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MULTICOLOR PRINTING PRESS FOR ROUND OBJECTS

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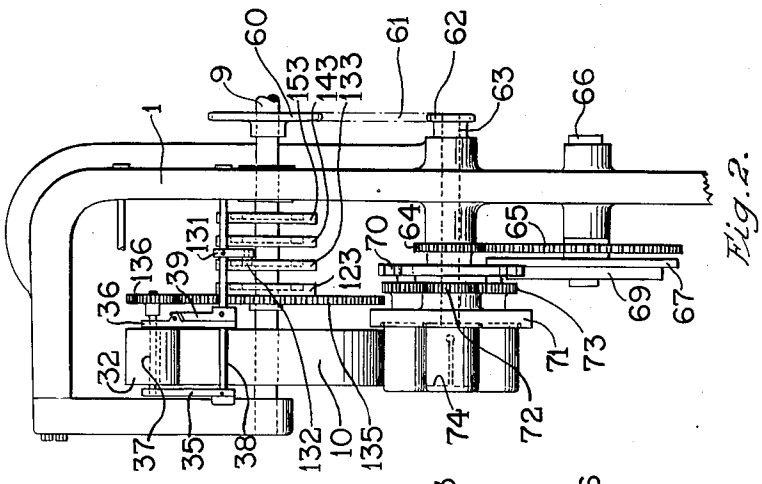


Fig. 2.

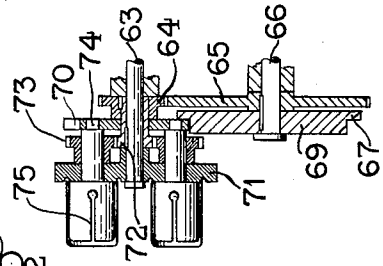


Fig. 3.

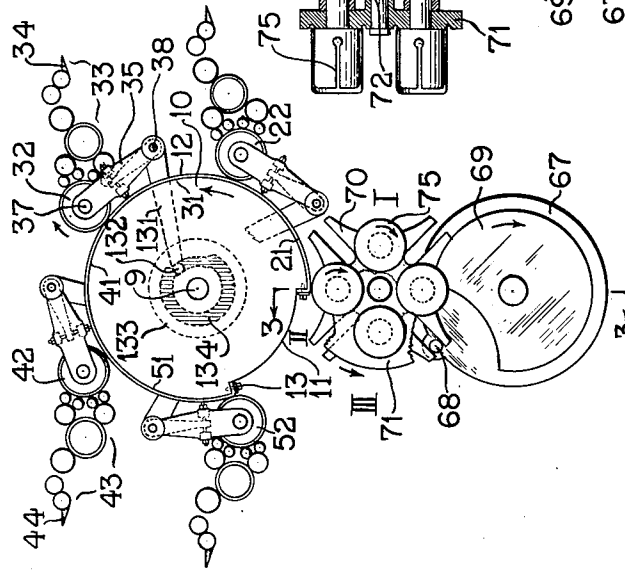


Fig. 1.

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MULTICOLOR PRINTING PRESS FOR ROUND OBJECTS

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This invention relates to multicolor printing on round surfaces in one operation. More particularly, the herein disclosed apparatus permits the so-called process printing of round surfaces and produces for the first time a satisfactory superimposition of colors on such surfaces to reproduce any multicolored design thereon.

Until now all the machines and methods of which I am aware as having been proposed for the multiple color printing in one operation on round, rigid or semi-rigid objects such as glass or plastic bottles, metal cans, etc. either produce a multicolor design having the respective color areas in juxtaposition, or simply produce a plurality of parallel, differently colored bands on the round surface. Some of these machines operate on the principle of direct letterpress printing, but inasmuch as the work pieces to be printed are made from hard, non-elastic material in most instances, direct letterpress printing from metal printing plates is out of question because of the short life of the plates. The use of rubber plates of course is possible, but the quality of the print produced by means of plates from rubber or any other type of sufficiently resilient material is generally inferior and such that the fine details as required in halftone printing are unattainable.

Another type of presses proposed for the printing on round surfaces provides for the simultaneous offset of a multicolor design from a transfer blanket or drum to which the design is first transferred by means of successively engaging printing rolls. This arrangement is useful for the printing of juxtaposed colored areas but is not adaptable for process printing where the inks are partly trapped on top of each other and where, due to surface differences, spreading of the most prominent ink spots would occur. One way of printing superimposed colors on round surfaces has been to dry the first ink before the second color is printed. But the use of separate transfer blankets with relatively small diameter round objects involves a most delicate and difficult problem of attaining register and it has been impossible to get effective and satisfactory results in this manner.

I have devised an apparatus for process printing on round objects, by offsetting successive prints from a single blanket, with the round object being held in a single jig throughout the printing operation to ensue perfect register. The set-up is so designed that each printing plate contacts the blanket only during the portion of the cycle necessary to transfer its ink image, thereby preventing smearing of the successive prints, and permitting the tack of the successive inks to be adjusted to provide for perfect trapping on the work piece to be decorated. In order to trap several different inks on top of each, the ink having the highest tack must be deposited first on the surface to be printed and inks having successively decreasing tack thereafter. The herein disclosed apparatus provides for the deposition of printing inks on round surfaces in the required sequence in one single operation and solves the problem of process printing on round objects. Moreover, by causing the transfer cylinder to revolve intermittently and using a jig which turns the work piece in synchronism with the advancement of the transfer blanket while it is in and out of contact therewith, the device can be readily adapted for the process printing of plane-surfaced, formed articles.

The invention can be best understood by referring to the accompanying drawing, in which:

Fig. 1 is a side elevation of herein claimed printing press with certain parts broken away and other parts removed,

Fig. 2 is a front elevation with certain parts removed, and

Fig. 3 is a cross section of the work-holding chuck along the line 3—3 in Fig. 1.

While the printing press comprises a driving mechanism, a work feeding device, a printing unit and a plurality of inking assemblies, the drawing exhibits only so much of the elements as is necessary for an understanding of the operation.

Referring more specifically to the drawing which illustrates a device for process printing with the three base colors yellow, red, and blue-green, as well as with a gray printer, there is shown a transfer cylinder **10** the circumference of which has a recessed section **11**, while the non-recessed part is covered with a transfer blanket **12**, the ends of which are turned inwardly and secured by means of plates and set-screws such as shown at **13**, which permit the easy replacement of worn-out blankets.

The surface area of the blanket is subdivided into four equal sections **21**, **31**, **41** and **51**, which are the printing sections for the four inks. Generally, for any number of colors to be printed the transfer cylinder requires a circumference equal to $m \cdot 2r\pi + x$, wherein r is the radius of the work pieces to be printed, m is the number of colors, and x is the linear distance of the recessed part, the length of which depends upon the printing speed and the relative rapidity at which one work piece can be replaced by another in printing position.

In the illustrated instance there are four printing cylinders **22**, **32**, **42** and **52**, each transferring a specific color design to the blanket. These cylinders can be adapted for any of the known modes of printing, viz. letterpress, rotogravure, or planographic, but letterpress printing is the most desirable. Each type of printing requires its particular inking mechanism. An inking mechanism as exemplified in conjunction with the plate cylinder **42** and comprising the roller train **43** for the ink transfer and the ink well **44** is typical for letterpress printing. The plate cylinders, in turn, may be adapted for dry offset printing or wet offset printing according to known principles. Each plate cylinder and inking mechanism is arranged to move in and out of contact with the transfer blanket, so that it will transfer an ink pattern of specific color onto the corresponding section of the transfer blanket **12**. As the transfer cylinder **10** moves past the plate cylinder stations, the blanket section **21**, for example, picks up the ink pattern from plate cylinder **22**, the blanket section **31** from plate cylinder **32**, and so on. As soon as one of the plate cylinders has made one complete rotation in contact with the respective blanket section and thereby has transferred its ink pattern over the entire length of this blanket section, the plate cylinder is moved out of contact with the blanket and remains out of contact until the next turn of the transfer cylinder. The differently colored inks which are transferred in this manner simultaneously to different sections of the transfer blanket are subsequently picked up, one after the other, by a work piece brought in contact with the transfer cylinder.

One way of establishing contact between the plate cylinders **22**, **32**, **42** and **52** and the transfer blanket **12**, and of breaking the contact again at the proper instant, is shown in the accompanying drawings. The plate cylinders and part of the inking trains are supported by levers, such as the levers shown in connection with the plate cylinder **32**, consisting of the two arms **35** and **36** which, at one end, retain the shaft **37** between themselves on which the plate cylinder **32** is rotatably mounted. A

shaft 38 connects the other end of the said two arms and extends to one side, as shown, to be mounted in frame 1. For the purpose of adjustment, the arm pair 35 and 36 is rotatably mounted on shaft 38. However, by means of the short link 39 which has a sleeve at one end whereby it is fixedly mounted on shaft 38 and a set-screw arrangement at the other end whereby, as shown, this link is connected to the arm 36, the said arm pair and the plate cylinder held therebetween can be accurately fixed in position on shaft 38.

Fastened to that part of the shaft 38 which extends to one side from the arm pair 35 and 36 is another arm 131, angularly offset against the said arm pair and carrying a roll 132 at the free end which engages the cam groove 134 in the disk 133 secured upon the shaft 9 of the blanket cylinder 10. The shape of the groove is such that the roll following its contour imparts a cam motion to the lever arrangement which, at precise intervals, moves the plate cylinder 32 in and out of contact with the transfer blanket 12.

Similarly arranged levers, shafts, adjustment links and grooved cam disks, as indicated by the disks 123, 143 and 153 in Fig. 2 are provided in connection with the plate cylinders 22, 42 and 52. Thus, if the transfer cylinder is subdivided into, say, five equal parts and the four disks are mounted in such a manner that the cam-follower groove of each succeeding disk is advanced 72° over the cam-follower groove of the preceding disk, the four plate cylinders will make contact with adjacent sections of the transfer blanket, at the same moment and for the same length of time.

In order to transfer the variously colored design elements in register to the work piece, the plate cylinders cannot be free-wheeling, but must be given a surface speed which is synchronized to that of the transfer blanket 12. The shaft 9 of the transfer cylinder, which is the main drive shaft of the press, carries the gear 135, shown in Fig. 2, for this purpose. This gear actuates four other gears, one for each of the plate cylinders, such as the illustrated gear 136, which is centered about the shaft 37 of the plate cylinder 32. If, in breaking contact between the plate cylinders and the transfer blanket after the transfer of the design elements to the respective section of the blanket, the degree of lift of the plate cylinders is held to a minimum, the gears as exemplified in the gears 135 and 136, are not taken out of mesh and the transfer cylinders rotate continuously, in and out of contact with the transfer blanket.

The various elements of the printing machine are mounted on a stationary frame illustrated in Fig. 2 and indicated by the numeral 1. The main drive shaft 9, which is shown to be mounted transversely between the frame, has a sprocket wheel 60 attached thereto which engages the links of a chain 61 and thereby drives another sprocket wheel 62 that is mounted on a shaft 63 which is the drive shaft of the work holder. Attached to the said drive shaft is the gear 64 which meshes with the gear 65 fitted to the shaft 66 which is mounted into one of the uprights of the frame 1. The gear 65 actuates the driver 67 of a Geneva wheel arrangement imparting the necessary intermittent motion to the work holder in synchronism with the rotation of the transfer cylinder 10. For this purpose the said driver is provided with a roller 68 at the periphery and with a circular boss 69, partly cut away, as shown. Mounted concentric with the shaft 63 but not actuated thereby is the cross 70 in operative alignment with the driver 67. As shown in Fig. 1, this cross has four radial slots, 90° offset against each other. The roller 68 engages one of these slots each time the driver 67 makes one complete revolution and turns the cross 70 thereby one quarter revolution.

In order to prevent the cross 70 from turning while the roller 68 is rotating to engage the next slot, the circular boss 69 of the roller engages the concave surface of the cross adjacent thereto. The numeral 71 indicates a plate covering the cross 70 which is mounted on and revolves with the shaft 63. The gear 72, keyed to the shaft 63, engages the four gears 73, each of which actuates a shaft 74 which, in turn, supports a work holder, such as the split chucks 75 in the instant case.

In the operation of the printing machine, the work pieces are continuously loaded at position I, printed at position II and removed at position III. If the device is hand-fed, the operation of the machine permits feeding with one hand while the printed work pieces can be removed with the other hand. Obviously, the device can be fed and the printed objects be removed mechanically. While a new work piece is inserted, the differently colored inks are transferred in the afore-described manner onto the different sections of the transfer blanket 12 in order to be picked up one after the other by the work piece after the latter has been moved to the position II.

I claim:

1. A machine for printing on round objects comprising a frame, a transfer drum mounted on said frame, said drum having a recessed surface section and a non-recessed surface section carrying a rubber transfer blanket, a plurality of printing cylinders with individual inking means arranged around said transfer drum adapted to apply their inked designs to different but equally arcuate sections of the blanket, each equal to the circumference of the round object to be printed, means to simultaneously bring all the printing cylinders into contact with the blanket at the same time, and to maintain contact during travel of the dum through a distance equal to the arcuate section, means to keep all said cylinders out of contact with the blanket during the remaining travel of the drum, means for rotating the transfer drum, and means for driving the round object in contact with the blanket at the lineal speed of the blanket to effect consecutive transfer of the inked designs in superimposed registered relationship.

2. A machine for printing on round objects comprising a frame, a transfer drum mounted on said frame, said drum having a recessed surface section and a non-recessed surface section carrying a rubber transfer blanket, a plurality of printing cylinders with individual inking means arranged around said transfer drum adapted to apply their inked designs to different but equally arcuate sections of the blanket, each equal to the circumference of the round object to be printed, means to continuously drive the printing cylinder while the drum is being rotated, means to simultaneously bring all the printing cylinders into contact with the blanket at the same time, and to maintain contact during travel of the drum through a distance equal to the arcuate section, means to keep all said cylinders out of contact with the blanket during the remaining travel of the drum, means for rotating the transfer drum, and means for driving the round object in contact with the blanket at the lineal speed of the blanket to effect consecutive transfer of the inked designs in superimposed registered relationship.

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