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E. H. WEINBERG ETAL

3,200,741

DRIVE MEANS FOR AN INTERMITTENTLY OPERATING MEMBER

Filed Oct. 28, 1963

2 Sheets-Sheet 1

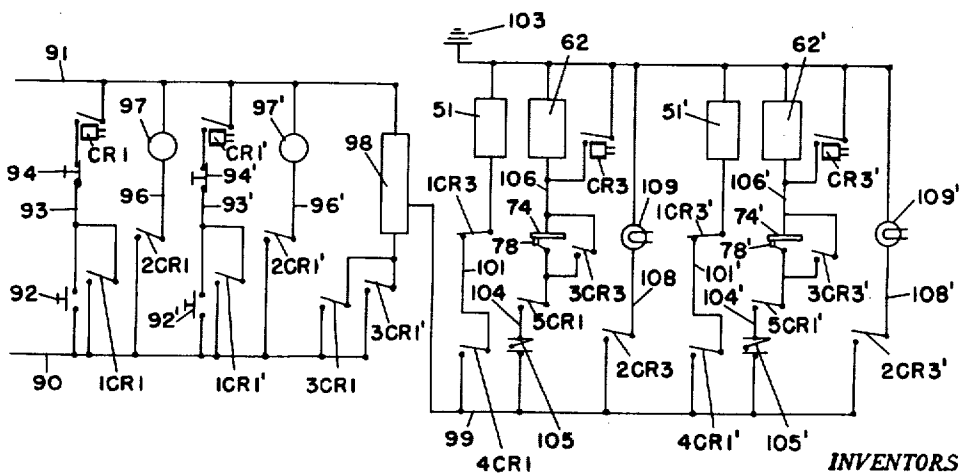
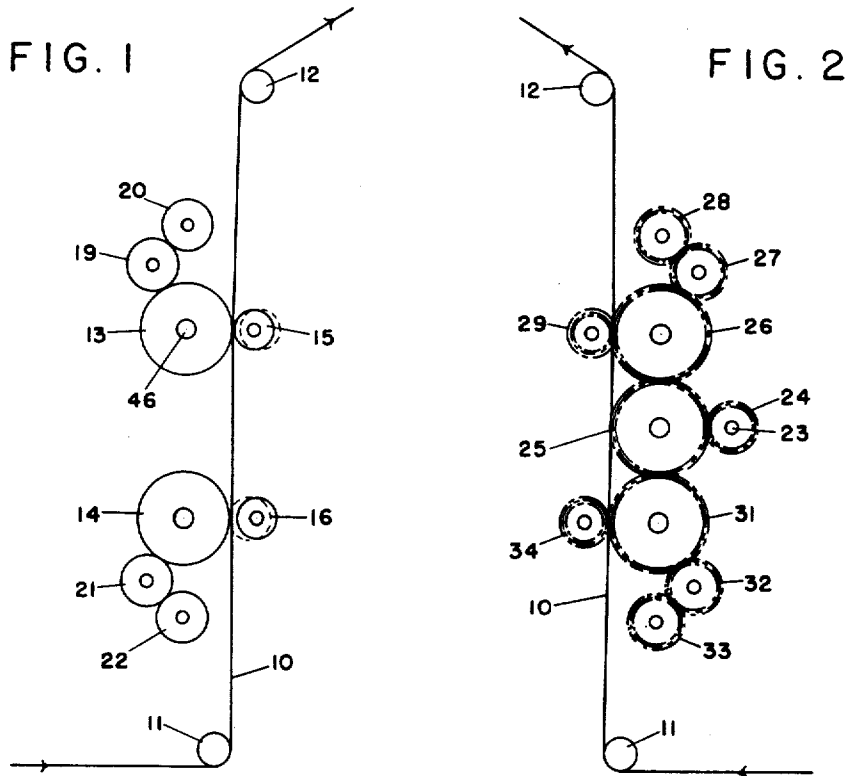


FIG. 4

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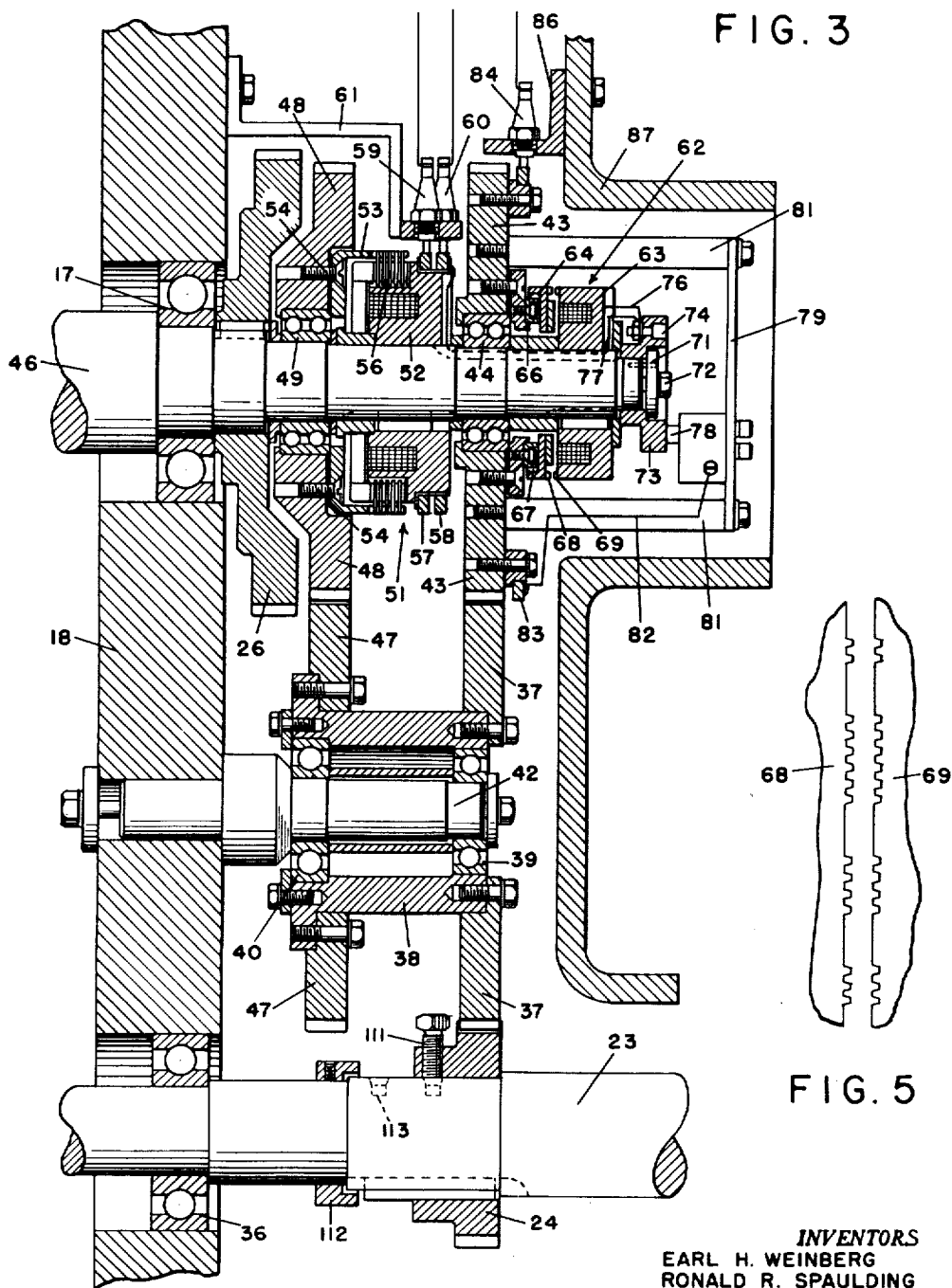
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DRIVE MEANS FOR AN INTERMITTENTLY OPERATING MEMBER

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15 Claims. (Cl. 101-221)

In its broader aspects the invention pertains to mechanism for driving an auxiliary member which is adapted to have intermittent coaction with a continuously operating machine. It is directed more specifically to an improved drive and associated control means for initially accelerating an intermittently operable member adapted to have coaction with a continuously operating device and for thereafter engaging said member with the positive drive means of said device when said member is precisely synchronized therewith.

Although the invention is susceptible of use in a wide variety of applications, it will be described hereinafter in conjunction with an imprinter unit for web fed printing presses for which purpose it is particularly advantageous.

In the normal course of producing a large volume of products on a web fed printing press it often is necessary to imprint different specific information on specified numbers or lots of said products as they are being printed. This is usually accomplished by means of an imprinter unit consisting of a plate cylinder and a coacting impression cylinder which are driven in unison with the printing press from the press drive mechanism. Generally, only a relatively small number of the products are imprinted with any given information and after the required number are completed the plate on the imprinter plate cylinder must be changed to imprint different information on the next lot, etc. Due to the high speed at which web presses operate the respective lots of products are each produced in a relatively short time and frequent stops are thus necessary to change the plate on the imprinter cylinder. These stops not only cause a substantial loss of production time, but they are also responsible for an increase in the number of waste products produced because of the time required after each stop before the proper ink and water balance is re-established.

To avoid the necessity for stopping the press each time the imprinter plate is changed it has been known to use a double imprinter unit consisting of two sets of plate and impression cylinders with associated inking mechanisms. In such case it is possible to prepare the plate cylinder of one printing couple while the other is operating and when the required number of products have been printed the second imprinting couple is rendered operative while the first couple is stopped and made ready for its next run. In this way the press proper can operate continuously without a break in the production schedule.

This type of operation requires special drive and control means for the respective imprinting couples which must be capable of quickly accelerating the plate cylinder of the inactive couple to running speed and to thereafter lock said cylinder in register with the main press drive. This must be accomplished with exact precision at the instant that the plate cylinder is synchronized with the main drive and at which time it is in register with the other printing elements of the press.

The mechanisms employed heretofore for this purpose have been unreliable at best and are incapable of providing the consistent and precise control necessary for efficient operation under normal circumstances. This, no doubt, accounts for the fact that substantially all of the imprinting currently produced on web presses is done with

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a single imprinter having a plate cylinder which is coupled directly to the main press drive.

It is an object of this invention therefore to provide improved drive and control means for an auxiliary member, such as the plate cylinder of an imprinter unit on a web fed printing press, which is capable of initially driving and thereafter connecting said member with continuously operating drive mechanism when said member is in precise synchronism with the drive mechanism.

Another object is to provide a drive and control mechanism for an auxiliary member which is adapted to drive said member at a fixed differential speed with respect to a main drive mechanism and which includes sensing means for effecting engagement of said member with the main drive mechanism when the member is precisely synchronized therewith.

A further object is to provide drive and control means for driving an auxiliary member from a main drive mechanism and which includes means to prevent premature engagement of said member with the main drive mechanism.

Another object is to provide drive and control means for an auxiliary member adapted to have intermittent coaction with a constantly operating device and which is capable of accelerating and connecting said member in register with said device regardless of the speed at which said device is running.

A still further object is to provide a preliminary drive mechanism for an auxiliary member which includes a first friction clutch means for initially accelerating said member to substantially operating speed, a second positive drive clutch means for coupling said member to a main drive mechanism and sensing means for actuating said second clutch means automatically when the member and the main drive means are precisely synchronized.

With these and various other objects and advantages in view, the invention may consist of certain novel features of construction and operation, as will be more fully described and particularly pointed out in the specification, drawings and claims appended hereto.

In the drawings which illustrate a preferred embodiment of the device and wherein like reference characters are used to designate like parts:

FIGURE 1 is a schematic side elevational view of a double imprinter unit illustrating the arrangement of the impression cylinders, plate cylinders and the coacting inking rollers;

FIGURE 2 is a schematic side elevational view similar to FIGURE 1, but taken from the opposite side of the unit and illustrating the drive arrangement for the respective elements;

FIGURE 3 is an enlarged sectional view showing the drive mechanism and control means of the invention for the upper plate cylinder of the imprinter unit;

FIGURE 4 is a wiring diagram of the control circuitry; and

FIGURE 5 is a fragmentary view showing the complete periphery of the second clutch elements to illustrate the contour of the interengaging teeth.

In the drawings which illustrate a preferred embodiment of the invention, a web of material 10 to be imprinted is caused to travel about guide rollers 11 and 12 which guide the web in a path that extends upwardly between the plate cylinders 13-14 and the respective coacting impression cylinders 15-16 of an imprinter unit which may be located at any suitable position in the printing press. Each plate cylinder is journaled for rotation in bearings 17, FIGURE 3, seated in the side frames 18 of the imprinter unit and the forms carried by said cylinders are arranged to be inked by conventional inking mechanisms which include the inking rollers 19-20 and 21-22, respectively.

The impression cylinders 15 and 16 are also mounted for rotation in the side frames 18. However, the impression cylinders are journaled in eccentric bushings or equivalent means not shown which are adjustable manually to move the impression cylinders bodily between operative and inoperative positions with respect to the coating plate cylinders. In FIGURE 1 the upper impression cylinder 15 is shown in the operative position wherein it functions in combination with the plate cylinder 13 to print impressions on the web as the latter passes through the nip of said cylinders. The lower impression cylinder 16, on the other hand, is shown in the inoperative position wherein it is spaced from the inactive plate cylinder 14 to provide clearance for the web to pass between said cylinders without interference when the latter are inoperative.

The foregoing elements of the imprinter unit are driven in unison with the printing press by a series of intermeshing gears as illustrated in FIGURE 2, which derive power from a drive shaft 23 that is connected directly with the main press drive. A drive gear 24 which is keyed to the shaft 23, is adapted to drive an idler gear 25 which, in turn, transmits power to either one or both of the plate cylinders through drive means which will presently be described.

A gear 26 mounted on the shaft of the plate cylinder 13, drives the associated inking rollers 19 and 20 through gears 27 and 28, and it also drives the coating impression cylinder 15 through gear 29 mounted on the shaft thereof. A similar gear 31, mounted on the shaft of plate cylinder 14 drives the inking rollers 21 and 22 through gears 32 and 33, and it also drives the impression cylinder 16 through the gear 34.

Although the impression cylinders are movable between operative and inoperative positions with respect to the plate cylinders the gears 29 and 34 thereon are adapted to remain in mesh with the drive gears 26 and 31, respectively, so that the impression cylinders will rotate in unison with the respective plate cylinders when the latter are operative.

Although the press with which they are associated is in constant operation, the two plate cylinders and their coating elements are arranged to be driven intermittently and preferably alternately so that one plate cylinder may be stopped and made ready for a subsequent operation while the other plate cylinder is printing. The mechanism whereby the plate cylinders are initially accelerated and then engaged with the main press drive, when they are properly synchronized therewith, is best illustrated in FIGURE 3. In this figure only the drive and control means for the upper plate cylinder 13 is shown, but it will be understood that a similar mechanism is provided for the lower plate cylinder 14 so that the operator may engage either one or both cylinders at required intervals. It also will be noted that whereas the main drive gear 24 is shown in FIGURE 2 as located at one side of the idler gear 25, which would be its normal location, it is shown as being located below said gear in FIGURE 3 merely for convenience of illustration.

The drive shaft 23, which rotates constantly when the press is in operation is journaled for rotation in the frame 18 by means of the bearings indicated by numeral 36 and the gear 24 which is keyed thereto is adapted to drive an intermediate gear 37. The latter gear is secured to the housing 38 which is journaled by bearings 39 and 40 for rotation about the axis of the stub shaft 42 projecting from the frame 18 and it drives a gear 43 of equal pitch diameter and which is mounted on the bearing 44 for rotation about the axis of the shaft 46 of the plate cylinder 13.

The housing 38 also carries a gear 47, the pitch diameter of which is slightly greater than that of the gear 37, and said gear 47 is arranged to drive a gear 48 which is also mounted on a bearing 49 for rotation about the axis of shaft 46. The pitch diameter of the gear 48 is

slightly smaller than that of the gear 43 and therefore, when the press is in operation, it will be evident that gear 48 will be driven at a slightly faster rate than the gear 43. The speed differential between gears 43 and 48 is not critical but a ratio of about 1.02 to 1 is preferred.

An electromagnetic disc clutch 51 is employed to connect gear 48 to the shaft 46 to thereby accelerate and initially drive the plate cylinder 13 when the latter is to be operated. The magnet body 52 of said clutch is keyed to the shaft 46 and the coating spider portion 53 is secured to the gear 48 by means such as the bolts 54. The friction discs 56 which are alternately connected to the spider portion and magnet body, respectively, are adapted when the coil of the magnet body is energized, to engage and thus drive the shaft 46 at the same speed as the gear 48. The magnet body 52 is also provided with slip rings 57 and 58 which are continuously engaged by brushes 59 and 60, respectively, supported in the bracket 61 on the frame 18 and which serve to complete circuits to said clutch in a manner and for the purpose as will be explained more fully hereinafter.

The gear 43 is also arranged to be coupled to the shaft 46 after said shaft has been accelerated to approximately press speed. The coupling means consists of an electromagnetic tooth clutch 62 which functions to positively maintain the plate cylinder 13 in proper register while in operation. The magnet body 63 of said clutch is keyed to the shaft 46 whereas the armature plate 64 is mounted on a circular adapter plate 66 that is bolted to the side face of the gear 43. The armature plate and the adapter plate are provided with coaxially disposed splines 67 on their inner and outer surfaces respectively, which serve to lock the two plates together against relative rotary motion, but which permit the armature plate to move axially relative to the adapter plate when the magnet body 63 is energized so that the face teeth 68 on the armature plate will engage the face teeth 69 on the magnet body thereby locking the gear 43 to the shaft 46. In the present embodiment, the face teeth 68 and 69 are so constructed that they will only engage when the armature plate 64 and the magnet body 63 are in corresponding angular positions and which will insure that the plate cylinder 13 is properly synchronized with the main drive.

For an illustration of a preferred form of clutch teeth reference is made to FIGURE 5 which discloses teeth 68 and 69 in developed form for the complete periphery of the clutch. The contour of both clutch elements consist of a series of projecting teeth and which alternate with depressed areas. The depressed area of the one clutch element is adapted to receive the projecting teeth of the other clutch element. However, the series of projecting teeth vary in length as do also the depressed areas and accordingly it will be apparent that the clutch elements will interengage to establish a positive drive only when the teeth and depressed areas of the respective clutch elements are precisely synchronized. This requires that the gear 43, having one clutch element fixed thereto, have a particular angular position with respect to the other clutch element which is fixed to shaft 46.

Secured to the end of the shaft 46 by means of the plate 71 and bolt 72 is a disc 73 made of insulating material and having a conductive insert or contact 74 in the face thereof which is connected by conductor 76 to the magnet body 63 of the clutch 62. A second conductor 77 connects the contact 74 to the slip ring 58 on the magnet body 52 of the disc clutch 51. Said conductor is also effective to energize a relay in the control circuit through brush 60 as will be explained hereinafter.

The contact 74 is arranged to be engaged at predetermined intervals by a brush 78 which is secured to a plate 79 mounted to the ends of the rods 81 which are secured to the gear 43. A conductor 82 connects the brush 78 to the slip ring 83 which is mounted on the

The circuitry for controlling the mechanism and the sequence of operation as above described is illustrated schematically in FIGURE 4 wherein the conductors 90 and 91 are connected to a source of 110 volt, 60 cycle, alternating current. Accordingly when the START button 92 for the plate cylinder 13 is depressed, control relay

To stop plate cylinder 13 after its group of products is completed, the operator first moves the impression cylinder 15 to its inoperative position whereupon he depresses the STOP button 94. This opens the control relay CR1 which in turn opens relay contacts 1CR1, 2CR1, 3CR1, 4CR1 and 5CR1 thereby opening the circuits across the START switch 92; the circuit to the timer 97; to the D.C. converter 98 to the disc clutch 51; and the tooth clutch 62. Opening of relay contact CR1 also opens relay CR3 which in turn causes relay contact 1CR3 to close, thereby preparing the circuit 101 for the next energization of disc clutch 51. It also opens relay contact 2CR3 to extinguish the signal lamp 109 and

contact 3CR3 to break the circuit across brush 78 and contact 74.

The circuitry for the lower plate cylinder 14 is identical to that for the plate cylinder 13 and follows the same sequence. Therefore, in FIGURE 4 the corresponding elements bear corresponding reference numerals with a suffix and it is deemed unnecessary to repeat the explanation of the operation.

It will be understood, however, that operation of the respective plate cylinders is at the option of the operator and they may be operated alternately as has been described, or in unison if the situation requires. Moreover, if no imprinting is required, neither plate cylinder will be utilized and in such event the imprinter can be disengaged from the main drive by loosening the set screw 111, FIGURE 3, and sliding the drive gear 24 axially on shaft 23 against the stop 112. In this position the gear 24 will no longer mesh with gear 37 and it can be locked in said position by inserting screw 111 into the opening 113 provided therefor.

While we have herein disclosed electromagnetic clutches for controlling the drive of the plate cylinder it will be readily appreciated that other well known types of clutches such as pneumatic mechanical or hydraulic clutches can be utilized with equal efficiency and therefore this is not to be construed as a limitation. Moreover, the sensing means illustrated, namely, the brush 78 and the disc 73 with the contact 74, are not critical to the operation of the device and this function could readily be accomplished by any other device such as a proximity switch, a photoelectric cell or a mechanical type limit switch which is capable of emitting an impulse or closing a circuit to energize the associated tooth clutch at the appropriate instant.

We claim:

1. In mechanism of the class described, a rotatable member having a shaft, a first gear rotatably mounted on said shaft, continuously operating means for driving said first gear, a second gear rotatably mounted on said shaft, continuously operating means for driving said second gear at a differential speed with respect to said first gear, a first manually actuatable clutch means for coupling said first gear to said shaft to thereby accelerate and drive said member at the same speed as said first gear, a second clutch means for coupling said shaft to said second gear when said member is properly synchronized therewith, sensing means including a member mounted for rotation with said shaft and a coacting member mounted for rotation with said second gear for detecting the relative angular positions of the rotatable member and said second gear, and means responsive to said sensing means for energizing said second clutch means when said rotatable member and said second gear are in precisely corresponding angular positions.

2. In mechanism of the class set forth, the combination comprising a continuously operating drive mechanism, an auxiliary member adapted to be driven intermittently by said drive mechanism, a first drive gear driven by said mechanism, a clutch for connecting said auxiliary member with said first drive gear for accelerating and driving said member at a predetermined speed, a second drive gear rotating at a differential speed with respect to said first drive gear, a second clutch for connecting said second drive gear to said member, the drive element of said second clutch being mounted on the second gear and the driven element being mounted on said member, whereby said drive and driven elements rotate at a differential speed, said drive and driven elements being engageable only when said member and said second gear are precisely synchronized, sensing means including an element on said member and an element on said second gear for detecting the relative angular positions of said second gear and said member, and means responsive to said sensing means for actuating said second clutch to

thereby lock said member to said drive mechanism when the member and drive are in synchronism.

3. In mechanism of the class described, in combination, a rotatable member including a shaft, a first gear mounted on the shaft for independent rotation, continuously operating means for driving said first gear, a second gear also mounted on the shaft for independent rotation, continuously operating means for driving said second gear at a differential speed with respect to said first gear, a first magnetic clutch for coupling the first gear to said shaft whereby to cause the shaft to rotate at the speed of the first gear, a second magnetic clutch for coupling said second gear to said shaft when the second gear and shaft are in precise synchronization, sensing means for detecting synchronization by detecting the relative angular positions of the second gear and shaft, means responsive to the sensing means for energizing the second magnetic clutch when synchronization between the second gear and shaft is detected by the sensing means, whereby the second gear is coupled to the shaft, and other means rendered operative simultaneously with the energization of the second magnetic clutch for effecting de-energization of the first magnetic clutch.

4. In mechanism of the class described, in combination, a rotatable member including a shaft, a first gear mounted on the shaft for independent rotation, continuously operating means for driving said first gear, a second gear also mounted on the shaft for independent rotation, continuously operating means for driving said second gear at a differential speed with respect to said first gear, a first clutch for coupling the first gear to said shaft whereby to cause the shaft to rotate at the speed of the first gear, a second clutch for coupling said second gear to said shaft when the second gear and shaft are in precise synchronization, sensing means for detecting synchronization by detecting the relative angular positions of the second gear and shaft, means responsive to the sensing means for activating the second clutch when synchronization between the second gear and shaft is detected by the sensing means, whereby the second gear is coupled to the shaft, and other means rendered operative simultaneously with the activation of the second clutch for effecting de-activation of the first clutch.

5. In mechanism of the class as defined by claim 4, wherein the first clutch is of the friction type and wherein the second clutch is of the positive engaging type.

6. In mechanism of the class as defined by claim 4, wherein the sensing means includes a part rotated by the shaft and another part rotated by the second gear.

7. In mechanism of the class described, in combination, a rotatable member including a shaft adapted to rotate intermittently, a first gear mounted on the shaft for independent rotation, drive means having meshing relation with the first gear for rotating the same continuously, a second gear also mounted on the shaft for independent rotation, drive means having meshing relation with the second gear for rotating the same continuously and at a differential speed with respect to the said first gear, a first magnetic clutch for coupling the first gear to the shaft when the magnetic clutch is energized, whereby the shaft is caused to rotate at the same speed as that of the first gear, a second magnetic clutch for coupling the second gear to the shaft when the second clutch is energized, said second magnetic clutch including parts fixed to and rotating with the second gear and shaft respectively and which are so constructed and arranged that the parts interengage only when the clutch part on the second gear and the clutch part on the shaft are precisely synchronized, sensing means including an element on the second gear and an element on the shaft for detecting the relative angular positions on said second gear and shaft, means responsive to the sensing means for energizing the second magnetic clutch when synchronization between the second gear and shaft is detected by the sensing means, whereby the second gear is coupled to the

shaft, and other means rendered operative simultaneously with the energization of the second magnetic clutch for effecting de-energization of the first magnetic clutch.

8. Mechanism of the class as defined in claim 7, wherein the means responsive to the sensing means includes an electric circuit with the sensing means providing a switch for the circuit, and wherein said switch is closed at the moment synchronization occurs between the second gear and shaft.

9. Mechanism of the class as defined in claim 7, wherein the means responsive to the sensing means includes an electric circuit with the sensing means providing a switch for the circuit and wherein said switch is closed at the moment synchronization occurs between the second gear and shaft, and additionally including a timer in said circuit in series relation with the switch.

10. In a double imprinter unit, in combination, a pair of printing couples each including a plate cylinder and an impression cylinder, a shaft for journalling each plate cylinder, drive mechanism for rotating each shaft to thereby rotate each plate cylinder at a predetermined speed, said drive mechanism including a first gear mounted on each shaft for independent rotation, a second gear also mounted on each shaft for independent rotation, means forming part of the drive mechanism for rotating the second gear at a differential speed with respect to the first gear, a first magnetic clutch means for each first gear for coupling the gear to its shaft when the clutch means is energized, a second magnetic clutch means for each second gear for coupling the gear to its shaft when the clutch means is energized, sensing means having associated relation with each second gear and with its shaft for detecting the relative angular positions of the said gear and shaft, means responsive to each sensing means for energizing the second magnetic clutch thereof when synchronization is detected by the sensing means whereby to couple the second gear to its shaft, and other means rendered operative simultaneously with the energization of a second magnetic clutch for effecting de-energization of that first magnetic clutch which is associated with its particular shaft.

11. In a double imprinter unit as defined by claim 10, wherein the drive mechanism is driven from a single source of power.

12. In an imprinter unit, in combination, a printing couple including a plate cylinder and an impression cylinder, a shaft for journalling the plate cylinder, drive mechanism for rotating the shaft to thereby rotate the cylinder, said drive mechanism including a first gear train capable of rotating the shaft and therewith the plate cylinder at a differential speed with respect to a desired printing speed, first clutch means for rendering the first gear train operative when the said clutch means is activated, whereby when the first gear train is operative the cylinder is being driven at said differential speed, a second gear train capable of rotating the shaft at the desired printing speed, second clutch means for rendering the second gear train operative when the second clutch means is activated, and sensing means for activating the second clutch means when the plate cylinder is synchronized with the second gear train and for simultaneously de-activating the first clutch means.

13. In an imprinter unit as defined by claim 12, wherein the first clutch means is of the friction type and wherein the second clutch means is of the positive engaging type.

14. In an imprinter unit, in combination, a printing couple including a plate cylinder and an impression cylinder, a shaft for journalling the plate cylinder, drive mechanism for rotating the shaft and thus the cylinder, said drive mechanism including a first gear train for accelerating and driving the shaft and thus the plate cylinder at a differential speed with respect to a desired printing speed, first magnetic clutch means for rendering the first gear train operative when the clutch means is energized, a second gear train capable of positively driving the shaft at the desired printing speed, second magnetic clutch means for rendering the second gear train operative when the second clutch means is energized, sensing means for detecting synchronization between the shaft and the second gear train by detecting the angular positions of the shaft and the second gear train, and means responsive to the sensing means for energizing the second clutch means when synchronization is detected by the sensing means, whereby the shaft is coupled to the second gear train, and other means rendered operative simultaneously with the energization of the second clutch means for effecting de-energization of the first clutch means.

15. In an imprinter unit having a plate cylinder and a coating impression cylinder adapted to be operated at intervals to imprint data in register on selected portions of a web as it passes through a printing press, the provision of drive means for initially accelerating and thereafter driving the plate cylinder in register with the web comprising, a first drive gear adapted to be driven by the main press drive at a fixed differential speed with respect to the speed of the press, a second drive gear adapted to be driven by the main press drive at the same speed as the press, first clutch means having operation when activated to couple the plate cylinder to the first drive gear whereby the plate cylinder is accelerated and thereafter driven at said fixed differential speed, second clutch means having operation when activated to couple the plate cylinder to the second drive gear whereby the plate cylinder is driven in register with and at the same speed as the press, manually actuatable means for activating the first clutch means to thereby accelerate and drive the plate cylinder at said differential speed, sensing means for detecting the relative angular positions of the differentially rotating plate cylinder and the second gear, and automatic means responsive to said sensing means for activating the second clutch means and simultaneously de-activating the first clutch means when the plate cylinder and the second drive gear are in precisely corresponding angular positions.

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EUGENE R. CAPOZIO, *Primary Examiner.*

UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,200,741

August 17, 1965

Earl H. Weinberg et al.

It is hereby certified that error appears in the above numbered patent requiring correction and that the said Letters Patent should read as corrected below.

Column 5, line 27, strike out "in the same direction but at a" and insert instead -- at a differential speed which is --; column 5, line 58, strike out "63 of clutch 62, of clutch 622idncoqqfisila3"; column 8, line 26, for "indepnent" read -- independent --.

Signed and sealed this 8th day of March 1966.

(SEAL)

Attest:

ERNEST W. SWIDER

Attesting Officer

EDWARD J. BRENNER

Commissioner of Patents