A machine for printing on articles having two inking stations each with a printing block and a carriage carrying a squeegee movably mounted for sweeping over and inking the printing block and a single printing station common to the two inking stations. A transfer unit with two transfer arms carrying transfer pads is pivotally mounted for reciprocating movement parallel to the stations and axial reciprocating movement perpendicular to the stations, and the inking stations are arranged symmetrically with respect to a plane passing through the pivotal axis of the transfer unit and the central zone of the printing station. Each transfer pad may print the same or different colors. With two-color printing the same color order can be maintained with a high printing rate. The transfer arms may also be provided with a plurality of said transfer pads for simultaneously printing on a plurality of objects.
MACHINE FOR PRINTING ON ARTICLES HAVING TWO INKING STATIONS AND A SINGLE PRINTING STATION COMMON THERETO

The present invention relates generally to the printing of an object of any kind following a process known as the Bienne transfer, from the name of the Swiss town in which this process first saw the light.

This process, which permits both the printing of objects of flat shape and objects of any non-flat shape, consists of the use of a transfer pad, of gelatine for example, or more recently of elastic synthetic material such as synthetic rubbers, neoprene, butadiene, or better still rubber with silicones, this transfer pad being successively applied, first on a block hollow-engraved to represent the design to be reproduced, previously inked and wiped, and then to the object to be printed.

The ink present on the block is taken-off by the transfer pad and is transferred by this latter to the object to be printed.

Machines have already been proposed which effect the various necessary operations in an automatic manner.

In particular, there has already been proposed a machine comprising an inking station equipped with a block-carrier plate and a trolley movably mounted for sweeping over and inking a block of this kind, a printing station equipped with an object-carrier plate and a transfer arm carrying a transfer pad and mounted on the one hand pivotally with a reciprocal motion parallel to the said plates between the said stations, and on the other hand, movable to-and-fro perpendicularly to the said plates, at each of the said stations.

In such a machine however, there is only one impression for every two downward movements of the transfer arm carrying the transfer pad, the first downward movement of this arm being necessary for taking-off the ink from the block.

In consequence, the efficiency of such a machine is relatively low and in addition this machine does not permit printing of an object in two colours.

In order to overcome these drawbacks, there has also been proposed a machine in which the transfer arm is mounted pivotally with a reciprocal motion, but rotatably with a step-by-step forward motion, this arm carrying a plurality of transfer pads in such manner that at each downward movement there is simultaneously an extraction of the ink from a block by a transfer pad and printing of an object by another transfer pad.

However, the drive of the forward step-by-step movement of such an arm necessitates relatively complicated mechanisms, and in addition the machine thus obtained is relatively bulky, due to the fact that the transfer arm sweeps over a complete circumference, and that an inking station is associated with each printing station.

Furthermore, although there are for example two blocks and four transfer pads, it is not possible to print two colours successively at the same printing station.

The present invention has for its object a machine for printing an object of any kind following the Bienne transfer method which is free from these drawbacks and which in addition has other advantages.

The machine according to the invention is of the kind comprising an inking station equipped with a block-carrier plate and a trolley movably mounted for sweeping over and inking the said block, a printing station equipped with an object-carrier plate and a transfer arm carrying a transfer pad and pivotally mounted on one hand with a to-and-fro movement parallel to the said plates between the said stations, and on the other hand movable to-and-fro perpendicularly to the said plates at each of the said stations, and is characterized in that it comprises a second station similar to the first and symmetrical with this latter with respect to a plane passing through the pivotal axis of the transfer arm and the central zone of the printing station, and in that, for this second printing station a second transfer arm is provided which is keyed on the first and which also carries a transfer pad.

Thus, and because of the to-and-fro movement of the transfer arm, at each downward movement of this arm there is a taking-off of the ink from a block at an inking station by a first transfer pad, and application to an object, at the printing station, of the ink previously taken-off by the second transfer pad at the other inking station.

The efficiency of the machine is thus doubled, while two inking stations serve the same printing station, and its overall size remains a minimum.

In the foregoing, it has been assumed that the blocks at the inking station were identical, for the application of the same impression to successive objects, an object being therefore printed on each downward movement of the transfer arm.

However, the blocks of the inking station may be different for the application for example of two different colours to the same object, such an object being thus printed in two stages after two downward movements of the transfer arm.

In fact, it became apparent that by utilizing for the construction of the transfer pads, a synthetic material of the silicone rubber type, it was possible to ensure successively, at very short intervals of time, the application of two colours on the same object without previously drying the first coat, and without this latter being smeared, disturbed or taken-off during the printing of the second colour.

This remarkable property may be imputed to a kind of passivation to which the ink employed is subjected with respect to the particular material of the transfer pad, after a first contact of this ink with that material.

According to a preferred form of construction, between a transfer arm of the machine according to the invention and the trolley of the associated printing station, there is provided a crank-rod system for operating this trolley.

Thus the operation of a trolley of this kind is advantageously effected by such a transfer arm, without any other control device.

The objects of the invention, their characteristic features and their advantages will further be brought out in the description which follows below by way of example, reference being made to the accompanying diagrammatic drawings, in which:

FIG. 1 is a general perspective view of the machine in accordance with the invention;
FIG. 2 is a partial plan view of this machine;
FIG. 3 is a view in partial cross-section taken along the line III—III of FIG. 2;
FIG. 4 is a partial view in elevation in the direction of the arrow IV of FIG. 2, with cross-section and parts broken away locally;
FIG. 5 is to a larger scale a partial cross-section of this machine, taken along the line V—V of FIG. 1;
FIG. 6 is a detail view in cross-section taken along the broken line VI—VI of FIG. 5;
FIG. 7 is a detail view in elevation of the direction of the arrow VII of FIG. 6;
FIG. 8 is a partial view in cross-section taken along the line VIII—VIII of FIG. 5;
FIG. 9 is a partial view in elevation of the direction of the arrow IX of FIGS. 8 and 10;
FIG. 10 is a partial view in cross-section taken along the line X—X of FIG. 9; and
FIG. 11 is a fragmentary perspective view of another embodiment, in which each transfer arm carries plural transfer pads.

According to the form of embodiment shown diagrammatically in FIG. 1, the machine according to the invention comprises a frame 10 which carries an operating unit 11, a printing station 12 located at the front of this operating unit 11, and two inking stations 13A, 13B, located on each side of this latter.

The operating unit 11 is driven by a motor 14 and comprises an input shaft 15 driven in rotation by a belt which couples it to the motor shaft 14 and an output shaft 16.

Between its input shaft 15 and its output shaft 16, the driving unit 11 comprises parts intended to ensure, in response to continuous rotation of the input shaft 15, a cyclic movement of the shaft 16, comprising successively a rotation through substantially 90° in one direction, an axial lowering movement, an axial lifting movement, a rotation substantially through 90° in the direction opposite to that preceding, an axial downward movement and an axial upward movement in order to return to the initial position.

A driving unit of this kind, sold commercially in particular by the FERGUSON Company, is well known in itself and will not be described in detail below.

It is only necessary to state that the rotations of the shaft are effected for example by a toothed segment engaging with a pinion keyed on this shaft, while its axial displacements are ensured by a fork, the teeth of which are in engagement with a hub keyed on the shaft, this fork being controlled for pivotal movement by a cam.

On the output shaft 16 of the driving unit 11, according to the invention, there are keyed two transfer arms 17A, 17B, each associated respectively with the inking stations 13A and 13B and arranged substantially at 90° with respect to each other.

Each of these transfer arms carries a transfer pad 18A, 18B, fixed for example by screwing on a threaded shaft adjustable axially in position on the corresponding transfer arm, parallel to the shaft 16, as shown in cross-section in FIG. 4 with respect to the transfer arm 17A.

On each transfer arm 17A, 17B is also keyed, beyond the shaft 16, an elongated slot 20A, 20B which extends substantially at 90° with respect to the corresponding transfer arm 17A, 17B.

The printing station 12 comprises a bracket 21 which is fixed on the frame 10 and which carries an object-carrier plate 22; an object 23 to be printed has been shown diagrammatically in broken lines in FIGS. 1 and 4.

The inking stations 13A, 13B are symmetrical with each other with respect to a plane passing through the pivotal axis AP of the transfer arms 17A, 17B and through the central zone ZM of the printing station 12, that is to say through the central zone of the object-carrier plate 22.

One only of these inking stations, namely the inking station 13A will be described below, it being understood that the inking station 13B is of a similar composition.

The inking station 13A comprises a block-carrier plate 25A, on which is placed the block 26A to be inked.

A tank forming an ink-well 27A is arranged at the side of the plate 25A, between this latter and the driving unit 11.

A trolley 28A is movably mounted above the block-carrier plate 26A and the ink-well 27A associated with this latter.

For this purpose, this trolley is slidably mounted on parallel guides 29A which enclose the plate 25A and the ink-well 27A, and a crank-rod system 30A connects it to the associated transfer arm 17A.

This rod system 30A comprises a crank-rod 31A, preferably adjustable in length, as shown in FIG. 3, in order to permit an adjustment of the position of the trolley 28A. At one extremity, this crank-rod 31A is articulated by a shaft 32A to the trolley 28A, and at the other extremity it carries a shaft 33A which is slidably engaged in a passage of the transfer arm, this passage being preferably formed by a shouldered member 34A mounted adjustably in position in the slot 20A of the transfer arm 17A so as to permit an adjustment of the travel of the trolley 28A, as shown in FIGS. 2 and 3, a ball bushing may be interposed between the shaft 33A and the shouldered member 34A in which it is caused to slide.

As can be seen from FIG. 5, the trolley 28A carries two scrapers, one 35A provided for inking the block 26A, the other 36A provided for scraping-off the excess ink deposited by the previous scraper on this block.

The inking scraper 35A is mounted overhung at the end of a metal plate 37A and the latter is carried by a fork 38A movably mounted on the trolley 28A, perpendicular to the block-carrier plate 25A.

For this purpose, this fork is provided with two lugs 39A slidably mounted on two shafts 40A carried by the trolley 28A.

Perpendicular to these shafts 40A, the fork 38A carries a stud 41A which (see FIG. 9) projects towards the exterior and is engaged in one of the arms 42A of a rocking lever 43A pivotally mounted at 44A on the trolley 28A, this arm having for this purpose the shape of a fork, and the stud 41A being guided in an elongated slot 48A.

Preferably and as shown, the fork 38A carries the scraper 35A through the intermediary of a unit 45A mounted adjustably in position perpendicular to the block-carrier plate 25A by means of a threaded shaft 46A engaged by screwing into a threaded passage 47A of the fork 38A, which makes it possible to regulate the pressure of the said scraper on the said plate.

A similar arrangement is adopted for the wiping scraper 36A: this latter is carried by a unit 50A mounted adjustably in position on a fork 51A perpendicularly to the block-carrier plate 25A, by means of a threaded shaft 58A engaged in a threaded bore 59A of the fork 51A, and this fork 51A is itself engaged by means of lugs 52A on shafts 53A which are carried by the trolley 28A perpendicularly to the said plate.

Preferably, as shown in FIG. 7, the scraper 36A is pivotally mounted on the unit 50A on which it is carried, around a shaft 55A parallel to the block-carrier
plate 25A.

This arrangement makes it possible to regulate the inclination of the scraper 36A. A screw 56A carried by this latter is engaged in an elongated slot 57A (FIGS. 6 and 7) for locking the scraper 36A after its inclination has been adjusted.

According to an arrangement similar to that described for the scraper 35A, the fork 51A which carries the scraper 36A is provided, parallel to the block-carrier plate 25A, with a stud 57A which projects towards the exterior (FIGS. 8 and 9) and which is engaged in a second arm in the shape of a fork 58A of the rocking lever 43A and in a guiding slot 49A.

As has been shown in FIG. 10, a ratchet device 60A is associated with the rocking lever 43A for the releasable locking of this latter in either of two extreme positions, symmetrical with each other with respect to a mean vertical arrangement passing through its axis 44A, which is intermediate between the forks 38A and 51A.

For its operation, the rocking lever 43A carries a roller 62A intended to co-operate with two stops 63A and 64A mounted so as to be adjustable in position on a strip 65A parallel to the guides 29A of the trolley 28A, on the course of this latter (see FIGS. 1 and 3).

As shown diagrammatically in FIGS. 3 and 4, the object-carrier and block-carrier plates are advantageously mounted so as to be adjustable in height on the frame 10.

It will be assumed below that if an object 23 to be printed is in position on the object-carrier plate 22 of the printing station 12, the transfer arm 17A is in the top position, as shown in FIG. 1.

At the same time, the trolley 28A of the inking station 13A is above the block 26A put in position on the block-carrier plate 25A of the inking station 13A, and this block is inked following a process which will be described later. The scraper 36A is in the bottom position, against the block 25A, while the scraper 35A is in the top position, at a distance from this block (see FIG. 5).

Similarly, and as will be apparent subsequently, the transfer pad 18B of the transfer arm 17B associated with the inking station 13B carries an impression which it has previously acquired from the block in position at this inking station 13B.

A printing cycle begins.

There is first of all a rotation through a quarter revolution of the shaft 16 in the direction of the arrow 60 of FIG. 1.

On completion of this rotation, the transfer pad 18B is located above the object 23 in position at the printing station 12, and the transfer pad 18A is vertically in line with the block 26A in position at the inking station 13A, this block having been uncovered by the trolley 28A of this station.

In fact, during the course of its rotation, the transfer arm 17A, keyed on the shaft 16, has acted through the crank system 30A to cause the movement of the trolley 28A from the block 26A to the associated ink-well 27A located below the said trolley.

In FIG. 2, the final position of the transfer arm 17A is shown diagrammatically in broken lines.

During the course of its translation, the trolley 28A has applied the scraper 36A against the block 25A so as to wipe this block and eliminate the excess ink.

On the completion of the translation movement of the trolley 28A, the roller 62A of its rocking lever 43A has come into contact with the stop 63A provided for that purpose on the strip 65A, which has compelled this rocking lever to tilt over.

This rocking movement causes an upward movement of the scraper 36A which moves away from the block 25A, and a downward movement of the scraper 25A which then is dipped into the ink well 27A.

There is then a downward movement of the shaft 16 which causes the application to the object 23 of the impression existing on the transfer pad 18B.

At the same time, the transfer pad 18A is pressed against the block 26A and removes the ink present on this block.

There is then an upward movement of the shaft 16, which frees the object 23 which has just received a first impression.

In the case where the machine is utilized for the application of a single impression on such objects, the blocks present at the printing stations 13A and 13B being identical, the previously printed object 23 is withdrawn from the object-carrier plate 22 and a new object to be printed is put into position there.

On the other hand, in the case where such objects are to receive two successive impressions of different colours, the blocks existing at the inking stations 13A and 13B being different, the object 23 then present at the printing station 12 is left in position there.

There is then a rotation of the shaft 16 through a quarter revolution in the opposite direction to that preceding, that is to say in the direction opposite to that shown by the arrow 60 in FIG. 1.

On completion of this rotation, the transfer pad 18A provided with the ink or impression which it has taken from the block 26A is again located vertically above the object 23.

At the same time, during the course of this rotation, the transfer arm 17A has acted through the crank system 30A to cause the trolley 28A to return to the vertical line of the block 26A.

During the course of this return movement, the scraper 35A which is in the bottom position and dips into the ink well 27A, drives the ink before it and this ink sweeps over the block 26A so as to ink this latter.

At the end of this return movement, the roller 62A of the rocking lever 43A comes into contact with the stop 64A arranged, as has already been seen, on the travel of the trolley 28A, which causes a rocking movement of the lever 43A in the opposite direction to that preceding.

Due to this rocking movement, the scraper 35A is brought back to the top position, while the scraper 36 is lowered for subsequently wiping the block 26A, as described above.

There is then a downward movement of the shaft 16, at the end of which the transfer pad 28A, pressed against the object 23, as shown diagrammatically in broken lines in FIG. 4, transfers this latter the ink or the impression which it carries.

It will be understood that operations similar to those described take place at the inking station 13B with a displacement of a half-cycle with respect to those preceding.

The shaft 16 again moves upwards and a fresh printing cycle can begin.

The material utilized in the composition of the transfer pads 18A, 18B is preferably a synthetic silicone rubber.
It will of course be understood that the present invention is not restricted to the forms of application described and shown, but includes any alternative form of construction.

In particular, in the example shown, the inking scraper 35A is inclined with respect to the block-carrier plate, like the wiping scraper 36A and in the same direction as this latter, but these inclinations could be in opposite directions to each other.

In addition, in the example shown, the placing in position at the printing station of the objects to be printed and their removal after printing is effected manually. It will be obvious that it is possible to equip the machine according to the invention with any loading and/or unloading device which is capable of carrying out these operations automatically.

In particular, according to a form of embodiment (not shown), it is possible to associate with the printing station a rotatable table or turret, a trolley, or any other driven transport means, advancing step-by-step in the vertical line of the said station and thus permitting the automatic supply of objects to be printed to this station, in synchronism with the control of the transfer arms, the said objects carried by the said transport means stopping at the printing station for the time necessary for their printing in one or two colours.

In the particular case of printing in two colours, a step-down gearing is provided between the drive of the transport means and that of the transfer arms in such manner that each object to be printed remains in position at the printing station during two successive downward movements of the said transfer arms.

In addition, as shown in FIG. 11, each transfer arm 17A may carry a number of transfer pads 18A, arranged for example longitudinally along the said arm, or transversely with respect thereto, for the simultaneous printing of several objects by a single transfer arm, which increases the efficiency of the machine.

The number of object-carrier plates 22 is of course provided in consequence, and the bracket 21 fixed on the frame 10 is adapted to receive a number of such plates.

Finally, according to the alternative form shown in broken lines in FIG. 8, two rocking levers 43A may be provided on each side of the trolley 28A, two strips 65A with the corresponding stops 63A, 64A being also provided.

What is claimed is:

1. A machine for printing on articles, comprising a first inking station, a second inking station, each inking station having a printing block and a carriage with inking means and wiping means mounted for sweeping movement over its associated printing block, a single printing station common to both said inking stations and having a support for articles to be printed, and a transfer unit including a pair of arms each carrying a transfer pad, means mounting the transfer unit for rotational movement between a first travel position in which one of the transfer pads is above one of the inking stations and the other transfer pad is above the printing station and a second travel position in which the other transfer pad is above the second inking station and the one transfer pad is above the printing station, means connecting the transfer unit with each of the carriages for movement therewith, the inking means at one of the stations and the wiping means at the other of the stations being operative during the displacement from the first travel position to the second travel position, and the wiping means at the other of the stations and the inking means at the other of the stations being operative during the displacement from the second travel position to the first travel position, and means mounting the transfer unit for axial reciprocating displacement from each of said first and second travel positions of the transfer pads to corresponding operative positions at the respective stations, and vice versa.

2. A machine as claimed in claim 1, wherein said transfer arms are located substantially at 90° with respect to each other.

3. A machine as claimed in claim 1, wherein the means connecting the transfer unit with the carriage comprises a crank-rod system provided between each transfer arm and the carriage of the associated inking station, for driving said carriage.

4. A machine as claimed in claim 3, wherein the crank-rod system comprises a crank-rod pivotally connected at one end of its associated carriage and carrying at the other end a pin received in a slot in its associated transfer arm.

5. A machine as claimed in claim 4, wherein said pin has a flanged member adjustably mounted in the slot.

6. A machine as claimed in claim 3, further comprising guides for guiding said carriage above the associated printing block and an ink reservoir mounted at the side of said printing block.

7. A machine as claimed in claim 6, wherein said inking means and wiping means comprises two squeegee mounted on said carriage, one for inking the printing block and the other for wiping the printing block.

8. A machine as claimed in claim 7, wherein each said squeegee is carried by a fork member movably mounted on said carriage perpendicularly to said printing block, the fork members being coupled together by a rocking lever pivotally mounted about an axis intermediate said fork members, and limit stops for limiting rocking movement of the rocking lever in the vicinity of the ends of the path of movement of the carriage.

9. A machine as claimed in claim 8, wherein at least one of said squeegee is adjustable in position, perpendicular to said printing block.

10. A machine as claimed in claim 9, wherein at least one of said squeegee is inclined with respect to said printing block.

11. A machine as claimed in claim 1, wherein each transfer arm is provided with a plurality of transfer pads for simultaneously printing on a plurality of objects in said single printing station.

* * * * *