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Greiner et al.

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[54] **DRIVE ARRANGEMENT FOR PERFECTING LITHOGRAPH PRESS UNIT**

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[51] **Int. Cl.** **B41f 5/04**

[58] **Field of Search** ..... 101/218-225, 212, 213, 216-217, 248, 178-181, 183, 229, DIG. 11, 152; 74/409

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[57] **ABSTRACT**

A lithograph press in which a web is simultaneously printed on both sides by passing the web between a pair of blanket cylinders, the blanket cylinders being gear driven from associated plate cylinders and the plate cylinders being coupled to a common drive shaft. An auxiliary torque loading is applied, by means of brakes, to the blanket cylinders, thereby to minimize the effect of transient changes in loading which tend to occur within the rotative cycle because of the tendency of one blanket cylinder momentarily to over-drive the other. In the disclosed embodiment the braking is accomplished by means of loaded hydraulic pumps coupled to the respective blanket cylinders.

3 Claims, 3 Drawing Figures

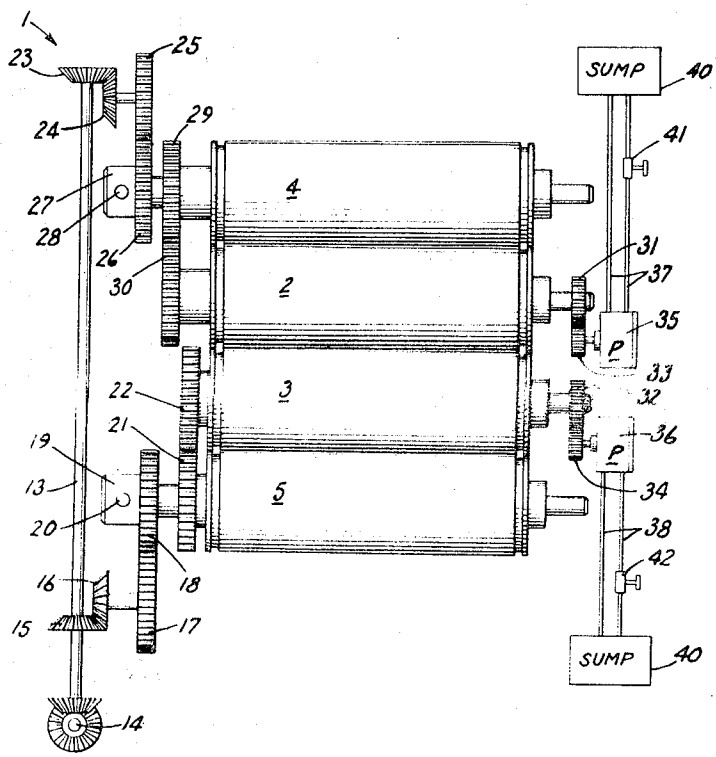
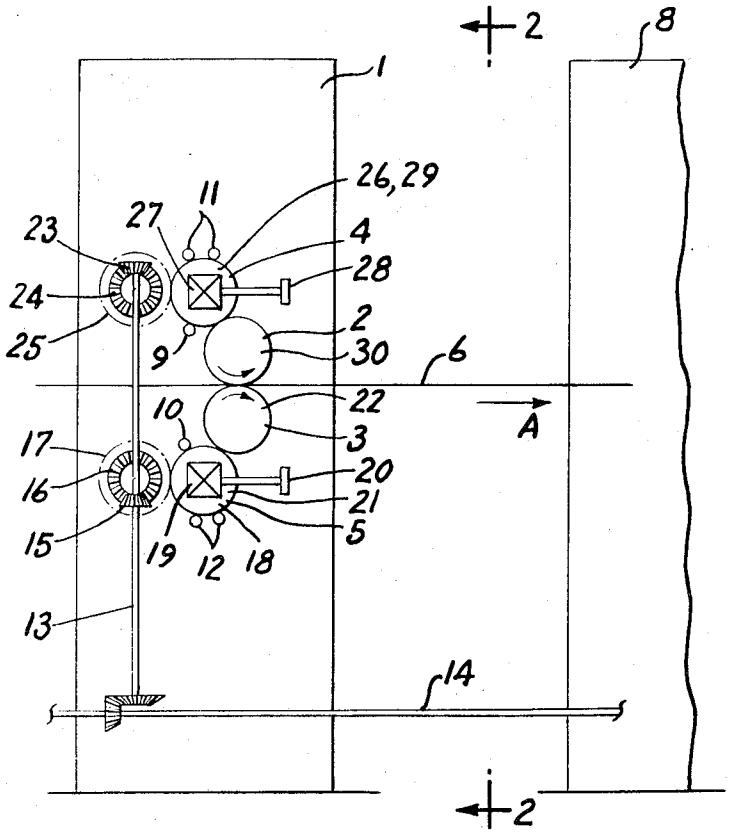


FIG. 1



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FIG. 2

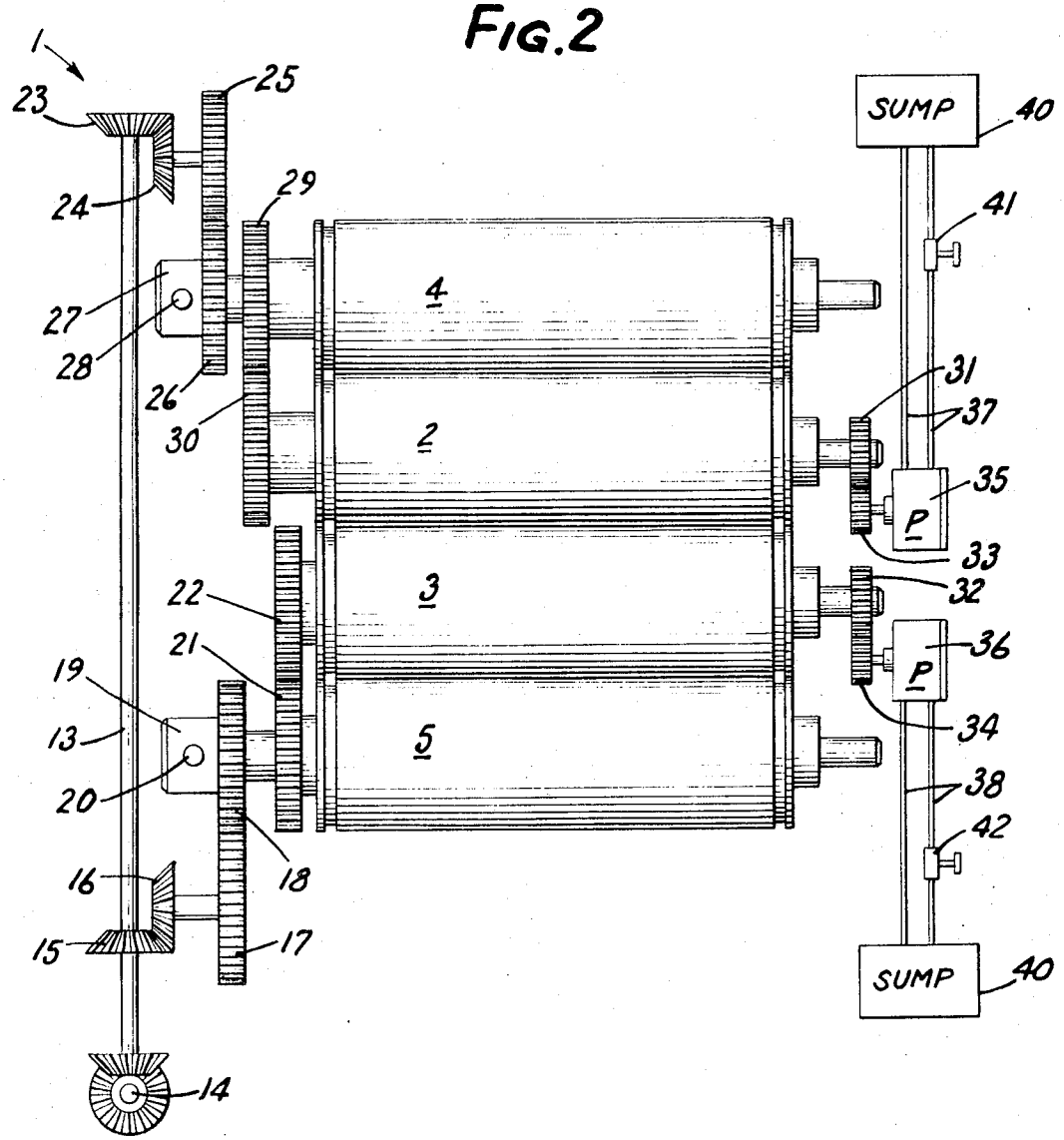
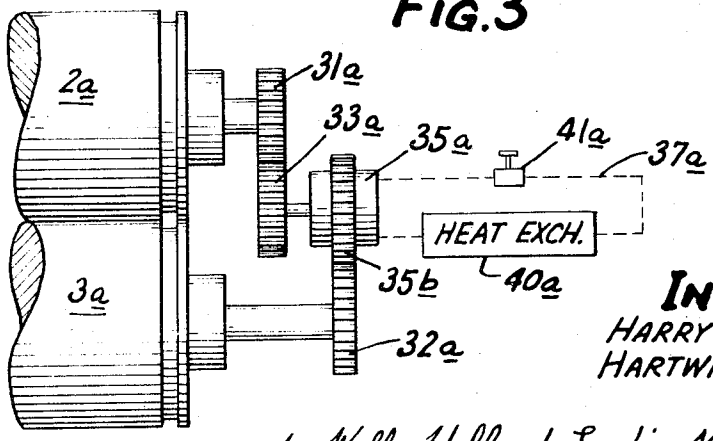


FIG. 3



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DRIVE ARRANGEMENT FOR PERFECTING LITHOGRAPH PRESS UNIT

In a conventional lithograph press of the perfecting type the web is run between two engaged blanket cylinders which are gear driven from the associated plate cylinders which, in turn, are coupled to a common drive shaft. Means are provided between each of the plate cylinders and the common drive shaft in the form of planetary gearing for enabling running adjustment of phase position.

Because of the symmetry of the cylinder drives and because of the close dimensional tolerances which are adhered to in constructing the blanket cylinders, and the blankets which are used thereon, one might assume that perfect printing would be achieved on both sides of the web. However experience shows that this is not the case. Lack of sharpness has been noted even where a high degree of care and precision have been exercised in the construction and operation of the press unit.

It is, accordingly, the object of the present invention to provide a perfecting type lithograph press which achieves a higher and more uniform quality of printing than has been possible in the past. It is a related object to provide an improvement for a lithograph press which may be added to conventional designs of presses conveniently, with relatively minor modification of press structure and at low cost.

Other objects and advantages of the invention will become apparent upon reading the attached detailed description and upon reference to the drawings in which:

FIG. 1 is a diagrammatic side elevational view of a printing unit to which the present invention has been applied.

FIG. 2 is a developed elevational view of the press unit showing the four cooperating cylinders and their associated driving mechanisms looking generally along the line 2—2.

FIG. 3 shows an alternate form of the invention.

While the invention has been described in connection with certain preferred embodiments, it will be understood that we do not intend to be limited to the particular embodiments shown but intend, on the contrary, to cover the various alternative and equivalent constructions included within the spirit and scope of the appended claims.

Referring now to the drawings, a lithographic press unit **1** is shown having a pair of blanket cylinders **2, 3** which are arranged in opposition to one another and which are respectively engaged by plate cylinders **4, 5.** Interposed between the blanket cylinders is a web **6** which travels in the direction indicated at A into a subsequent, similar press unit **8.** The printing plates mounted upon the plate cylinders **4, 5** are dampened and inked, respectively, by water form rollers **9, 10** and ink form rollers **11, 12** which are fed films of water and ink by means well known to those skilled in the art.

In the lithographic or "offset" method or printing, the plates have areas which are respectively water and ink-receptive so that the printed image is imparted, by the plates, to the surface of the blanket cylinders which simultaneously print upon the opposite sides of the web.

For the purpose of driving the cylinders at the desired surface speed a gearing arrangement is used which is set forth in some detail in FIG. **2.** Journaled in the press unit is a common vertical drive shaft **13** which is driven,

through a set of bevel gears, from a main horizontal drive shaft **14** which serves a group of printing units. The plate cylinder **5** is powered via a set of bevel gears **15, 16** which drive a set of spur gears **17, 18.** Interposed between the spur gear **18** and the plate cylinder **5** is a set of planetary gearing **19** having an adjustable control **20** whereby the phase of the plate cylinder **5** with respect to the drive shaft **13** may be varied while the press is in motion. Devices to produce a running phase or register adjustment are well known in the art, and reference may be had, for example, to prior U.S. Pat. No. 2,234,674 which issued Mar. 11, 1941. The blanket cylinder **3** is driven from the plate cylinder **5** by a set of meshing spur gears **21, 22.**

Similar means are provided for driving the other pair of cylinders. Thus a drive cOnnection is made from the vertical drive shaft **13** via bevel gears **23, 24** and spur gears **25, 26** to the plate cylinder **4.** Interposed for running phase adjustment is a planetary gear device **27** having a manual or other control **28** similar to the control **20.** The blanket cylinder **2** is driven from its cooperating plate cylinder **4** via spur gears **29, 30.** For accurately predetermining, and maintaining, the desired spacing between the axes of the cylinders, bearer rings, well known to those skilled in the press art, are employed.

It might be assumed that by exercise of close tolerances in the construction of the gear trains **15–22** and **23–30** the blanket cylinders would be driven in precise synchronism with one another to produce printing of highest quality. However, the results obtained in the operation of a well constructed and carefully adjusted lithograph press leave something to be desired. Our observations show that in spite of adherence to close tolerances slight variations occur in the radii of the blanket cylinders and their associated bearer rings within a rotative cycle. For example, during a point in the cycle portions of the blanket cylinder **2,** and its bearer rings, may have a slightly greater radius than the corresponding engaged portions of the blanket cylinder **3.** Thus blanket cylinder **2** which is momentarily moving at a faster peripheral rate than blanket cylinder **3** will attempt to over-drive the latter. This momentarily reduces the drive torque being transmitted through the gear train **15–22** and more particularly reduces the drive torque which exists between the spur gears **21, 22.** Thus the teeth of the spur gears **21, 22** are no longer fully and forcibly bottomed on one another. Departure from the forcibly bottomed drive condition causes a momentary small phase displacement between the blanket cylinder and its cooperating plate cylinder. While such phase displacement may be extremely small, nevertheless our observations show that it is sufficient to cause the pattern of ink which is "offset" from the plate onto the blanket cylinder **3** to be deposited in a slightly different position upon the surface of the blanket. Since the radial discrepancy which produces the momentary over-driving condition is of an indeterminant or random nature, particularly in view of the phase adjustments which are made, in the operation of the press, by manipulation of the controls **20, 28,** there is a loss of sharpness in the offset image which is printed out upon the web.

At a subsequent point in the rotative cycle the situation may be reversed, that is, the blanket cylinder **3** and the bearers thereon may be relatively higher (at a greater radius) than the corresponding, engaged por-

tions of the blanket cylinder **2**, causing the latter to be overdriven and causing a momentary reduction in the load imposed by the spur gear **30** upon the spur gear **29**. Thus there is a departure from the normal solid bottoming of the teeth of gear **30** upon the teeth of gear **29**, accompanied by a slight, yet detectable, discrepancy in the phase of the printed image being transferred from the plate cylinder **4** to the blanket cylinder **2**, resulting in a loss of sharpness in the image printed upon the web. The situation is worsened by the fact that the cylinder which momentarily overdrives the other is, during that time, doubly loaded.

In accordance with the present invention means are provided for imposing upon the blanket cylinders an auxiliary steady torque loading, a loading which is sufficiently great so as to maintain the gears of the respective drive trains, and more particularly to maintain the gears between the blanket and plate cylinders, constantly in a solidly bottomed condition notwithstanding the tendency of either of the blanket cylinders **2, 3** to be momentarily overdriven by the other. More specifically in accordance with the invention, we provide, coupled to the shaft of the blanket cylinders **2, 3** and anchored to the press frame, hydraulic pumps having circulating hydraulic lines which include a throttling obstruction so that the pumps impose a predetermined and controllable auxiliary torque loading upon the blanket cylinders. Thus as shown in FIG. **2** there is secured to the shaft of the blanket cylinder **2** a spur gear **31** which is in mesh with a spur gear **33** to drive an hydraulic pump **35**. Similarly, a spur gear **32** on the shaft of the blanket cylinder **3** drives spur gear **34** which powers an hydraulic pump **36**, both pumps being secured, as shown, with respect to the press frame. The pumps are connected to recirculating hydraulic lines **37, 38**, leading to a sump **40** and having series-connected throttle valves **41, 42** which may be adjusted to produce a predetermined level of back pressure. The valves may be of any type providing a restricted passage of variable cross section.

With auxiliary torque loading applied to cylinder **2** by pump **35** under normal driving conditions, the teeth of the spur gear **30** impose a relatively high level of reaction torque against the teeth of the gear **29** which may be referred to as "augmented torque." The condition sought to be overcome is the momentary unloading of the teeth on the gears **29, 30**. This can only occur when the torque applied to the cylinder **2** by the cylinder **3** and its bearers by the momentary tendency to overdrive exceeds the "augmented torque." By making the "augmented torque" sufficiently high, simply by closing down the throttle valve, this condition will never occur. The same is true of the cylinders **3, 5** in the opposite couple and the setting of the braking force for each of the blanket cylinders **2, 3** will be substantially the same.

Another way of looking at the matter is to consider that the torque which causes the overdriving tendency is by its nature limited. Augmenting the driving reaction not only insures that there is always a net torque in the driving direction but that the overdrive torque will be a reduced percentage of the driving torque making the torque in the driving gears more nearly constant.

Since the momentary overdriving tendency will vary from one press unit to the next, even among seemingly identical units, the throttling valves, beginning with relatively unobstructed flow, may be gradually turned toward the closed direction with increased throttling until momentary overdriving no longer occurs. The hydraulic pumps **35, 36**, in imposing torque loading upon the blanket cylinders, will necessarily waste a certain amount of energy which will be dissipated in the form of heat in the recirculated hydraulic fluid. However, the heat may be continuously dissipated by having a large enough sump or by having a simple type of heat exchanger interposed in the pump line, a small price to pay for effecting a substantial improvement in the printing quality.

It will be apparent to one skilled in the art that the use of hydraulic pumps as load-imposing devices, or brakes, is simply exemplary and that the invention may be practiced using other forms of brakes, for example, of the frictional disc or drum type. It will also be understood that the brakes may be in the form of rudimentary generators of the induction or eddy current type with the absorbed energy being dissipated either within the structure of the machine or in a separately mounted resistor bank. In short, any braking device capable of impoSing a fixed but adjustable torque loading with provision for removal of the absorbed energy may be used.

It will also be apparent to one skilled in the art that the invention in its broader aspects is not limited to use of two brakes and that the benefits of the invention are obtained, in part, by applying braking torque to only one of the two blanket cylinders.

Finally, it will be noted that while the invention may be applied to new presses, brakes may be installed with little or no modification of existing press designs, even in the field, with relatively little added expense provided that the prime mover which drives the main press shaft **14** has sufficient torque capability to handle the load.

Since, in the improved construction, there is no longer any possibility of one of the blanket cylinders overdriving the other to the extent of causing incipient or actual separation of the gear teeth driving the latter, it might be assumed that the overdriving tendency, which is still there, might evidence itself as momentary relative slippage between the blanket cylinders. It is one of the surprising consequences of the present invention that such slippage is not found to occur, possibly due to the accommodation provided by the resilient surfacing normally provided on blanket cylinders and the high degree of friction which normally exists between the web and the engaged printing surface of the blanket cylinders.

While the invention, in its preferred form, employs brakes respectively interposed between the blanket cylinders and the frame, it is apparent that the invention is not limited thereto and that, if desired, a brake may be interposed between the blanket cylinders in such a way that the cylinders rotate respective portions of the brake in opposite directions. Such an arrangement is shown in FIG. **3** in which corresponding parts are indicated by a corresponding number with letter subscript. Thus there is connected to blanket cylinder **2***a* a pair of spur gears **31**a, **33**a which drive the shaft of a brake **35***a*, the housing of the brake having a ring gear **35***b* thereon. The other blanket cylinder, indicated at **3***a*, is connected to a spur gear **32***a* which meshes with the ring gear so that the shaft and housing of the brake rotate in opposite directions. The brake may be in the

form of an hydraulic pump just as in the embodiment shown in FIG. 3 having an hydraulic line 37*a* which includes a throttle valve 41*a* and a heat exchanger 40*a*, conventional slip means being employed to maintain the hydraulic connections as the brake housing rotates. the blanket cylinders are thus mutually loaded to a degree which depends upon the setting of the throttle valve 41*a* to apply an augmented steady torque between the blanket cylinder drive gears **21, 22** and **29, 30** respectively.

What we claim is:

1. In a perfecting type lithograph press unit, the combination comprising a press frame, a pair of blanket cylinders journaled in the frame in running engagement with one another forprinting on opposite sides of a web passing between them, each of the blanket cylinders having an associated plate cylinder, a common press drive shaft, individual gear trains coupled to the drive shaft for gear-driving each blanket cylinder via its associated plate cylinder, each of the blanket cylinders having a brake coupled to the press frame for imposing auxiliary steady torque loading upon the gear trains to maintain the gears between each blanket cylinder and its associated plate cylinder in bottomed driving phase relation with respect to one another notwithstanding variations in torque loading due to transient frictional driving interaction between the blanket cylinders.

2. The combination as claimed in claim **1** in which each of the brakes is in the form of an hydraulic recirculating pump secured to the frame with associated means for throttling the flow.

3. In a perfecting type lithograph press unit, the combination comprising a press frame, a pair of blanket cylinders journaled in the frame in running engagement with one another for printing on opposite sides of a web passing between them, each of the blanket cylinders having an associated plate cylinder, a common press drive shaft, individual gear trains coupled to the drive shaft for gear-driving each blanket cylinder via its associated plate cylinder, each of the blanket cylinders having braking means directly coupled thereto for imposing auxiliary steady torque loading upon both of the gear trains to maintain the gears between each blanket cylinder and its associated plate cylinder in bottomed driving phase relation with respect to one another notwithstanding variations in torque loading due to transient frictional driving interaction between the blanket cylinders, and means for adjusting the braking force to a level above incipient separation of the teeth on the gears between the blanket and plate cylinders as one blanket cylinder momentarily tends to over-drive the other.

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