***a*, for example, is illustrated as being positioned between the grippers **64,72** on cylinders **30,34** when in the normal position shown in full lines. The spacing $x$ of grippers **64,72** is such that, upon shifting of cylinder **32**, gripper **68***a* moves to a position shown in dotted lines which is still between the adjacent grippers.

On the other hand, if the spacing of grippers **64,72** is less than that required to avoid gripper interference, the keeper ring **50** may be angularly positioned such that cylinder **32** can be shifted axially only in a position such as that shown in FIG. **1** where the grippers on the respective cylinders are angularly offset from each other. In this position of the cylinders, the grippers are not interleaved and the cylinder **32** may be shifted axially without concern for interference of the grippers. However, upon completion of shifting movement of cylinder **32**, the grippers **68** must be positioned to be interdigitated with the grippers **72** and **64** so that when the printing units are operated independently, the grippers on adjacent cylinders do not interfere.

In addition to avoiding interference between grippers on adjacent cylinders, it is also necessary to assure that the grippers on one cylinder do not engage the periphery of the next adjacent cylinder. Since cylinders **32** and **34** remain in meshing engagement, these two cylinders continue to operate in timed relationship. In addition, cam follower **78** is constructed such that the operative portion of the follower is axially elongated thereby to maintain operative engagement with the cam **80** in the axially shifted position of cylinder **32**. Hence, cylinders **32,34** cooperate in precisely the same manner in the disconnect position as during normal printing operations and interference between the grippers on one cylinder with the periphery of the adjacent cylinder does not present a problem.

However, this is a potential problem for cylinders **30** and **32**. Accordingly, each of cylinders **30** and **32** as shown in FIGS. **2** and **3** are reduced in diameter so that there is defined between the two cylinders a relieved space or clearance into which the grippers of both cylinders may open without engaging the periphery of the adjacent cylinder. This condition is illustrated in FIG. **3** wherein, for example, cylinder **32** is illustrated

as rotating relative to cylinder **30** and the grippers **68** may move to the dotted line position without engaging the periphery of the cylinder **30**.

While the invention has been described with reference to a specific embodiment, it is not intended that either the illustrated embodiment or the terminology employed in describing it is to be limiting; rather, it is intended to be limited only by the scope of the appended claims.

While a double width gear **46** has been illustrated as one means for maintaining operative engagement between the teeth of the gears **44,46**, while breaking mesh between gears **42,44**, it is to be appreciated that other gearing arrangements for accomplishing the same result may be employed.

With the construction shown, since none of the press cylinders are locked in stationary position while the gear teeth are out of mesh, it is possible to engage and disengage the separate sections of the press while the press is running. Preferably, this would be done at slow speed. If the keeper ring **50** is removed and the gripper finger spacings are such that any given finger stays between two adjacent grippers on the adjacent cylinder in both the engaged and disengaged positions, no part interferences are possible and the shifting of the cylinders can be accomplished without regard to the rotational positions of the cylinders.

On engagement of the separate press sections, the motors can be driven at slightly different speeds until the gear teeth properly align. Sensing means provided to sense this relationship can then be caused to actuate the gears into engagement in the usual manner while the units are being driven. Since interference of parts is impossible, further sensing means can be provided as a final assurance that the gears have correctly entered into mesh. This latter sensing means could be made to provide a control interlock to prevent the feeding of sheets or running of the press at high speed unless re-engagement has been made with the correct teeth in mesh. All of the above may also be made to occur with one press section stopped and the other being turned over at a very slow speed.

What is claimed is:

**1**. In a sheet fed multi-unit printing press having a plurality of individual printing units and including a pair of spaced vertical side frames,

a train of drive gears for said press,

a sheet transfer cylinder journaled on a horizontal axis in said side frames and having a gear at one end thereof constituting a portion of said gear train,

a pair of adjacent cylinders angularly spaced around said transfer cylinder each having a gear in mesh with the transfer cylinder gear,

all of said cylinders having sets of interdigitating sheet grippers thereon for successively transferring sheets by means of said grippers from one cylinder to the next,

each of said set of grippers being supported on its associated cylinder for pivoting movement between a radially outward position and a radially inward position, and

means for moving the transfer cylinder gear axially out of mesh with the gear on one of said adjacent cylinders while maintaining the mesh with the gear on the other of said adjacent cylinders for disconnecting the printing units from each other,

said transfer cylinder and said one adjacent cylinder being so dimensioned and arranged that the radially outer position of the grippers on each of these cylinders clears the periphery of the other cylinder whereby the cylinders may be rotated relative to each other.

**2**. The press of claim **1** wherein the teeth on the gear on the other of said adjacent cylinders have an axial dimension greater than the teeth of the gear on said transfer cylinder whereby said transfer cylinder gear remains in mesh with said gear on said other adjacent cylinder when shifted axially out of mesh with the gear on said one adjacent cylinder.

**3**. The press of claim **1** wherein said transfer cylinder, its gear and grippers are all mounted for axial movement as a unitary assembly,

the spacing of the grippers in each of said sets of grippers being such that the grippers on said transfer cylinder are interdigitated without interference with the grippers on said other cylinders both before and after axial shifting movement of said transfer cylinder.

**4**. The press of claim **1** and further including means operatively associated with said transfer cylinder gear enabling shifting movement of that gear in only one rotated position thereof.

**5**. The press of claim **2** wherein the axial dimension of said gear teeth on said adjacent cylinder is greater by an amount approximately equal to the distance through which said transfer cylinder gear is shifted.

**6**. A method of disconnecting and individually operating the printing units of a multi-unit printing press of the type having a plurality of individual printing units supported between a pair of spaced side frames, at least one sheet transfer cylinder journaled on a horizontal axis between said side frames for transferring printing stock from one printing unit to the next and a pair of adjacent cylinders angularly spaced around said transfer cylinder, a train of drive gears for said press with each of said cylinders having a gear at one end thereof constituting a portion of the drive train, all of said cylinders having sets of interdigitating sheet grippers thereon for successively transferring sheets by means of said grippers from one printing unit to the next, motor means for operating said drive train to drive all of the units of said press during the printing operation and auxiliary motor means associated with individual printing units to drive each unit individually, said method comprising the steps of:

shifting the transfer gear axially out of mesh with the gear on one of said adjacent cylinders while maintaining the transfer cylinder gear operatively connected to the gear on the other of said adjacent cylinders thereby to interrupt the drive train from one printing unit to the next, and

selectively actuating the auxiliary motor means for individual printing units to drive the individual units as desired.

**7**. The method of claim **6** wherein the step of shifting the transfer cylinder gear includes shifting the transfer cylinder axially, said method further including the steps of:

prior to shifting the transfer cylinder, positioning the sets of grippers such that said transfer cylinder may be shifted axially without interference between the grippers on that cylinder and the adjacent cylinders, and

shifting the transfer cylinder axially a distance such that the grippers thereon may be interdigitated with the grippers on the adjacent cylinders.

8. The method of claim 7 wherein the step of positioning the grippers comprises rotating the cylinders to a position where the grippers are displaced from a sheet transfer position.

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