

March 11, 1952

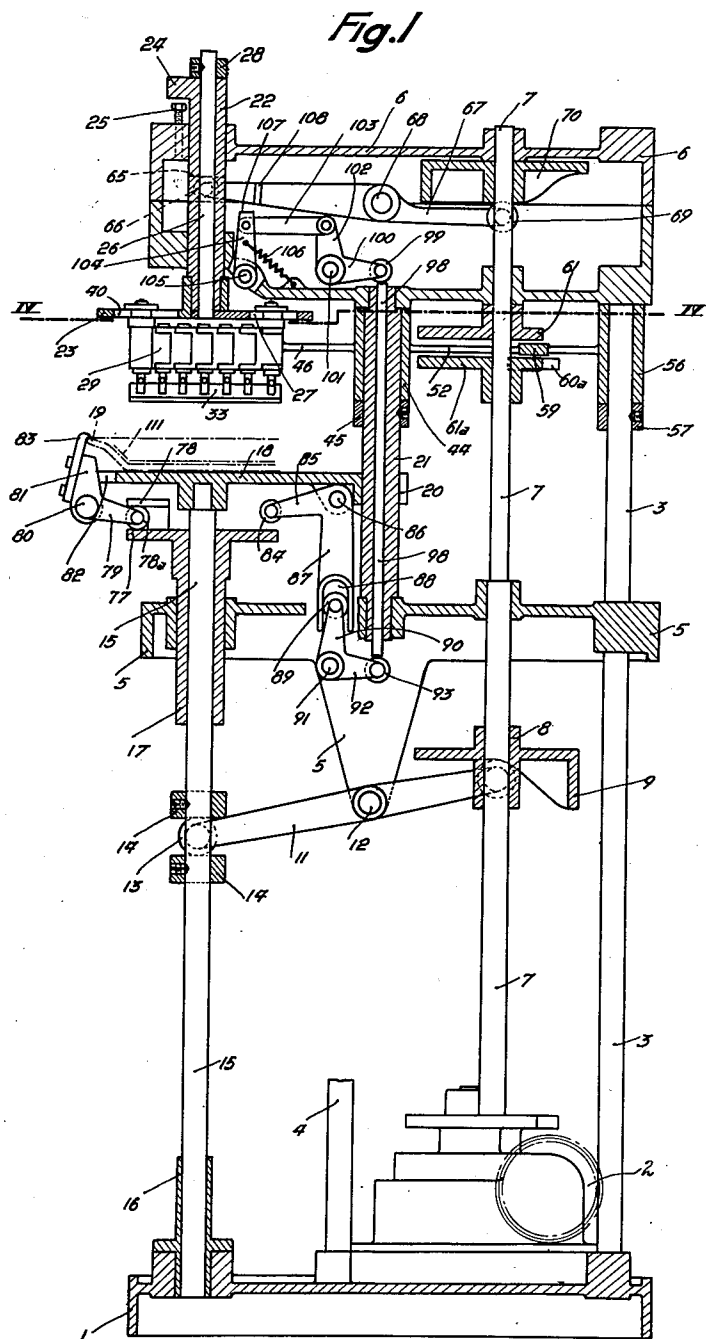
L. G. DUBUIT

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SILK SCREEN PRINTING MACHINE

Filed April 5, 1951

3 Sheets-Sheet 1



Inventor
Louis Gilbert Dubuit
by *Pace & Luma*
Attorney

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L. G. DUBUIT

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3 Sheets-Sheet 2

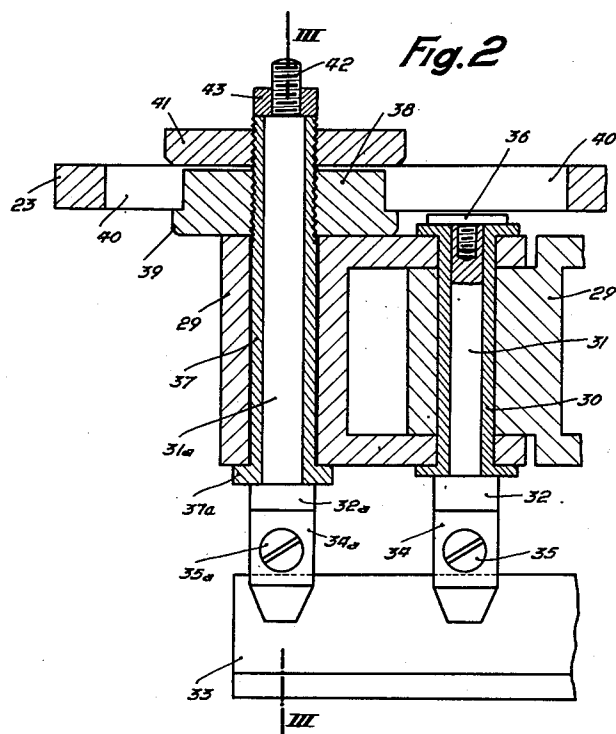
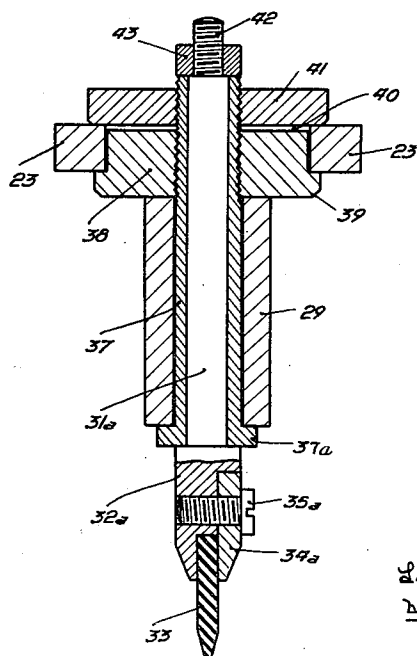


Fig. 3



Inventor
Louis Gilbert Dubuit
by *Paul H. Smoot*
Attorney

March 11, 1952

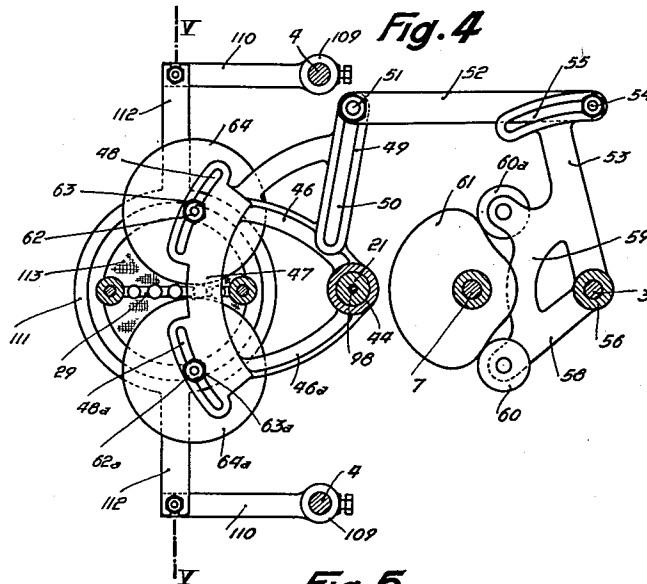
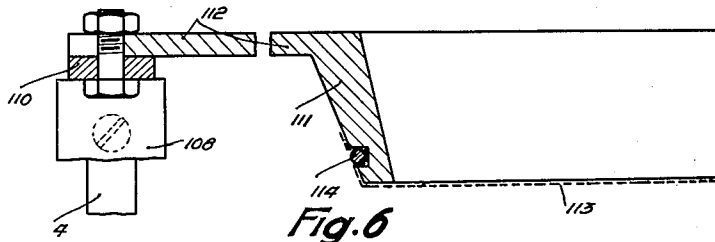
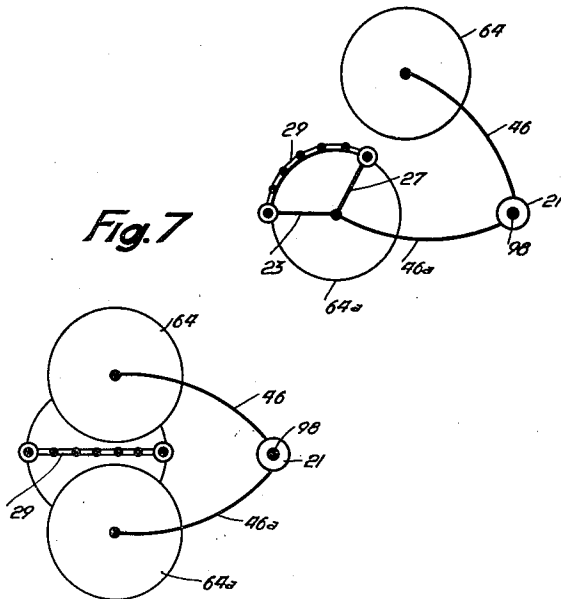
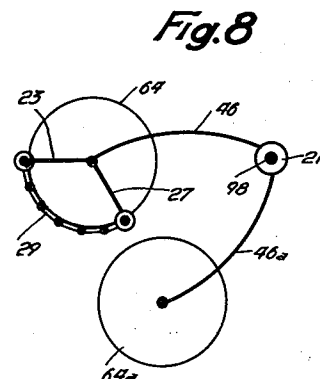
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Inventor
 Louis Gilbert Dubuit
 By *Pare & L...*
 Attorneys

UNITED STATES PATENT OFFICE

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SILK SCREEN PRINTING MACHINE

Louis Gilbert Dubuit, Paris, France

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In France October 4, 1950

8 Claims. (Cl. 101—126)

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The present invention relates to the printing by so-called silk-screen printing process. It is known that this method consists in placing the surface to be printed in contact with a silk screen or stencil the portions of which that do not correspond to the print to be applied having been obturated, then in placing on the stencil an ink or varnish which, by means of a squeegee, is caused to pass onto the surface to be printed through the free meshes of the stencil which remained.

This printing method is currently used for the ornamentation of plane surfaces or of developable surfaces of revolution. Thus, decorations or the like are printed by means of this method onto the flat portions of various articles, on bottles, on glasses or cylindrical or conical cups. However, certain difficulties have been met in the use of said method for the printing of circular surfaces such as the surface of plates, saucers or dishes. The printing of such surfaces has been operated hitherto by mean of a substantially circular stencil under which the surface to be printed is applied and a circular movement about an axis passing substantially through the centre of said surface is imparted to the squeegee intended to cause the ink or the varnish to pass through the stencil. When using such a manner of operating, it is possible to reproduce printings around the centre of the surface to be printed but it is, of course, not possible to point the centre of the plate.

The present invention has for its object to provide a device which makes it possible to obtain printings extending to all the desired points of a circular surface, including the centre of said surface.

The device according to the invention fundamentally comprises means for supporting a substantially horizontal stencil, means for supporting an article to be printed and for bringing the latter into contact with the lower surface of the stencil, a squeegee made of flexible material, the length of which is substantially equal to the diameter of the circular surface to be printed on the article, said squeegee being supported by a vertically rigid but horizontally flexible member, guiding means for bringing the squeegee to the shape of an arc of circle corresponding to a portion of the periphery of the surface to be printed, means for holding fast one of the ends of the squeegee supporting member, means for causing the squeegee to pass to a position which is symmetrical to the starting position of said squeegee with respect to the diameter of the sur-

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face to be printed which passes beneath the end of the squeegee which is held fast, and means for causing the other end of the squeegee supporting member to simultaneously describe an arc of circle corresponding to the periphery of the surface to be printed while passing through a point which is diametrically opposed to said end which is held fast.

The squeegee supporting member preferably consists of a chain formed of links pivotally secured to one another by means of vertical axles, said ax'es each carrying at their lower end a fastening member for the squeegee. One of the ends of said supporting member may thus be pivotally secured to a member fixed with respect to the stencil support and the other end may be pivotally secured to a crank or like member carried by a shaft rotatably mounted perpendicularly to the plane of the stencil above the centre of the latter.

The guiding means for the squeegee may consist of two discs having substantially the same diameter as the surface which is to be printed, said discs being fastened on both sides of the squeegee supporting member and in the same horizontal plane as said supporting member, on a support capable of swinging around an axis perpendicular to the said horizontal plane, means being provided in order to impart to said support a reciprocal rocking movement.

The device according to the invention will be more fully described hereunder with reference to the accompanying drawings in which:

Fig. 1 is a vertical sectional view of an embodiment of such a device the members supporting the stencil being removed and the stencil only being shown in chain dotted lines in its working position.

Fig. 2 is a sectional detail view on a larger scale showing the squeegee and its supporting member.

Fig. 3 is a sectional view through III—III of Fig. 2.

Fig. 4 is a sectional view through line IV—IV of Fig. 1.

Fig. 5 is a diametrical sectional view of the stencil supporting member.

Figs. 6, 7 and 8 are diagrammatical views showing three successive positions of the squeegee supporting and guiding means.

Referring now to the drawing, the device as shown comprises a base 1 on which is placed a driving motor 2 and in which are fastened three vertical columns supporting the device, viz.: a column 3 in the rear part of base 1 and two col-

umns 4 on both sides of said base. On said columns are mounted two supports 5 and 6 forming a casing in the upper part of the device. A vertical shaft 7 is journaled in bearings provided in supports 5 and 6 said shaft being connected in its lower part to the driving motor 2. On said shaft 7 is keyed a sleeve 8 carrying a crown cam 9. Said cam co-operates with a roller carried at the end of a lever 11 pivotally mounted at 12 on support 5, the other end of said lever carrying a roller 13 engaging between two collars 14 adjustably keyed on a vertical rod 15 sliding in its lower part in a guiding sleeve 16 carried by base 1, and in the neighbourhood of its upper end in a sleeve 17 slidably mounted in support 5. In its upper part, shaft 15 carries a disc 18 for supporting the article to be printed, for example a plate shown in chain dotted lines at 19 in Fig. 1. Disc 18 is provided with a lateral protruding terminating as a fork 20 the prongs of which encompass a vertical column 21 mounted between supports 5 and 6.

A square shaft 22 is slidably mounted in holder 6, axially of rod 15. On the lower end of said square shaft 22 is mounted a crank 23 while the upper end of said shaft carries a finger 24 co-operating with a set screw 25 mounted in holder 6, thereby limiting the stroke of said shaft 22 downward in holder 6.

Square shaft 22 is provided with a longitudinal bore in which is rotatably mounted a shaft 26 the lower end of which carries a crank 27, said shaft 26 being maintained longitudinally in shaft 22 by means of a collar 28.

The two ends of the squeegee supporting members are respectively secured on cranks 23 and 27. Said members comprise a chain made of links 29 each of which is pivotally secured to the following by means of a tube 30 crimped at its ends and into which extends an axle 31 which terminates at its lower part in a support 32. A rubber squeegee 33 is clamped in support 32 by means of a counter-plate 34 secured by a screw 35. Axles 31 are maintained in tubes 30 by means of a screw 36. In the linking bore of each terminal link of the so formed chain 29 is arranged a tube 37 which is provided in its lower part with a collar 37a and the upper end of which is externally screw-threaded. Screwed onto said externally screw-threaded part is a member 38 provided with a collar 39 extending through a slot 40 provided in crank 23, said member 38 being secured in said slot 40 by means of a locking nut 41. Inside tube 37 is arranged an axle 31a terminating in its upper part in an externally screw-threaded stud 42 on which is screwed a locking screw 43. Axle 31a extends in its lower part in a support 32a similar to supports 32 carried by shafts 31 and provided with a counter-plate 34a secured by means of a screw 35a and holding the ends of squeegee 33.

A sleeve 44 is freely rotatably mounted on column 21 and longitudinally held on said column by means of a collar 45. Said sleeve 44 is fast with two arms 46 and 46a supporting at their ends a circular segment 47 in which are provided two arcuate slots 48 and 48a. Secured to arm 46 is a lever 49 provided with a longitudinal slot 50 in which is secured the linking trunnion 51 of one of the ends of a connecting rod 52, the other end of said rod 52 being pivotally secured to a lever 53 by means of a trunnion 54 held in an arcuate slot 55 provided transversely at the end of said lever 53. Said lever 53 is fast with a sleeve 56 freely rotatably mounted on column 3 and lon-

gitudinally held on said column by means of a collar 57. Two rollers 60 and 60a co-operating with a cam 61 keyed on driving shaft 7 are rotatably mounted on a lever 58 and a member 59 which are both fast with sleeve 56. Fastened in slots 48 and 48a of sector 47 by means of a screw-threaded stud 62, 62a and of a nut 63, 63a respectively are two discs 64, 64a having substantially the same diameter as the circular surface which is to be printed, minus the thickness of the chain 29. The unit formed of the above described members is so arranged that discs 64 and 64a are substantially level with the middle transversal plane of links 59 when square shaft 22 is in its lower position.

Engaging a lateral notch 65 provided in square shaft 22 is a roller 66 rotatably mounted at one end of a lever 67 linked at 68 in support 6, the other end of said lever 67 carrying a roller 69 which co-operates with a crown cam 70 keyed on driving shaft 7.

Sleeve 17 carries at its upper end a disc 77 provided on its upper face with, for example, three stirrups such as 78 regularly distributed around said disc. Engaging between each of said stirrups and disc 77 is a roller 78a carried by one of the arms 79 of an angle-lever pivoted at 80 on a lap fast with disc 18, the other arm 81 of said angle-lever engaging a notch 82 provided on the periphery of disc 18. Arm 81 of each said levers carries a set plate 83, said plates 83 serving to center the article to be decorated on disc 18.

With disc 77 may also co-operate a roller 84 mounted at the end of an arm 85 of an angle-lever pivoted at 86 on disc 18, the other arm 87 of said angle-lever terminating in a fork 88. Engaging said fork is a roller 89 carried by one of the arms 90 of an angle-lever pivoted at 91 on disc 18, the end of the other arm 92 of said lever carrying a roller 93 on which rests the end of a rod 98 slidably mounted in an axial bore provided in column 21. Resting on the other end of said rod is a roller 99 carried by an arm 100 of an angle-lever pivoted at 101 in holder 6. Pivotally secured to the end of the other arm 102 of said angle-lever is a link 103 the other end of which is linked on a finger 104 rockingly mounted at 105 on holder 6 and acted upon by a return spring 106. Said finger 104 ends in a nose 107 adapted to co-operate with a lateral stop 108 carried by lever 67.

Two arms 110 are fastened on columns 4 of the machine by means of an adjustable sleeve 109. Said arms 110 support a frame 111 (Figures 4 and 5) formed, in the chosen example, of a ring having the general shape of a conical frustum provided with two lateral ears 112 adapted to be bolted on arms 110. The silk stencil 113 is stretched in said frame in a manner known per se in order to make it possible to transfer the desired printing to the article to be printed, said stencil being maintained by means of a string 114 engaged in a circular groove provided in the periphery of frame 111.

The outline of the various cams 9, 61, 61a and 70 forming part of the composition of the machine results from the operation of said machine as shall be described hereafter.

Initially, rod 15 is lowered as a result of the cooperation between lever 11 and cam 9 and square shaft 22, on the contrary, is raised as a result of the co-operation between lever 67 and cam 70. Sleeve 17 rests on support 5. On the other hand, due to the co-operation between cam

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61 and roller 60, discs 64 and 64a occupy the positions shown at Fig. 6. Stencil 113 being fed with varnish by any means known per se, motor 2 is started and a plate 19 is laid on disc 18. Owing to the rotation of shaft 7, cam 9 acting on lever 11 causes said lever to rock in the direction which raises rod 15 and drives plate 19 towards the stencil. Stirrups 78 carried by disc 77 and acting on levers 79—81 cause plates 83 to rock towards the centre of disc 18, thus centering plate 19. As the rising movement of rod 15 and disc 18 continues, disc 77 is raised by levers 79—81 which are held fast owing to the clamping of plates 83 against the edges of plate 19. Fig. 1 shows the various parts of the machine in the course of this movement of general rising. At the beginning of said movement discs 18 and 77 are spaced apart from each other in such a manner that lever 85 carrying roller 84 which rests on disc 77 is raised to a position which maintains rod 98 upward, said rod thus driving back lever 104 by means of lever 100—102 and of link 103 against the action of spring 106, and nose 107 being thus released from stop 108 carried by lever 67. During said movement, discs 18 and 77 move slightly away from each other, lever 85—87 rocks while leaving rod 98 free to move slightly downward but by a quantity which is insufficient for allowing nose 107 to come back on the path of stop 108. Simultaneously, cam 70 co-operating with roller 69 carried by lever 67 causes the rocking of said lever 67 in the direction which causes the downward sliding of square shaft 22. Squeegee 33 comes to rest on stencil 113 which is by construction sufficiently loose to come to apply against the bottom of the plate to be printed.

Cam 61 which rotates with shaft 7 then causes discs 64 and 64a to pass from the position shown at Fig. 6 to that shown at Fig. 8. At the beginning of said movement the chain formed of links 29 rests against disc 64a and follows, therefore, as well as squeegee 33 carried by said chain, a fraction of the periphery of the bottom of the plate which is to be printed, on one of the sides of said bottom. During the above mentioned movement of discs 64 and 64a, disc 64 presses against the chain formed of links 29 and drives it back while causing the rotation of crank 27 fast with shaft 26 which rotates freely inside square shaft 22. The whole surface of the stencil corresponding to the bottom of plate 19 is thus swept by squeegee 33, the linking axle 31a of the end of the chain on crank 27 describing a circle having the same radius as said bottom while passing through the intermediary position shown at Fig. 7 in which the chain formed of links 29 is stretched along a straight line coinciding with a diameter of plate 19. When discs 64 and 64a arrive to the extreme position shown at Fig. 8, cam 9 causes the rocking of lever 74 in a reverse direction to that which had taken place previously and rod 15 is lowered. As the lowering movement of shaft 15 continues, sleeve 17 is stopped in its stroke by support 5 and, rollers 78a then resting on disc 77, levers 79—81 rock while releasing the printed plate 19. Said plate is then removed, a new plate is laid on disc 18 and the same sequence of operations is repeated. During the next operative sequence, discs 64 and 64a pass back from the position shown at Fig. 8 to that shown at Fig. 6.

It may be seen that during the transfer operation the whole surface of the bottom of the plate has been swept and that the described machine

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therefore makes it possible to print any desired decoration even at the centre of the plate.

In case the operator handling the plates should omit, during the operation of the machine, to place a plate on disc 18 in due time, the rocking of levers 79—81 caused by the increase of the distance between discs 18 and 77 would be continued beyond that which normally takes place when plates 83 come to rest against the edges of a plate laid on disc 18. The spacing between discs 18 and 77 would then become large enough for rod 98 to be lowered by the action of levers 85—87 and 90—92, thereby allowing nose 107 of lever 104, acted upon by spring 106, to come on the path of stop 108. Lever 67 would be held fast in spite of the fact that roller 69 is released by cam 70 thus impeding the lowering of square shaft 22. In this manner, squeegee 33 cannot be brought into contact with stencil 113 and during the sweeping movement carried out by said squeegee, the latter cannot cause the passage of the ink or varnish through the stencil, thus avoiding the spoiling of disc 18.

The described machine can be used for the transfer of any decorations on plates, dishes, saucers or like articles with a circular, substantially plane surface and of any diameter under the condition that chains 29 are available the lengths of which are equal to the diameters of the surfaces which are to be printed.

Said chains of various lengths may be set in the desired position owing to the slots provided in cranks 23 and 27. Discs 64 and 64a corresponding to the desired diameter and plates 83 having the desired size or shape in order to encompass the article to be printed should also be available. If necessary, it is also possible to change disc 18 with the levers which it carries for adapting it to the size and shape of the article to be printed. All these modifications can be carried out readily and rapidly when the necessary spare parts are available. The strokes of rod 15 and of square shaft 22 can also be modified by moving collars 14 and screwing or unscrewing set screw 25 for adapting said strokes to the thickness of the article to be decorated.

What I claim is:

1. In a silk screen printing device for printing on a circular surface of an object, a silk-screen stencil, means for supporting said stencil in a substantial horizontal plane, means for supporting the object to be printed and means for applying the circular surface of said object which is to be printed under said stencil, a flexible squeegee cooperating with said stencil, the length of said squeegee being substantially equal to the diameter of said circular surface, horizontally flexible and vertically rigid supporting means for said squeegee, having approximately the same length as said squeegee, means for holding one end of said squeegee supporting means at a fixed point above the periphery of said circular surface in the object supporting means, means for guiding the other end of said squeegee supporting means along a part of the periphery of said circular surface, extending on both sides of a point diametrically opposed to the above mentioned fixed point, and means for causing said squeegee to take an arcuate position following part of the periphery of said circular surface and to pass from said position to a symmetrical position with respect to the diameter of said circular surface which passes through the above mentioned fixed point.

2. In a silk screen printing device for print-

ing on a circular surface of an object, a silk-screen stencil, means for supporting said stencil in a substantially horizontal plane, means for supporting the object to be printed and means for applying the circular surface of said object which is to be printed under said stencil, a flexible squeegee cooperating with said stencil, the length of said squeegee being substantially equal to the diameter of said circular surface, horizontally flexible and vertically rigid supporting means for said squeegee, having approximately the same length as said squeegee, a supporting member carried by the stencil supporting means and holding one end of said squeegee supporting means, at a fixed point above the periphery of said circular surface in the object supporting means, a rotatable shaft arranged vertically above the center of said circular surface in the object supporting means and above the screen, a crank arm extending laterally from said rotatable shaft and rigidly connected to said rotatable shaft, means for securing the other end of said squeegee supporting means on said crank arm, at a distance of the axis of said shaft substantially equal to the radius of said circular surface, and means for causing said squeegee to take an arcuate position following part of the periphery of said circular surface and to pass from said position to a symmetrical position with respect to the diameter of said circular surface which passes through the above mentioned fixed point.

3. In a silk screen printing device for printing on a circular surface of an object, a silk-screen stencil, means for supporting said stencil in a substantially horizontal plane, means for supporting the object to be printed and means for applying the circular surface of said object which is to be printed under said stencil, a flexible squeegee cooperating with said stencil, the length of said squeegee being substantially equal to the diameter of said circular surface, horizontally flexible and vertically rigid supporting means for said squeegee, having approximately the same length as said squeegee, a rod arranged vertically above the center of said circular surface in the object supporting means, said rod being longitudinally, slidably mounted in a support rigid with the stencil supporting means, but incapable of rotating in said support, an arm extending laterally from said rod, means for securing one end of said squeegee supporting means on said arm, an axial boring in said rod, a shaft rotatably mounted in said boring and axially fixed with respect to said rod, a crank arm extending laterally from said rotatable shaft and rigidly connected to said rotatable shaft, means for securing the other end of said squeegee supporting means on said crank arm, at a distance of the axis of said shaft substantially equal to the radius of said circular surface, and means for causing said squeegee to take an arcuate position following part of the periphery of said circular surface and to pass from said position to a symmetrical position with respect to the diameter of said circular surface which passes through the above mentioned fixed point.

4. In a silk screen printing device for printing on a circular surface of an object, a silk-screen stencil, means for supporting said stencil in a substantially horizontal plane, means for supporting the object to be printed and means for applying the circular surface of said object which is to be printed under said stencil, a flexible squeegee cooperating with said stencil, the

length of said squeegee being substantially equal to the diameter of said circular surface, a chain formed of links connected to one another by means of vertical trunnions, the lower ends of said trunnions being arranged to support said squeegee, whereby a horizontally flexible and vertically rigid supporting means are provided for said squeegee, said chain having approximately the same length as said squeegee, means for holding one end of said chain at a fixed point above the periphery of said circular surface in the object supporting means, means for guiding the other end of said chain along a part of the periphery of said circular surface, extending on both sides of a point diametrically opposed to the above mentioned fixed point and means for causing said squeegee to take an arcuate position following part of the periphery of said circular surface and to pass from said position to a symmetrical position with respect to the diameter of said circular surface which passes through the above mentioned fixed point.

5. In a silk screen printing device for printing on a circular surface of an object, a silk-screen stencil, means for supporting said stencil in a substantially horizontal plane, means for supporting the object to be printed and means for applying the circular surface of said object which is to be printed under said stencil, a flexible squeegee cooperating with said stencil, the length of said squeegee being substantially equal to the diameter of said circular surface, a chain formed of links connected to one another by means of vertical trunnions, the lower ends of said trunnions being arranged to support said squeegee, whereby a horizontally flexible and vertically rigid supporting means are provided for said squeegee, said chain having approximately the same length as said squeegee, a rod arranged vertically above the center of said circular surface in the object supporting means, said rod being longitudinally, slidably mounted in a support rigid with the stencil supporting means, but incapable of rotating in said support, an arm extending laterally from said rod, means for adjustably securing one end of said chain on said arm, an axial boring in said rod, a shaft rotatably mounted in said boring and axially fixed with respect to said rod a crank arm extending laterally from said rotatable shaft and rigidly connected to said rotatable shaft, means for adjustably securing the other end of said chain on said crank arm, and means for causing said squeegee to take an arcuate position following part of the periphery of said circular surface and to pass from said position to a symmetrical position with respect to the diameter of said circular surface which passes through the above mentioned fixed point.

6. In a silk screen printing device for printing on a circular surface of an object, a silk-screen stencil, means for supporting said stencil in a substantially horizontal plane, means for supporting the object to be printed and means for applying the circular surface of said object which is to be printed under said stencil, a flexible squeegee cooperating with said stencil, the length of said squeegee being substantially equal to the diameter of said circular surface, horizontally flexible and vertically rigid supporting means for said squeegee, having approximately the same length as said squeegee, means for holding one end of said squeegee supporting means at a fixed point above the periphery of said circular surface in the object supporting means, means for

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guiding the other end of said squeegee supporting means along a part of the periphery of said circular surface, extending on both sides of a point diametrically opposed to the above mentioned fixed point, a fork-like member having two branches extending one on each side of said squeegee supporting means and rotatably mounted on a vertical shaft, a circular member arranged on each said branches of said fork-like member in the same horizontal plane as the squeegee supporting means, the diameter of said circular member being substantially equal to that of said circular surface, said circular member being centered on a circular line passing above the center of said circular surface and the center of which is on the axis of said vertical shaft of said fork-like member, and means for communicating a reciprocating movement to said fork-like member about said vertical shaft.

7. In a silk screen printing device for printing on a circular surface of an object, a silk-screen stencil, means for supporting said stencil in a substantially horizontal plane, means for supporting the object to be printed and means for applying the circular surface of said object which is to be printed under said stencil, a flexible squeegee cooperating with said stencil, the length of said squeegee being substantially equal to the diameter of said circular surface, a chain formed of links connected to one another by means of vertical trunnions, the lower ends of said trunnions being arranged to support said squeegee, whereby a horizontally flexible and vertically rigid supporting means are provided for said squeegee, said chain having approximately the same length as said squeegee, a rod arranged vertically above the center of said circular surface in the object supporting means, said rod being longitudinally, slidably mounted in a support rigid with the stencil supporting means, but incapable of rotating in said support, an arm extending laterally from said rod, means for adjustably securing one end of said chain on said arm, an axial boring in said rod, a shaft rotatably mounted in said boring and axially fixed with respect to said rod a crank arm extending laterally from said rotatable shaft and rigidly connected to said rotatable shaft, means for adjustably securing the other end of said chain on said crank arm, a fork-like member having two branches extending one on each side of said chain and rotatably mounted on a vertical shaft, a circular member arranged on each said branches of said fork-like member, in the horizontal mean plane of said chain, the diameter of said circular member being substantially equal to that of said circular surface, said circular member being cen-

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tered on a circular line passing above the center of said circular surface and the center of which is on the axis of said vertical shaft of said fork-like member, and means for communicating a reciprocating movement to said fork-like member about said vertical shaft.

8. In a silk screen printing device for printing on a circular surface of an object, a silk-screen stencil, means for supporting said stencil in a substantially horizontal plane, means for supporting the object to be printed and means for applying the circular surface of said object which is to be printed under said stencil, a flexible squeegee cooperating with said stencil, the length of said squeegee being substantially equal to the diameter of said circular surface, a chain formed of links connected to one another by means of vertical trunnions, the lower ends of said trunnions being arranged to support said squeegee, whereby a horizontally flexible and vertically rigid supporting means are provided for said squeegee, said chain having approximately the same length as said squeegee, a rod arranged vertically above the center of said circular surface in the object supporting means, said rod being longitudinally, slidably mounted in a support rigid with the stencil supporting means, but incapable of rotating in said support, an arm extending laterally from said rod, means for adjustably securing one end of said chain on said arm, an axial boring in said rod, a shaft rotatably mounted in said boring and axially fixed with respect to said rod a crank arm extending laterally from said rotatable shaft and rigidly connected to said rotatable shaft, means for adjustably securing the other end of said chain on said crank arm, a fork-like member having two branches extending one on each side of said chain and rotatably mounted on a vertical shaft, a circular member arranged on each said branches of said fork-like member in the horizontal mean plane of said chain, the diameter of said circular member being substantially equal to that of said circular surface, said circular member being centered on a circular line passing above the center of said circular surface and the center of which is on the axis of said vertical shaft of said fork-like member, a driving motor, a shaft driven by said motor, a first cam on said shaft, arranged for communicating a reciprocal movement to said fork-like member about its shaft, and a second cam on said motor driven shaft, cooperating with a lever attached to the above mentioned vertically slidable rod.

LOUIS GILBERT DUBUIT.

No references cited.