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⑤④ **Individual driving system for printing units.**

⑤⑦ In an improved driving system for printing units of a printing machine, the respective printing units are driven by a common drive source via a line shaft and/or by individual drive sources and position control devices provided in the respective printing units. The line shaft is preferably coupled with the respective drive sources via differential reduction gears. The construction of the driving system is such that mount positions of plates equipped on the plate drums in the respective printing units can be moved to the positions where exchange of plates can be executed simultaneously in the respective printing units, and after finishment of exchange of plate, can be returned to the mechanically registered relative phases of the plate drums before execution of the exchange of plates.

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INDIVIDUAL DRIVING SYSTEM FOR PRINTING UNITS

BACKGROUND OF THE INVENTION:

Field of the Invention:

The present invention relates to an individual driving system that is applicable to printing units in a printing machine.

Description of the Prior Art:

At first, the known technique in the prior art will be described, by way of example, in connection to a both-side four-color blanket-to-blanket type offset rotary press. As shown in Fig. 5, four both-side monochrome printing units 1 (1a, 1b, 1c and 1d) are installed as aligned in one row, and they are driven by a line shaft 4. Since the mount positions of plates 3 (3a, 3b, 3c and 3d) mounted on the plate drums 2 in the printing unit 1 are different depending upon diameters D of the plate drums 2 (2a, 2b, 2c and 2d) and an interval L between the printing units (between units 1a and 1b), even if the mount position of the plate 3a is located at a position convenient for exchange of a plate in a certain printing unit, for instance, in a first color printing unit 1a, the mount positions of the plates in the other printing units are not always located at position convenient for exchange of a plate. Accordingly, in the prior art in each printing unit, after the mount position of a plate has been brought to a position convenient for exchange of a plate, exchange of a plate would be effected. In the above-described example of the printing machine in the prior art, if it is assumed that in the printing unit 1a of the first color the mount position of the plate 3a is located at a position convenient for exchange of the plate, at first the plate 3a on the first color plate drum 2a is exchanged, then the line shaft 4 is rotated so that the mount position of the plate 3b on the second color plate drum 2b may come to a position convenient for exchange of the plate, and then this plate 3b is exchanged. Subsequently, the above-described works are repeated in sequence, and exchanges of the plates are executed. Accordingly, after the plates 3 on the plate drums 2 in the respective units have been entirely exchanged, the relative phases of the respective plate drums 2 would be mechanically registered with one another. However, since the color register of a practically printed pattern would involve a little error due to precision in mounting of a plate onto a plate drum, deviation of a pattern printed on a plate relative to a plate mount reference position, and the like, color

registering is effected by providing a small-sized motor and thereby this error is corrected (hereinafter called "color register"). To that end, in place of a motor 13 in Fig. 1, a small-sized motor 31 is provided. Since this small-sized motor 31 and relevant parts thereof are identical to those shown in Fig. 4, they will be explained in connection to the preferred embodiment as will be described later.

According to the technique in the prior art as described above, as the mount positions of the plates are different in the respective printing units, it is necessary that the plates is exchanged after the mount position of the plate has been brought to a position convenient for exchange of a plate (a predetermined position) for each printing unit, and accordingly, it involved the problem that a lot of time and labor are necessitated.

SUMMARY OF THE INVENTION:

It is therefore one object of the present invention to provide an improved driving system for printing units of a printing machine, which makes it possible, to execute exchange of plates simultaneously in the respective printing units, and moreover, after finishment of exchange of plates, to return the respective plates on the plate drums to the mechanically registered relative phases before execution of the exchange of plates.

According to one feature of the present invention, there is provided an individual driving system for printing units of a printing machine, comprising drive sources and position control devices for individually operating printing units respectively provided with plate drums, and constructed in such manner that mount positions of plates equipped on the plate drums in the respective printing units can be moved to the positions where exchange of plates can be executed simultaneously in the respective printing units, and after finishment of exchange of plates, can be returned to the mechanically registered relative phases of the plate drums before execution of the exchange of plates.

More particularly, in order to achieve the aforementioned object, according to the present invention the following provisions are made:

(1) In each printing unit, an individual drive motor associated with a brake and having high/low two-stage variable and reversible speeds (hereinafter called simply "motor") is provided in place of the color registering small-sized motor in the prior art.

(2) A position detecting encoder (of rotary type) is provided at a blanket drum (or a plate

drum).

(3) An electromagnetic clutch (associated with a brake) is provided in a color register indicating potentiometer.

It is to be noted that in a printing drum drive system in each printing unit that is driven by a line shaft, differential reduction gears (hereinafter called simply "differential gears"), for instance, a harmonic drive (Fig. 4) consisting of a web generator F corresponding to a sun gear, circular splines D and S corresponding to sun orbits, and a flex spline P corresponding to a planetary gear, is used.

According to the present invention having the aforementioned characteristic features, as the motor is rotated at a high speed in order to calculate the positions where simultaneous exchange of plates is possible, the plates in the respective printing units quickly occupy the positions convenient for exchange of plates (preset positions). Also, after completion of the simultaneous exchange of plates, since the work of returning the plate drums to the original mechanically registered relative phases of the plate drums is carried out by rotating the motor at a high speed, the plate drums can be quickly returned to the positions where mechanical register is precisely established. In addition, as the motor is associated with a brake, during normal operations (during printing) when the printing units are driven from the line shaft via the differential gears (similarly to the prior art) through the differential gears, since the web generator of the differential gears is firmly fixed by the brake of the above-mentioned motor, deviation of the mechanical phase of the plate drum would not arise. Furthermore, during normal operation, during unit drive for the purpose of simultaneous exchange of plates (a mode inherent to the present invention), and during drive upon adjustment of color register (similar to the prior art) (hereinafter called drives of first mode, second mode and third mode), respectively, it becomes possible to drive the differential gears by the line shaft and firmly fix the web generator, to fix the line shaft and drive the web generator by the motor, and to drive the differential gears by the line shaft while driving the web generator by the motor.

Moreover, according to the present invention, upon taking the positions for simultaneous exchange of plates, the amount of rotation of the plate drums from the original positions (the mechanically registered positions) up to these simultaneous plate exchange positions, as well as the amount of return rotation of the plate drums after exchange of plates that corresponds to the above-mentioned amount of rotation, are counted.

The above-mentioned and other objects, features and advantages of the present invention will

become more apparent by reference to the following description of one preferred embodiment of the invention taken in conjunction with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS:

In the accompanying drawings:

Figs. 1, 2 and 3 are schematic views showing drive routes of operation modes 1, 2 and 3 in one preferred embodiment of an individual driving system for printing units according to the present invention;

Fig. 4 is a detailed cross-section view showing a structure of differential speed reduction gears in the individual driving system shown in Figs. 1 to 3; and

Fig. 5 is a schematic front view showing an arrangement of printing units in a conventional four-color offset rotary press and a line shaft for driving the respective printing units.

DESCRIPTION OF THE PREFERRED EMBODIMENT:

Now one preferred embodiment of the present invention will be described with reference to Figs. 1 to 4. In these figures, reference numeral 2 designates a plate drum, numeral 3 designates a plate, numeral 4 designates a line shaft, numerals 5 and 6 respectively designate gears, numeral 7 designates differential reduction gears, numerals 8 and 9 respectively designate bevel gears, numerals 10, 11 and 12 designate gears, numeral 13 designates a high/low two-stage variable-speed reversible motor associated with a brake, numerals 14, 15, 18 and 19 designate gears, numeral 16 designates a fixed shaft (of the differential gears) connected to the motor 13 via the gears 14 and 15, numeral 17 designates an output shaft (of the differential gears), numeral 20 designates an electromagnetic clutch associated with a brake, numeral 21 designates a color registering potentiometer, numeral 22 designates a position detecting encoder, numeral 23 designates a blanket drum, reference character F designates a web generator of the differential gears 7, characters D and S designate circular splines, and character P designates a flex spline.

In a drive system, as shown in Fig. 1, the line shaft 4 rotationally drive the gear 12 of the plate drum 2 through the gears 5 and 6, the differential gears 7, the bevel gears 8 and 9 and the gear 10, and via the gear 11 of the blanket drum 23. In addition, the gear 14, the gear 15 meshed with this gear 14, and the web generator F of the differential

gears 7 which are mounted at the axial end of the input shaft 16 having the gear 15 fixedly secured thereto, are rotated by the high/low two-stage variable-speed reversible motor 13 associated with a brake. Furthermore, the color registering potentiometer 21 is rotated by the motor 13 through the gears 18 and 19 and the electromagnetic clutch 20 associated with a clutch.

Upon driving of mode 1 shown in Fig. 1, the brake acts upon the motor 13(31) and firmly fixes the motor. Accordingly, the web generator F of the differential gears holds a fixed state, hence rotation of the line shaft 4 is transmitted to the gears 5 and 6, and reduced in speed by the differential gears 7, and rotates the gear 12 via the bevel gears 8 and 9 and the gears 10 and 11. In addition, an angular position of the plate drum in one revolution with respect to a given mechanical origin is detected by the encoder 22 provided on the plate drum or the blanket drum. While the electromagnetic clutch 20 takes the ON state, since the motor 13(31) is fixed, the potentiometer 21 would not operate (The above-mentioned is similar to the heretofore known driving system.).

Upon driving of mode 2 shown in Fig. 2, a brake (not shown) acts upon the line shaft 4, hence the line shaft 4 is fixed, the motor 13 rotates at a high speed, the electromagnetic clutch 20 takes the OFF state, and so, the color registering potentiometer 21 would not move. In addition, the position detecting encoder 22 is fed with electric power, hence it counts the amount of rotation of the plate drum 2, and it transmits a signal representing the counted amount to a control device (not shown). The high-speed rotation of the motor 13 is transmitted through the gears 14 and 15, the web generator F of the differential gears 7, the circular spline D supported via a bearing, the flex spline P, the circular spline S and the output shaft 17 to which the circular spline S is fixedly secured, and via the bevel gears 8 and 9 to the gear 12.

Accordingly, the mount positions of the plates 3 mounted on the plate drums 2 of the respective printing units would come to predetermined positions convenient for exchange of plates. Subsequently, after the simultaneous exchange of the plates, the plate drums 2 are returned to their mechanically registered relative positions before the exchange of the plates. At this time also, the motor 13 rotates at a high speed, and when the plate drum 2 has been rotated by the amount corresponding to the amount counted by the above-described position detecting encoder 22 through the same drive route as that upon the above-described simultaneous exchange of plates and thus returned to the original position, the rotation of the motor 13 is stopped. It is to be noted that control of the motor 13 so as to rotate normally

when the counted amount exceeds 180 degrees but to rotate reversely when it is equal to or less than 180 degrees, is effected in the above-mentioned control device.

It should be remarked that this mode 2 driving is an inherent drive mode of the present invention which was not found in the prior art.

Upon driving of mode 3 shown in Fig. 3, the rotation of the line shaft 4 is transmitted to the gears 5 and 6, and is reduced in speed by the differential gears 7, and the gear 12 is rotated via the bevel gears 8 and 9 and the gears 10 and 11. At the same time, the motor 13 rotates at a low speed, and rotates the web generator F via the gears 14 and 15. Accordingly, adjustment of register can be effected slowly. Furthermore, the color registering potentiometer 21 is rotated by the motor 13 through the gears 18 and 19 and the electromagnetic clutch 20 associated with a brake, and the amount of rotation is displayed on an indicator of the control device (in turns of a color register amount). In addition, when the electromagnetic clutch 20 associated with a brake has become an ON (engaged) state, the potentiometer 21 is braked by the brake of the clutch 20 so that it may not rotate too easily due to the rotation of the motor 13.

It is to be noted that upon the above-described exchange of plates, in a printing machine as shown in Fig. 5, after all of the upper plates 3 (3a, 3b, 3c and 3d) have been subjected to simultaneous exchange of plates, simultaneous exchange of plates for the lower plates 3' (3'a, 3'b, 3'c and 3'd) is executed. (Because in view of the arrangement of the printing drums, both the upper and lower plates cannot be simultaneously exchanged, due to the difference in the mount position between the upper plates 3 and the lower plates 3'.)

As will be appreciated from the detailed description of the invention above, according to the present invention, owing to the facts that there are provided drive sources and position control devices for individually operating printing units respectively provided with plate drums, and they are constructed in such manner that mount positions of plates equipped on the plate drums in the respective printing units can be moved to the positions where exchange of plates can be executed simultaneously in the respective printing units, and after finishment of exchange of plates, can be returned to the mechanically registered relative phases of the plate drums before execution of the exchange of plates, the following advantages are obtained:

(1) Since simultaneous exchange of plates becomes possible and after simultaneous exchange of plates adjustment of the mechanical register can be effected precisely, working time and labor are reduced.

(2) The simultaneous exchange of plates and

the mechanical register are executed through quick operations, while the color register can be effected automatically through slow operations.

While a principle of the present invention has been described above in connection to one preferred embodiment of the invention, it is intended that all matter contained in the specification and illustrated in the accompanying drawings shall be interpreted to be illustrative and not in a limiting sense.

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Claims

1. An individual driving system for printing units of a printing machine, comprising drive sources and position control devices for individually operating printing units respectively provided with plate drums, and constructed in such manner that mount positions of plates equipped on the plate drums in the respective printing units can be moved to the positions where exchange of plates can be executed simultaneously in the respective printing units, and after finishment of exchange of plates, can be returned to the mechanically registered relative phases of the plate drums before execution of said exchange of plates.

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2. An individual driving system for printing units as claimed in Claim 1, further comprising differential reduction gears for connecting a line shaft with the respective printing units, said respective drive sources for individually operating said printing units being connected to said differential reduction gears.

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3. An individual driving system for printing units as claimed in Claim 2, wherein said drive source for individually operating printing units are individual drive motors associated with brakes which have high/low two-stage variable and reversible speeds.

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4. An individual driving system for printing units as claimed in Claim 1, wherein position detecting encoders are provided at the plate drums or blanket drums.

5. An individual driving system for printing units as claimed in Claim 2, wherein a color registering potentiometer is connected via an electromagnetic clutch to an output shaft of each one of said drive sources for individually operating the respective printing units.

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Fig. 1

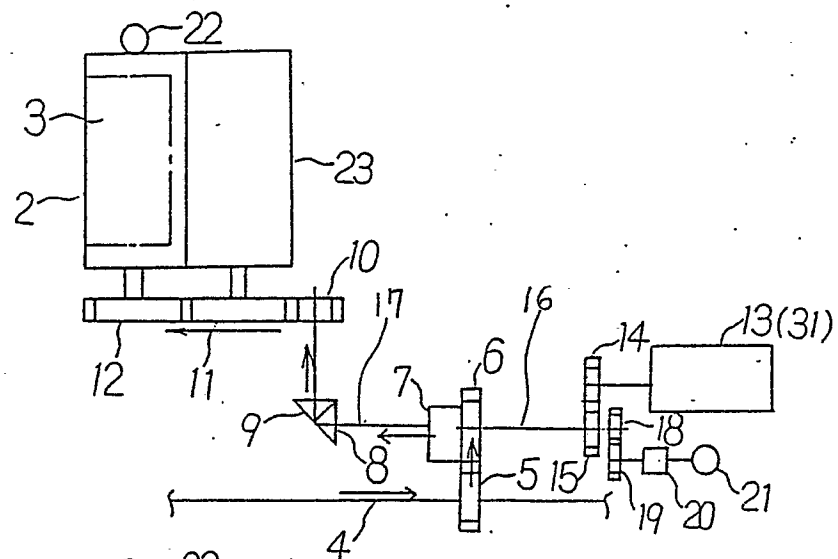


Fig. 2

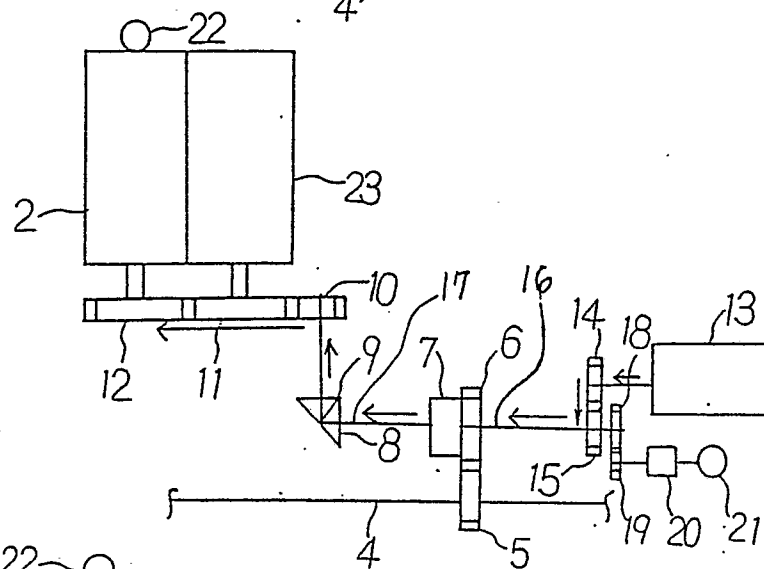


Fig. 3

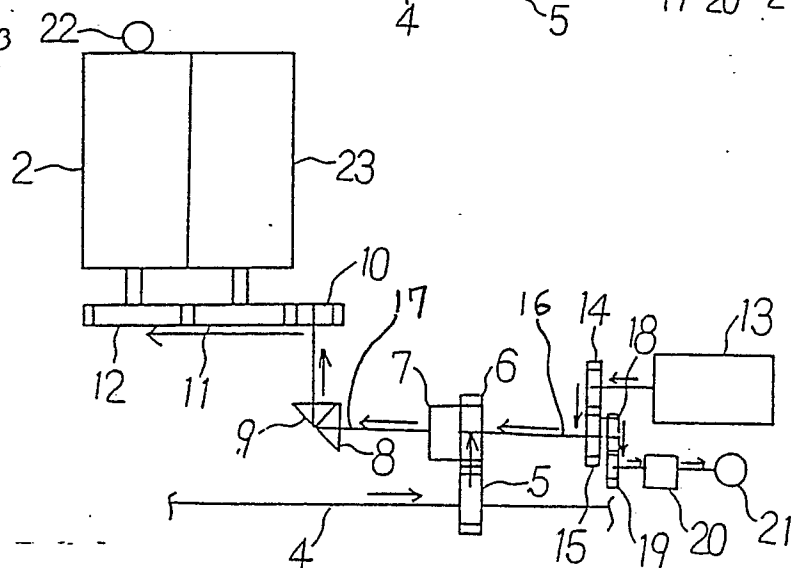


Fig. 4

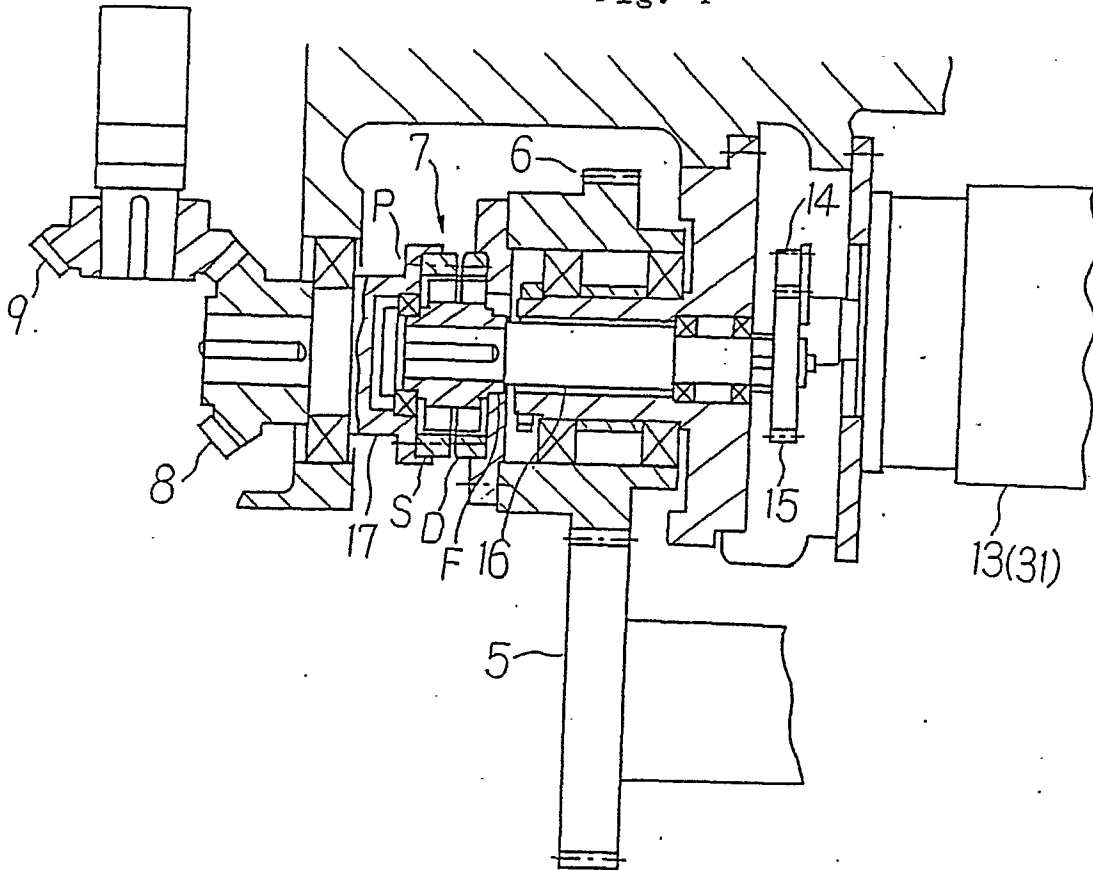


Fig. 5 (Prior Art)

