MULTICOLOR PRINTING PRESS FOR ROUND OBJECTS

Filed April 30, 1952

Fig. 1.

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MULTICOLOR PRINTING PRESS FOR ROUND OBJECTS

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Application April 30, 1952, Serial No. 285,153

2 Claims. (Cl. 101—38)

This invention relates to multicolor printing on round
surfaces in one operation. More particularly, the herein
disclosed apparatus permits the so-called process print-
ing 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.,
cannot produce a multicolor design having the respective
color areas in superposition, or similarly produce a plurality
of parallel, differently colored bands on the round sur-
face. 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 success-
ively engaging printing rolls. This arrangement is useful
for the printing of juxtaposed colored areas but is not adap-
table 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 sepa-
rate transfer blankets with relatively small diameter
round objects involves a most delicate and difficult prob-
lem 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 ensure 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 prevent-
ing 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 decreas-
ing tack thereafter. The herein disclosed apparatus pro-
vides 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. More-
ever, by causing the transfer cylinder to rotate inter-
mittently 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-surf-
faced, 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 mecha-
nism, a work feeding device, a printing unit and a plu-
arity 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 illus-
trates a device for process printing with the three base
colors yellow, red, and blue-green, as well as gray, as well
printer, there is shown a transfer cylinder 10 the circum-
ference 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 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 \( m \cdot 2\pi - r \cdot x \), 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 cylin-
ders 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
station, 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 simulta-
neously 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 cylin-
ders 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 10 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 152 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 drive 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 is radial holes, 90° off 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 1, 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. If 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 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 linear 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 linear speed of the blanket to effect consecutive transfer of the inked designs in superimposed registered relationship.

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