Jan. 3, 1939. A. DULTGEN ET AL 2,142,501

METHOD AND MEANS FOR MAINTAINING REGISTER IN MULTIUNIT PRESSES

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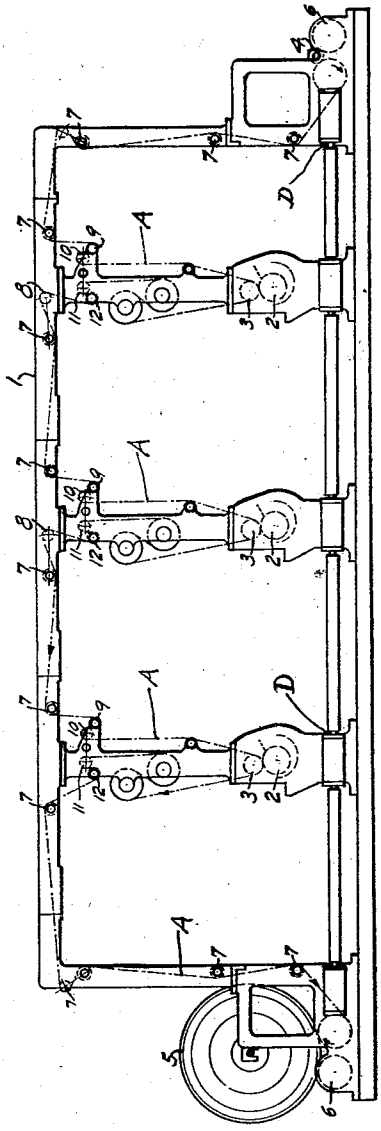


FIG. 1

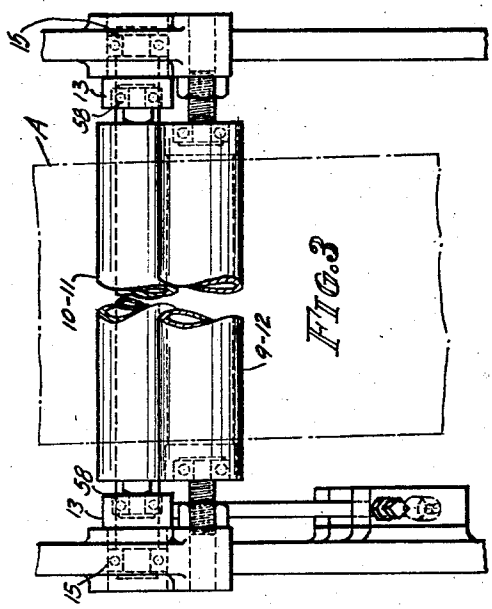


FIG. 3

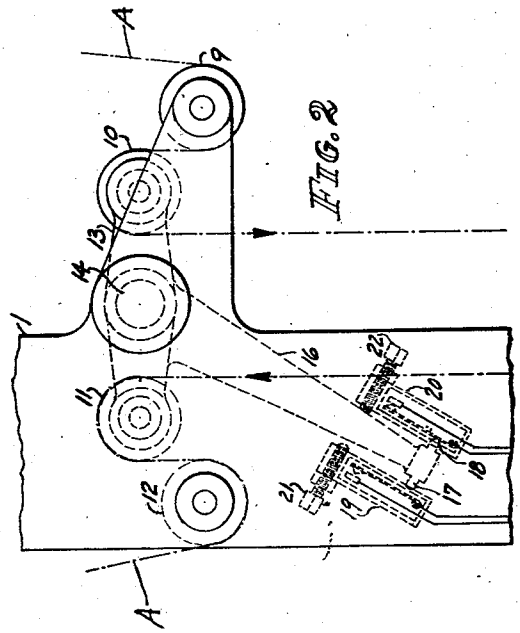


FIG. 2

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FIG. 5

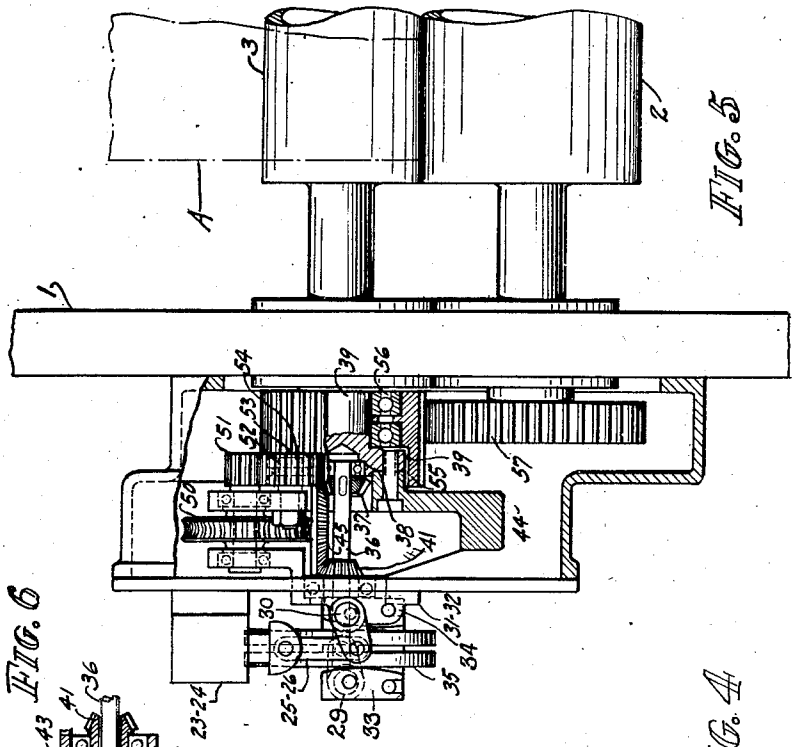


FIG. 6

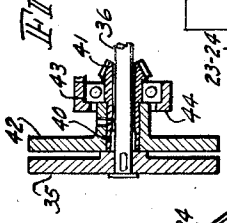
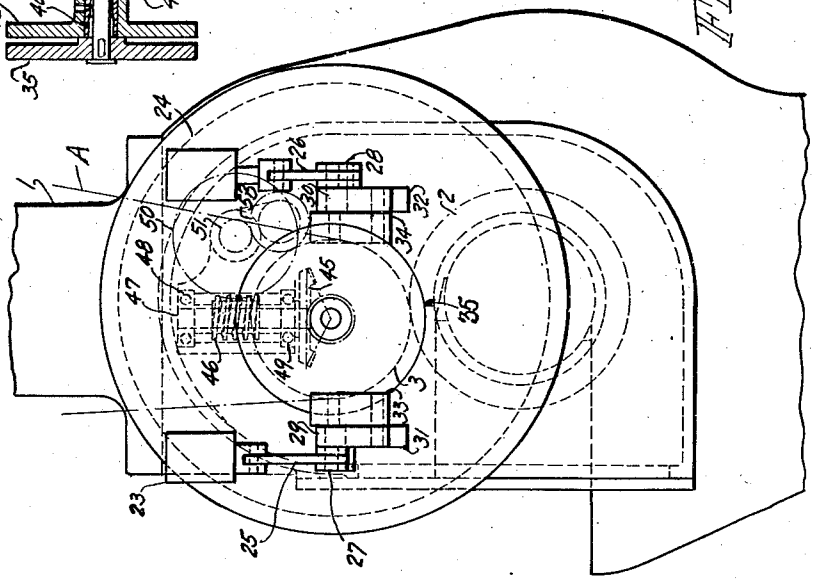


FIG. 4



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# UNITED STATES PATENT OFFICE

2,142,501

## METHOD AND MEANS FOR MAINTAINING REGISTER IN MULTIUNIT PRESSES

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10 Claims. (Cl. 101—171)

This invention relates to method and means for maintaining register in multi-unit presses.

In the operation of multi-color web printing presses, serious difficulty has been experienced in maintaining the register of the prints applied by the different printing cylinders, and manual adjustment of the position of the web in the different printing units has been necessary during any long continued operation of such a press in order to obtain passably good register. The maintaining of register is more difficult in intaglio or gravure printing presses than in others and is so great as seriously to retard the use of such presses for multi-color work.

We have determined the cause of the failure of multi-color web presses to maintain register of the prints during long-continued operation, and have provided by our invention automatic means for maintaining register. We have thus obviated the loss and poor quality work heretofore resulting from the failure of such presses to maintain register of prints and the inconvenience and difficulties involved in manual readjustments to restore it.

We have found that the failure of multi-color web presses to maintain register is due to slight variations in the diameters of the printing cylinders and the fact that the rate of travel of the web over each printing cylinder is determined by the peripheral speed of that printing cylinder. Although such variations in diameter and in rate of travel are frequently so small as to be unobservable, their effect is cumulative. Thus, if, in a printing press designed to move the web at 800 feet a minute and having printing cylinders 10 inches in diameter, the first printing cylinder is oversize by one ten-thousandth of an inch in diameter (that is, .001 per cent. oversize), the rate of travel of the web over this cylinder will be 800.008 feet per minute (that is, .001 per cent. in excess of the intended rate), which is not susceptibly different from a speed of 800 feet per minute. But, if the second cylinder is exactly 10 inches in diameter, the difference in the speed of the web over the first and second cylinders will result, after ten minutes' operation, in increasing the length of the reach of the web between the first two printing cylinders by .08 foot or about nine-tenths of an inch, which will cause a serious error in register, which will continue to increase and become more serious during the continued operation of the press. In intaglio presses, the variation in diameter between cylinders is sometimes as much as one one-thousandth of an inch, so that the cumulative effect of the difference in the peripheral speeds of the printing cylinders causes serious errors of register in a comparatively short time.

This difficulty cannot be overcome merely by driving printing cylinders varying in diameter at the same peripheral speed, for, while this might result in making the rates of travel of the web over each cylinder equal, the non-uniform rotational speed of the printing cylinders would cause a relative circumferential displacement of their printing surfaces, which would make the prints out of register on the web notwithstanding uniformity in the rate of travel of the web over each cylinder.

By our invention, we have overcome difficulties heretofore encountered in maintaining register.

A practical apparatus embodying our invention includes web-moving members independent of the printing cylinders (that is, not continuously directly connected therewith) for moving the web across the printing cylinders of each unit of a multi-unit press and regulating means for maintaining the average peripheral speeds of the web-moving members of the different units equal to a high degree of accuracy. According to one feature of our invention which we regard as important, the regulating means take the form of a governing mechanism actuated by variations in the tensions of the reaches of the web between units to vary the relative peripheral speeds of the web-moving members so as to restore the tension on each reach of the web to its original value.

In applying our invention to intaglio multicolor presses, where the need for it is greatest, we utilize the impression roller of each unit as the web-moving member and provide governing means actuated by the tension of the reaches of the web to control the speeds of the impression rollers.

In the accompanying drawings we have shown the application of our invention to a standard rotogravure, multi-unit press. In the drawings:

Fig. 1 is a side elevation of an intaglio press provided with apparatus embodying our invention;

Fig. 2 is a fragmentary side elevation and Fig. 3 a fragmentary end elevation showing the control rolls and arms;

Fig. 4 is a side elevation and Fig. 5 an end elevation of the drive mechanism of an impression roller; and

Fig. 6 is a sectional detail of the brake discs incorporated in this mechanism.

The printing press shown in Fig. 1 has a main

frame 1 on which are mounted printing cylinders 2, impression rollers 3, an unwinding or supply roll 4, a rewinding roll 5, feed rolls 6 for the unwinding and rewinding rolls, and guide roll 7 for guiding a web A from the unwinding roll 4 successively between the printing cylinder and impression roller of each of the printing units of the press and then to the rewinding roll 5. The printing cylinders of all the units are driven at the same rotational speed by the usual mechanical gearing from a common drive shaft D.

The reaches of the web between the printing units and also the reach of the web between the unwinding roll 4 in the first printing unit and that between the last printing unit and rewinding roll 5 pass over control rolls 9, 10, 11, 12. The rolls 9 and 12 of each unit are fixed on the frame of the machine while each pair of rolls 10 and 11 are mounted on opposite ends of a lever 13 fulcrumed on the frame at 14. Each lever 13 has an extension or arm 16 provided with projections 17, 18, positioned so that the projection 17 closes a contact switch 19 when the lever 13 is tipped in one direction and the projection 18 closes a contact switch 20 when the lever 13 is tipped in the other direction. Set screws 21, 22 limit the motion of the extension 16 to that which is necessary to permit it to operate one or the other of the contact switches. Solenoids 23 and 24 (Fig. 4) mounted on the casing of the impression roller drive mechanism are connected in an electric circuit containing the contact switches 19 and 20 so that the closing of the switch 19 energizes the solenoid 23 and the closing of the switch 20 energizes the solenoid 24.

The driving mechanism for the impression rollers 3, which are the web-moving members of the units, connects each impression roller 3 with the shaft of the printing cylinder 2 of its unit in such manner that the peripheral speed of the impression roller is slightly greater than the peripheral speed of the printing cylinder when the solenoid 23 is energized, and is slightly less than the peripheral speed of the printing cylinder when the solenoid 24 is energized. When neither solenoid is energized, the speed of the impression roller 3 is determined by that of the corresponding printing cylinder 2. During this neutral period, it is immaterial whether the impression roller 3 be driven by surface friction from the printing cylinder so that its peripheral speed is the same as that of the printing cylinder, or whether the impression roller be driven from the shaft of the printing cylinder so that its rotational speed is proportional to that of the printing cylinder. In the particular drive mechanism shown in Figs. 4 and 5, the shaft of the impression roller 3 is geared to the shaft of the printing cylinder 2 when neither solenoid is energized. A gear 57 is fixed on the shaft of the printing cylinder 2 and meshes with a gear 55 floating on the shaft of the impression roller 3. An arm 44 fixed to the shaft of the impression roller 3 carries a bevel gear 41 in which is a roller-bearing 40. A brake disc 35 is held by means of a stud 36 attached to a bevel gear 37 which rests in a ball-bearing 38 in a shaft 39 and in the roller-bearing 40 of the bevel gear 41. The bevel gears 37 and 41 mesh with the bevel gear 45 which is fastened to a worm 46 by means of a shaft 47 rotatively mounted on the arm 44. The worm 46 meshes with a worm-wheel 50 connected with a stud gear 51 journalled on the arm 44. The gear 51 meshes through an intermediate gear 53 on ball-bearings 52 and stud 54 held on the arm 44 with the gear 55. Brake shoes 33, 34 positioned to contact with the brake discs 35 and 42, respectively, are mounted on eccentric studs 29, 30 held in brackets 31 mounted on a gear casing 32 fixed to the frame of the press. The studs 29, 30 on which the brake shoes are mounted are connected to the solenoids 23 and 24 by links 25 and 26 and levers 27 and 28.

The operation of the device is described as follows:

The web is initially led through the machine as shown in Fig. 1 in such manner that the tension of the different reaches of the web is equal, so that each of the levers 13 and arms 16 is in its central or neutral position and all the switches 19 and 20 are open. Each impression roller 3 is then driven at the same rotational speed as the printing cylinder, so that the rates of speed of the web through the different units are proportional to the peripheral speeds of the impression rollers which exercise a greater friction on the web than the printing cylinders. Since it is no more possible to make the impression rollers of absolutely uniform diameter than it is to make the printing cylinders of absolutely uniform diameter, the peripheral speeds of the impression rollers will vary slightly when all the impression rollers are thus driven at the same rotational speed. For the sake of illustration, it will be assumed that the impression roller of the middle unit is slightly larger in diameter than the other impression rollers, so that, when the levers are all in neutral position, the web travels through this unit a little more rapidly than through the other units. This will result in increasing the tension on the reach of the web between the first and second units and decreasing the tension on the reach of the web between the second and third units. As soon as this difference in tension has become appreciable and before any appreciable lack of register has resulted, the control roll 10 of the middle unit will be pulled down and the control roll 11 allowed to move up swinging the arm 16 of this unit so as to close the switch 19. This will energize the solenoid 23 and this solenoid will move the brake shoe 33 into contact with the brake disc 35. This holds the bevel gear 37 against rotation causing the gear 45 to rotate, rotating the worm 46, the worm-wheel 50 and the gears 51 and 53 so as to make the arm 44 turn in relation to the gear 53, making the impression roller 3 run slower. The decrease in speed of the impression roller results in a decrease in the rate of travel of the web through the middle unit which continues until the tensions on the reaches of the web on opposite sides of the middle unit again become equal restoring the lever 13 and arm 16 to the neutral position so as to open the switch 19, de-energize the solenoid 23, and permit the brake disc 35 to turn freely so that the impression roller 3 is again driven at its original speed.

If the diameter of the impression roller of the second unit happens to be less than that of the impression rollers of the other units, a similar but opposite adjustment will be caused by a tipping of the lever 13 in the direction opposite from that in the illustration just described, so that it energizes the solenoid 24 through the switch 20 and increases the speed of rotation of the impression roller.

Where, as is usually the case, there are slight

differences in diameter between all the impression rollers, automatic adjustments such as have been described will occur in all the units whenever there are appreciable variations in the tensions of the reaches of the web and in this way register will be repeatedly restored and the average rates of travel of the web through each of the units will be maintained exactly the same no matter how long the press may operate.

The same result will be achieved in case the impression rollers are frictionally driven from the printing cylinders when neither solenoid is energized, as in this case differences in the speed of the web through the different units caused by differences in the diameters of the printing cylinders will be compensated for by the automatic adjustment. It will be understood, therefore, that the invention is not limited to the particular mechanism which has been described in the way of illustration, nor is it limited to use of impression rollers as a means for controlling the speed of the web. While the greatest utility of the invention, so far as we are now aware, is in its applicability to existing intaglio multi-unit presses, it may advantageously be applied also to multi-unit presses of other types.

What is claimed is:

1. In a multi-unit, rotary, web printing press, a device for keeping the printing of two units in register, comprising a web-moving means associated with each unit and in continuous driving contact with the web, and means actuated by changes in the tension of the reach of the web between the two units to cause a change in the ratio of the peripheral speeds of the web-moving means of the two units to effect a small positive change in the ratio of the speeds of travel of the web through the two units to restore the tension to a predetermined value.

2. In a multi-unit, rotary, web printing press, a device for keeping the printing of two units in register, comprising a web-moving means associated with each unit and in continuous driving contact with the web, and means actuated by a change in the tension of the reach of the web between the two units caused by a difference in the peripheral speeds of the web-moving means of the two units to reverse the difference in the peripheral speeds of the web-moving means of the two units until the tension is restored to its original value.

3. A method of maintaining register in a multi-unit, rotary, web printing press in which a web-moving means in continuous driving contact with the web is associated with each unit, which comprises utilizing the tension of the reaches of the web between the units to control the relative peripheral speeds of the web-moving means of the units so as to make the average peripheral speeds of the web-moving means of all the units equal.

4. A method of maintaining register in a multi-unit, rotary, web printing press in which a web-moving means in continuous driving contact with the web is associated with each unit, which comprises utilizing inequalities in the tensions of the reaches of the web at the intake and discharge sides of a unit to vary the peripheral speed of the web-moving means of the unit to restore said tensions to equality.

5. In a multi-unit, rotary, web printing press, a device for maintaining register, comprising a web-moving means associated with each unit and in continuous driving contact with the web, and means automatically actuated by a difference in tension of the web at opposite sides of a unit to change the peripheral speed of the web-moving means of the unit until equality of tension is restored.

6. A device for maintaining register in a multi-unit, rotary, web printing press in which the printing cylinders of all the units are driven at the same angular velocity, comprising a web-moving member associated with each unit and in continuous driving contact with the web, means for rotating said web-moving members at approximately equal peripheral speeds, and governing means actuated by a difference in the tension of the reaches of the web at opposite sides of any unit to change the peripheral speed of the web-moving member of that unit without varying the speed of the printing cylinder of the unit to restore equality of tension of said reaches.

7. A device for maintaining register in a multi-unit, rotary intaglio, web printing press in which the printing cylinders of all the units are driven at the same angular velocity, comprising governing means actuated by changes in the tension of the web between any two of the printing units to vary the speed of the impression roller of said unit without varying the speed of the printing cylinder of the unit to restore said tension to its original value.

8. A device for maintaining register in a multi-unit, rotary intaglio, web printing press in which the printing cylinders of all the units are driven at the same angular velocity, comprising governing means actuated by an increase of the tension of the reach of the web leading into any unit to decrease the speed of rotation of the impression roller of that unit without varying the speed of the printing cylinder of the unit until the tension of said reach is restored to its original value and actuated by a decrease in the tension of said reach to increase the rate of rotation of said impression roller without varying the speed of the printing cylinder until the tension of said reach is restored to its original value.

9. A device for maintaining register in a multi-unit, rotary, web printing press whose printing cylinders are driven at the same angular speed but have slightly different peripheral speeds, which comprises web-moving means in continuous, uniform, non-slipping, driving engagement with the web, and means for moving said web-moving means across the printing cylinder of each unit at the same average speed.

10. A device for maintaining register in a multi-unit, rotary, web printing press whose printing cylinders are driven at the same angular speed but have slightly different peripheral speeds, comprising a rotary web-moving member associated with each unit and in continuous, uniform, non-slipping, driving engagement with the web, and means for rotating said web-moving members at the same average peripheral speed.

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