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[54] **CYLINDER ARRANGEMENT FOR AN OFFSET LITHO MACHINE**
9 Claims, 5 Drawing Figs.

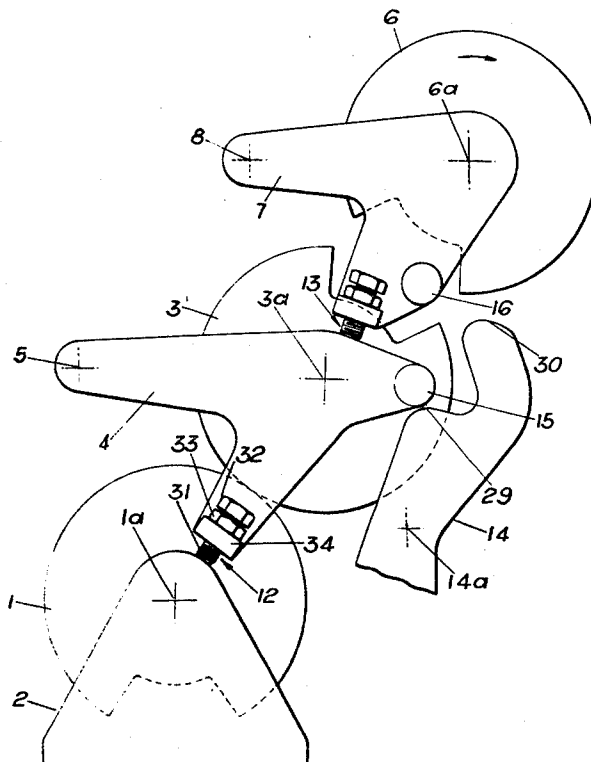
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101/144, 101/247, 101/248
 [51] Int. Cl. **B41f 7/04,**
B41f 13/34
 [50] Field of Search **101/218,**
247, 248, 139, 140, 143, 144, 145, 182, 184, 185,
192, 284, 285, 23, 36, 37, 91, 217

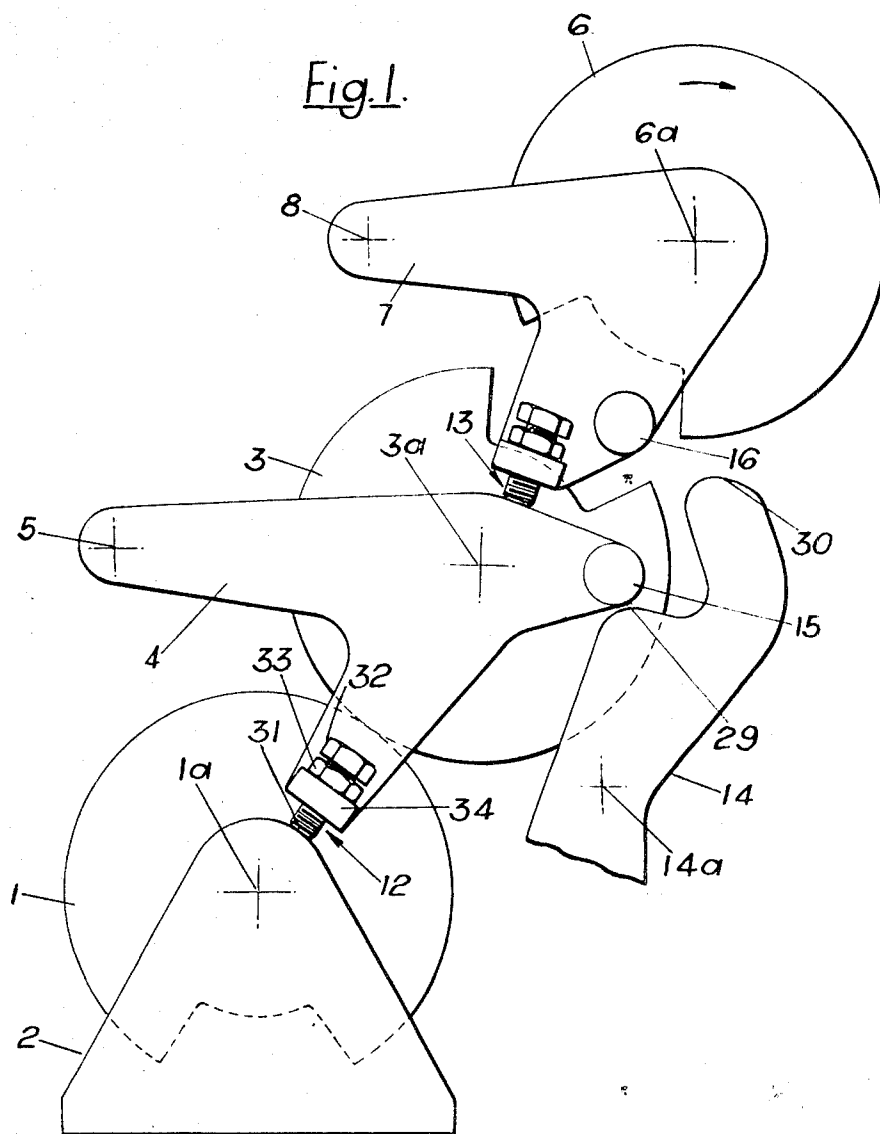
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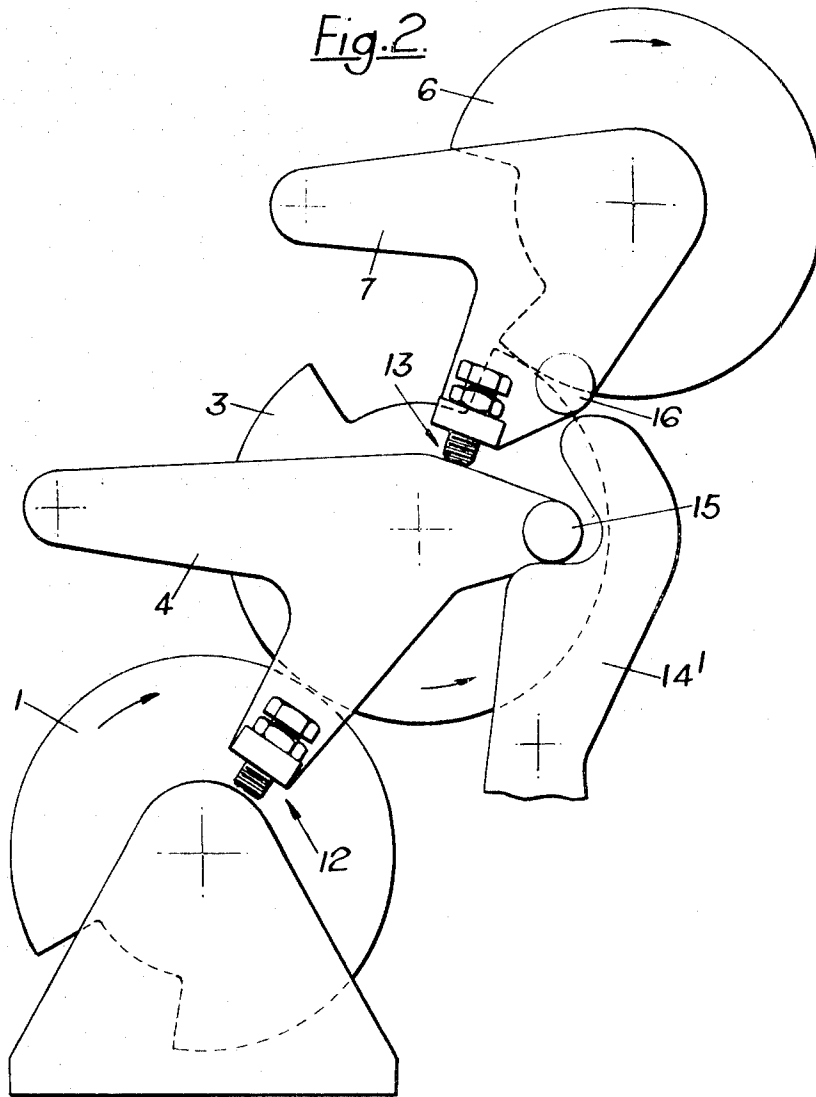
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ABSTRACT: The disclosure includes an offset printing press in which the blanket and plate cylinders are mounted on swingable bearers to separate them from the impression cylinder and preferably also from each other. An adjustable stop mechanism is provided to define a minimum spacing between the axes of the blanket and impression cylinders and advantageously a further such mechanism is provided between blanket and plate cylinders. The cylinders may be separated by operation of a lifting lever. Drive gearing between two of the cylinders, desirably the blanket and impression cylinders, may include one of the two nonintermeshing gears attached to each cylinder, and a pair of intermeshing planetary pinions each meshing with a different one of the two gears.

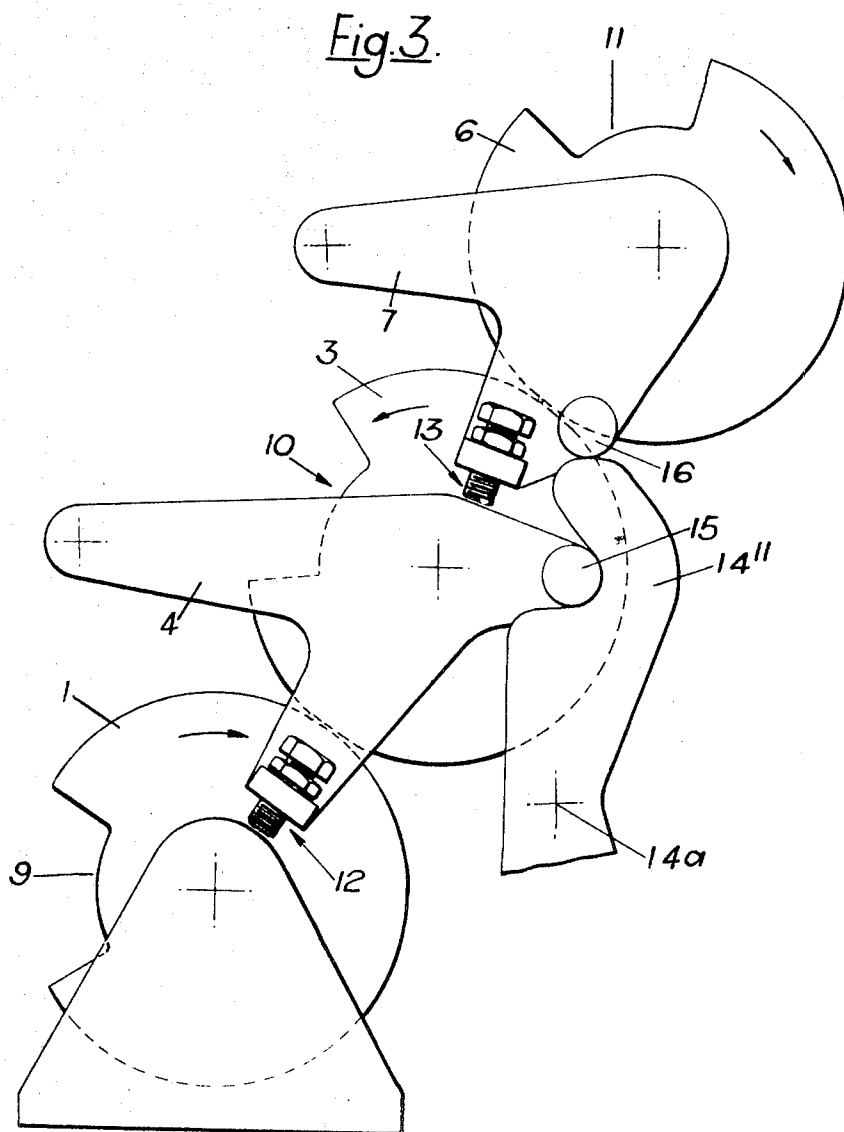




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Fig. 4.

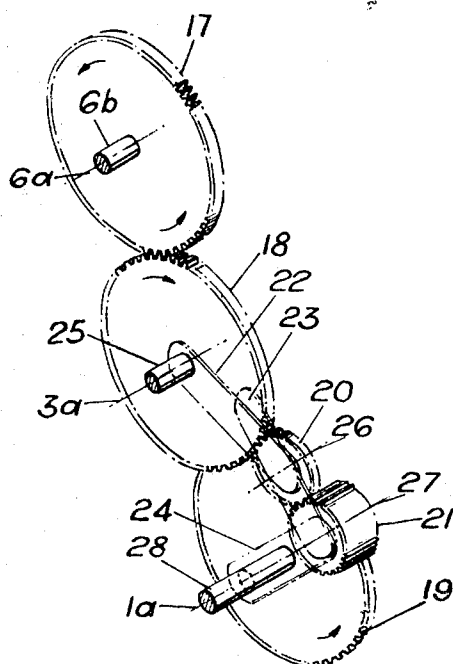
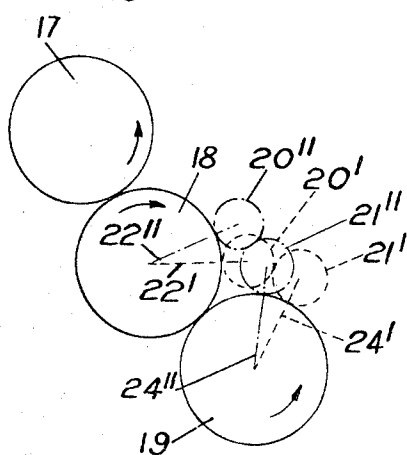


Fig. 5.



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CYLINDER ARRANGEMENT FOR AN OFFSET LITHO MACHINE

This invention relates to an improved form of printing apparatus, and more particularly to an offset lithographic printing apparatus.

Known offset lithographic printing devices employ three cylinders, namely plate or master cylinder, a blanket cylinder for receiving an offset impression from the plate cylinder, and an impression cylinder which supports the printing paper while the offset impression or copy is transferred from the blanket cylinder onto the paper. For satisfactory printing operation there are other various requirements which should be fulfilled by the apparatus. These include (a) a means of bringing the various cylinder surfaces into contact (plate cylinder with blanket cylinder and blanket cylinder with impression cylinder) and often a further means of bringing only the plate cylinder and blanket cylinder into contact with one another for the purpose of building up the image prior to printing, (b) a means of maintaining suitable compressive forces between the plate and blanket cylinders and the blanket and impression cylinders, allowance being made for any cylinder surface irregularities such as anchorage recesses or paper grippers, and (c) a means of maintaining the axes of the various cylinders in alignment.

Some conventional arrangements for pressing the blanket cylinder into contact with the impression cylinder, and particularly where the two cylinders concerned are located one above the other, may experience what is known as "pressure drop-off" in which fluctuations in contact pressure occur, with the resulting deterioration in the quality of the print obtained. When a recess in the cylindrical surface of one cylinder comes into register with the plane joining the axis of that cylinder with that of the adjacent cylinder, contact pressure is temporarily relaxed. This has the result that, not only is the pressure relaxed between the two cylinders in question, but also the blanket cylinder, which is usually in contact simultaneously with the impression cylinder, moves towards the associated cylinder to take up the clearance by the register of the recess with the cylindrical surface. Thus the contact pressure between the blanket cylinder and the other of the three cylinders is also relieved. Such movement of the blanket cylinder towards the said associated cylinder is permitted by the existence of working tolerances in the blanket cylinder bearings, possibly caused by wear of the bearings.

According to the present invention we provide an offset printing press wherein the impression cylinder, blanket cylinder and plate cylinder are each rotatably mounted in cylinder bearers and are positioned with their axes spaced at different levels, the blanket and plate cylinder bearers being pivotally mounted for lateral movement of the blanket and plate cylinder axes with respect to the impression cylinder axis, and an adjustable stop mechanism is provided to define a minimum lateral spacing of the blanket cylinder axis from the impression cylinder axis during pivotal motion of the blanket cylinder bearer, thereby maintaining a substantially uniform spacing between such axes even when the respective cylinders are out of contact with one another. Advantageously the axis of the impression cylinder may be fixed and the axes of the blanket and plate cylinders be independently movable with respect thereto.

Desirably a further adjustable stop mechanism may be positioned between the blanket and plate cylinders. Conveniently the press may include a lifting lever pivotable between an out-of-the-way position and a first operative position in which a cam surface on the lifting lever engages with a part of the blanket cylinder bearer to raise the blanket cylinder out of the contact with the impression cylinder. Preferably the lifting lever may include a further cam surface which, when the lifting lever is in a second operative position, engages a part of the plate cylinder bearer to raise the plate cylinder out of the contact with the blanket cylinder. Desirably the first operative position of the lifting lever may be between the out-of-the-way

position and the second operative position and the first mentioned cam surface may be so shaped that when the lifting lever is in its second operative position the blanket cylinder remains clear of the impression cylinder.

In one particularly suitable embodiment of the invention two of the cylinders are angularly adjustable with respect to one another and are each provided with one of a pair of nonintermeshing gears, each of the cylinders having one of a pair of swinging arms pivotally mounted for rotation about the cylinder axis, each of the swinging arms being provided with a pinion which engages with the gear on the associated cylinder, and the two pinions being arranged to be intermeshing with each other. If desired the two pinions may be constrained to remain in mesh with each other by means of a third arm articulated to each of the swinging arms. Suitably means may be provided for effecting swinging of one of the swinging arms about its associated axis of pivoting. More conveniently the two relatively angularly adjustable cylinders may be the blanket cylinder and the impression cylinder.

In order that the present invention may more readily be understood, the following description is given of one embodiment of printing apparatus according to the invention. Reference will be made, merely by way of example, to the accompanying drawings in which:

FIG. 1 is a side elevational view showing the arrangement of the three cylinders of the printing apparatus, the cylinders being shown in printing relationship;

FIG. 2 is a view, similar to FIG. 1, but showing the plate and blanket cylinders in printing engagement while withdrawn from contact with the impression cylinder, for purposes of proofing;

FIG. 3 is a further side elevational view of the cylinders showing the blanket cylinder withdrawn from both the impression cylinder and the plate cylinder;

FIG. 4 is a perspective view showing the transmission gear train of the plate, blanket and impression cylinders; and

FIG. 5 is a side elevational view, is somewhat schematic form, illustrating the intermeshing relationship of the various pinions shown in FIG. 4.

Referring now to the drawings, and in particular to FIGS. 1 to 3, the printing apparatus illustrated comprises an impression cylinder 1 journaled at 1a to a rigid frame comprising a pair of upstanding lugs 2, a blanket cylinder 3 journaled at 3a to a swinging frame comprising a pair of side arms 4 pivotally mounted at 5, and a plate cylinder 6 journaled at 6a to a further swinging frame comprising a pair of side arms 7 pivotally mounted at 8. Reference to Fig. 3 will show that the impression, blanket and plate cylinders 1, 3 and 6 have recesses 9, 10 and 11 respectively in their cylindrical surfaces. The recesses 9, 10 and 11 are conventional in printing apparatus, and are commonly provided for the paper grippers, plate clamps, and blanket clamps respectively.

The swinging frame supporting the blanket cylinder 3 is provided with a pair of adjustable abutment members of stops 12, each stop 12 being associated with one of the side arms 4. Similarly, the plate cylinder supporting frame is associated with a pair of adjustable stop members 13, each stop member being associated with one of the two side arms 7. The adjustable stop member 12 is illustrated as comprising a stud or bolt having a shank 31 and hexagonal head 32, the stud being provided with a lock nut 33 and extending through a suitably threaded aperture in the projection 34 of the side arm 4. The construction of the adjustable stop member 13 is similar to that described with reference to stop member 12.

An arm 14 is shown as being pivoted at 14a to the fixed frame of the apparatus and including a forklike end portion comprising abutment surfaces 29 and 30. The side arms 4 and 7 of the swinging frames are provided with projections 15 and 16 respectively in the form of integrally formed pegs. Upon pivoting movement of the arm 14 to the position shown at 14' in FIG. 2 the abutment surface 29 engages the peg 15 of side arm 4 and effects movement of the peg 15 with resulting anticlockwise pivoting movement of the side arm 4 about its axis

5. Although not evident from the drawings, a pair of such arm members 14 is provided, the arms 14 being linked for joint rotation about their common pivot 14a and being adapted to engage two similarly disposed pegs 15, one on each of the side arms 4.

Upon further movement of the arm 14 to the position illustrated at 14'' in FIG. 3, the abutment surface 30 of each arm 14 engages the peg 16 of the associated side arm 7 of the plate cylinder supporting frame and urges the peg 16 upwardly thereby effecting anticlockwise pivoting movement of the plate cylinder-supporting frame about the pivot 8. It is clear from the drawings that, in the FIG. 2 position, the blanket cylinder is out of engagement with the impression cylinder but is still in contact with the plate cylinder and that, in the FIG. 3 position, the blanket cylinder is free from contact with either the plate cylinder or the impression cylinder.

The operation of the roller arrangement depicted in FIGS. 1 to 3 will now be described by the way of further example.

In the FIG. 1 position in which the cylinders 1, 3 and 6 are in their printing configuration the apparatus operates normally with the plate and impression cylinders rotating in a clockwise direction and the blanket cylinder rotating in an anticlockwise direction. The orientation of the various cylinders is so chosen that the recesses 10 and 11 will be in register simultaneously with the normal to the tangential plane common to cylinders 3 and 6, i.e. they will both intersect the imaginary line joining pivots 3a and 6a in FIG. 1 simultaneously. The recesses 9 and 10 as shown in FIG. 1 may both be in register with the normal to the tangential plane common to cylinders 1 and 3 at the same time, depending upon the adjustment of the print position as described below.

Considering first the instance when recesses 10 and 11 are in register, i.e. the situation depicted in FIG. 1, it will be seen that as the leading edges of the two recesses pass through the imaginary line joining axes 3a and 6a, the contact pressure will tend to be relieved. In conventional apparatus this would result in slack occurring between the blanket cylinder and the plate cylinder and would result in movement of the blanket cylinder towards the plate cylinder in order to take up any existing slack or wear in the journal 3a. This would result in diminishing contact pressure between the impression cylinder 1 and the blanket cylinder 3.

Further, in the apparatus described the adjustable stop member 13 will be so adjusted that only very slight clockwise pivoting movement of the side arms 7 is possible before the abutment face at the end of the stop member 13 engages the associated abutment surface of the side arm 4. The slight pivotal movement referred to is virtually negligible as can be judged from the example that during normal operation of printing apparatus the clearance between each adjustable stop member 12 or 13 and the associated abutment surface of the frame component 2 or 4 will be between 0.002 and 0.005 inches (0.051 to 0.127 mm.). This clearance is taken up after which further pivoting of side arms 7 is prevented, and the angular movement of the side arms 7 can therefore be seen to be extremely small.

It will be seen from the above-description of the movement of the side arms 7 and the function of the adjustable stop member 13, that the fluctuations in the magnitude of the force exerted on the side arms 4 by virtue of the weight of the assembly of plate cylinder 6 and side arms 7 is virtually eliminated. Further, the point of contact between the adjustable stop member 13 and the associated side arm 4 has been carefully chosen so that the force exerted on the side arm 4 by the stop member 13 has a line of action coincident with the plane containing the axes 3a and 6a of the blanket and plate cylinders 3 and 6 respectively. Thus the moment, about the pivot 5 of the side arm 4, exerted by the weight of the side arms 7 and plate cylinder 6 through the agency of the adjustable stop member 13, is substantially the same as the moment of the assembly of side arms 7 and plate cylinder 6 exerted through the agency of the line of contact between the blanket and plate cylinders 3 and 6 in normal operation thereof.

When the recesses 9 and 10 of the impression and blanket cylinders 1 and 3 respectively are in register the function of the adjustable stop member 12 is similar to that described above with reference to the stop member 13 in that a negligible clockwise rotation of side arms 4 about pivot 5 is permitted. There will thus be little or no tendency for the blanket cylinder to move towards the impression cylinder and hence away from the plate cylinder, this eliminating the likelihood of fluctuations in contact pressure between the plate cylinder and the blanket cylinder when the recesses 9 and 10 are in register.

FIG. 4 illustrates the drive mechanism interconnecting the impression, blanket and plate cylinders 1, 3 and 6 respectively. As shown in the Figure, the axes 1a, 3a and 6a of the cylinders are coincident with shafts 28, 25 and 6b respectively which fix the driving pinion 19, 18 and 17 to the respective cylinders 1, 3 and 6. The shaft 6b has a plate cylinder driving pinion 17 fixed thereto, the shaft 25 has the blanket cylinder drive pinion 18 fixed thereto and similarly the shaft 28 has the impression cylinder drive pinion 19 fixed thereon. The plate and blanket driving pinions 17 and 18 are in constant mesh with one another, but the blanket and impression cylinder pinions 18 and 19, although having equal diameters and having their axes spaced by a distance equal to the diameter of each, are in different parallel planes. As can be seen from FIG. 4, the impression cylinder driving pinion 19 is behind the blanket cylinder driving pinion 18.

The drive between blanket cylinder pinion 18 and impression cylinder 19 is effected by means of a pair of transmission pinions 20 and 21. The transmission pinion 20 has thickness approximately equal to that of the pinions 17, 18 and 19 and is freely rotatably mounted at the free end of the arm 22 which itself is freely pivotable about the axis 3a of blanket cylinder drive pinion 18. Likewise, the transmission pinion 21, having the same diameter as pinion 20, is freely rotatably mounted at the free end of arm 24 which is itself freely pivotably mounted about the axis 1a of impression cylinder drive pinion 19.

The length of the arms 22 and 24 are so chosen that the blanket cylinder drive pinion 18 is in constant mesh with the associated transmission pinion 20, and the impression cylinder drive pinion 19 is in constant mesh with the associated transmission pinion 21. As can be seen clearly in FIG. 4, the transmission pinion 21 has a thickness considerably in excess of that of transmission pinion 20, in order that it may be in mesh simultaneously with the transmission pinion 20 and the impression cylinder drive pinion 19 which is in a different but parallel plane to that of drive pinions 17 and 18 and transmission pinion 20.

In order to maintain the transmission pinions 20 and 21 in constant mesh a third freely pivotable arm 23 is mounted at one end of the free end of arm 24 associated with the impression cylinder drive pinion 19, and also, at a point spaced from such end, is mounted to the free end of arm 22 associated with the blanket cylinder drive pinion 18. The space between the two points of pivotable connection of the arm 23 to axis 26 of transmission pinion 20 and axis 27 of transmission pinion 21 is such that transmission pinions 20 and 21 are in constant mesh.

This configuration is illustrated more schematically in FIG. 5, in which the various pinions 17, 18, 19, 20 and 21 are depicted as friction wheels, in that no gear teeth are shown in this view. FIG. 5 therefore represents a diagrammatic side elevational view of the assembly of drive and transmission pinions. The transmission pinions 20 and 21 are depicted in two different configurations, by the broken line form 20' and 21' and by the dot dash line form as 20'' and 21''. Likewise the arms 22 and 24 are depicted in each of two positions 22', 22'' and 24', 24''.

In order more fully to exemplify the invention, the operation of changing the relative angular orientation between blanket cylinder 3 and impression cylinder 1 will now be described with reference to FIG. 5. The views of FIGS. 4 and 5 are substantially mirror images of the side elevational views of FIGS. 1 to 3, and thus the directions of rotation of the various cylin-

ders are such that plate and impression cylinder driving pinions 17 and 19 are rotating in an anticlockwise sense, whilst the blanket cylinder 18 rotates in the clockwise sense.

For the purpose of moving the printed image downwardly of a sheet of copy it is assumed that the leading edge of a sheet passing through the nip of impression and blanket cylinders 1 and 3 is in fact the top edge of the sheet when printed. In order to move the print down the sheet it is necessary that the sheet enter the nip earlier, i.e. that the impression cylinder 1 and its drive pinion 19 to rotated anticlockwise (as viewed in FIG. 5) with respect to the blanket cylinder 3 and its drive pinion 18.

For the purpose of the following explanation, it will be assumed that the positions of the transmission pinions 20 and 21 and associated arms 22 and 24 are changed while the blanket cylinder drive pinion 18 is held stationary.

In order to effect such clockwise movement of the impression cylinder drive pinion 19 with respect to the blanket cylinder pinion 18, it is necessary to move the arm 22 from its 22' (broken line) position to its 22'' (dot dash line) position. This will result in movement of the transmission pinion 20 from its 20' position to its 20'' position and will cause simultaneous anticlockwise rotation of such pinion 20. Although not illustrated in FIG. 5, the link 23 between transmission pinions 20 and 21 will cause transmission pinion 21 to follow with movement from its 21' (broken line) position to its 21'' (dot dash line) position and will result in clockwise rotation of the transmission pinion 21 in executing such movement. However, movement of the pinion 21 from 21' to 21'' will, without rotation, cause anticlockwise rotation of impression cylinder drive pinion 19. The additional clockwise rotation of pinion 21 caused by the anticlockwise rotation of pinion 20 in passing about the blanket cylinder drive pinion 18 will result in further anticlockwise rotation of the impression cylinder drive pinion 19. Since there is no other driving connection between the blanket cylinder pinion 18 and the impression cylinder pinion 19 (these pinions lying in separate planes and therefore not being in constant mesh with one another) the effective angular position of pinion 19 has been rotated with respect to that of pinion 18. As a result the sheet onto which the print is to be transferred enters the nip between impression cylinder 1 blanket cylinder 3 earlier than the appropriate part of the print to be transferred, and therefore the print will apparently move longitudinally downwardly of the sheet.

Although, for the purposes of clarity, the above description assumes that the blanket cylinder drive pinion 18 is stationary during movement of the arms 22 and 24, clearly there is no reason why the movement of the arms 22 and 24 should not take place during rotation of all three driving pinions 17, 18 and 19.

Any suitable means may be employed for moving the arms 22 and 24, and it can be seen that, by virtue of the link arm 23 between axes 26 and 27 of the transmission pinions 20 and 21, it is only necessary to exert a moment causing angular movement of one of the arms 22 and 24, the geometry of the arrangement being such that the other arm will respond automatically.

Rotation of the arm 22 or 24 may be effected by means of an electric motor, a rotary solenoid or any other known rotation inducing device. Alternatively a manual adjustment may be provided, by means of which the appropriate arm 22 or 24 may be rotated about its respective axis 3a or 1a.

In order to provide a means for adjustment of the contact pressure between the various rollers, compression springs or tension springs may be mounted between the side arms 4 and 7 and/or between the side arms 4 and the upstanding legs 2. Compression springs will reduce the contact pressure, whereas tension springs would increase the pressure. At the same time the small clearances between the side arms 4 and the supporting legs 2 or side arms 7 will prevent undesirable fluctuation in contact pressure.

It will be appreciated that, by adjusting the relative angular orientation of the impression cylinder with respect to the blanket cylinder, rather than the orientation of the plate cylinder

with respect to the blanket cylinder, the device illustrated provides a means of adjusting the print position without having to clean the blanket before resuming printing.

I claim:

1. An offset printing press comprising:
 - a an impression cylinder rotatable about a fixed axis;
 - b support means carrying said impression cylinder;
 - c a blanket cylinder rotatable about an axis which is disposed higher than said impression cylinder axis;
 - d gravity biased swinging blanket cylinder bearer means carrying said blanket cylinder and swingable for relative lateral movement of said blanket and impression cylinder axes, said gravity biasing being arranged to hold the blanket and impression cylinder in contact;
 - e a plate cylinder rotatable about an axis which is disposed higher than said blanket cylinder axis;
 - f gravity biased swinging plate cylinder bearer means carrying said plate cylinder and swingable for relative lateral movement of said plate cylinder and impression cylinder axes, said gravity biasing being arranged to hold the plate and blanket cylinder in contact;
 - g adjustable stop means carried by either of said impression cylinder support means and said blanket cylinder bearer means and defining a minimum lateral spacing between said impression cylinder axis and said blanket cylinder axis during swinging of said blanket cylinder bearer means; and
 - h further adjustable stop means carried by either of said plate cylinder bearer means and said blanket cylinder bearer means and defining a minimum lateral spacing between said blanket cylinder axis and said plate cylinder axis during said independent swinging of said blanket cylinder bearer means and said plate cylinder bearer means.
2. The printing press set forth in claim 1, and wherein said blanket cylinder bearer means and said plate cylinder bearer means are independently swingable whereby said blanket and plate cylinder axes are independently movable laterally with respect to said fixed impression cylinder axis.
3. The printing press set forth in claim 2, and further including: (a) a lifting lever pivotable between an out-of-the-way position and a first operative position; and (b) cam surface means on said lifting lever and engageable with said blanket cylinder bearer means upon movement of said lifting lever from its out-of-the-way position to its first operative position whereby said blanket cylinder bearer means is urged for swinging motion effective to move apart the blanket and impression cylinder axes.
4. The printing press set forth in claim 3, and including further cam surface means on said lifting lever, and wherein said lifting lever is also pivotable to a second operative position; said further cam surface means being positioned for engagement with said plate cylinder bearer means upon movement of said lifting lever from said first operative position to said second operative position whereby said plate cylinder bearer means is urged for swinging motion effective to move apart said blanket and plate cylinder axes.
5. The printing press set forth in claim 4, and wherein the first operative position of the lifting lever lies between the second operative position and the out-of-the-way position; and wherein the first mentioned cam surface means is constructed to remain in lifting contact with the blanket cylinder bearer means upon movement of said lifting lever from its first operative position to its second operative position.
6. The printing press set forth in claim 1, and including means for effecting relative angular adjustment between two of the cylinders, such adjustment means comprising:
 - a a first gear attached to a first one of said two cylinders;
 - b a second gear attached to the second one of said two cylinders and being positioned to be free from contact with said first gear;
 - c a first planetary pinion in mesh with said first gear;

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- d first planetary pinion supporting means constraining said first planetary pinion for movement about and meshing engagement with said first gear;
 - e a second planetary pinion in mesh with said second gear and with said first planetary pinion; and
 - f second planetary pinion supporting means constraining said second planetary pinion for movement about and meshing engagement with said second gear.
7. The printing press set forth in claim 6, and including

- means for constraining said first and second pinions for mutual intermeshing engagement.
8. The printing press set forth in claim 7, and including means for adjusting the position of one of said first and second pinions with respect to the associated gear.
9. The printing press set forth in claim 6, wherein the two angularly adjustable cylinders are the blanket cylinder and the impression cylinder.

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