July 4, 1939. F. R. FORD 2,164,707

DUPLICATING MACHINE

Filed Sept. 21, 1937 5 Sheets-Sheet 1

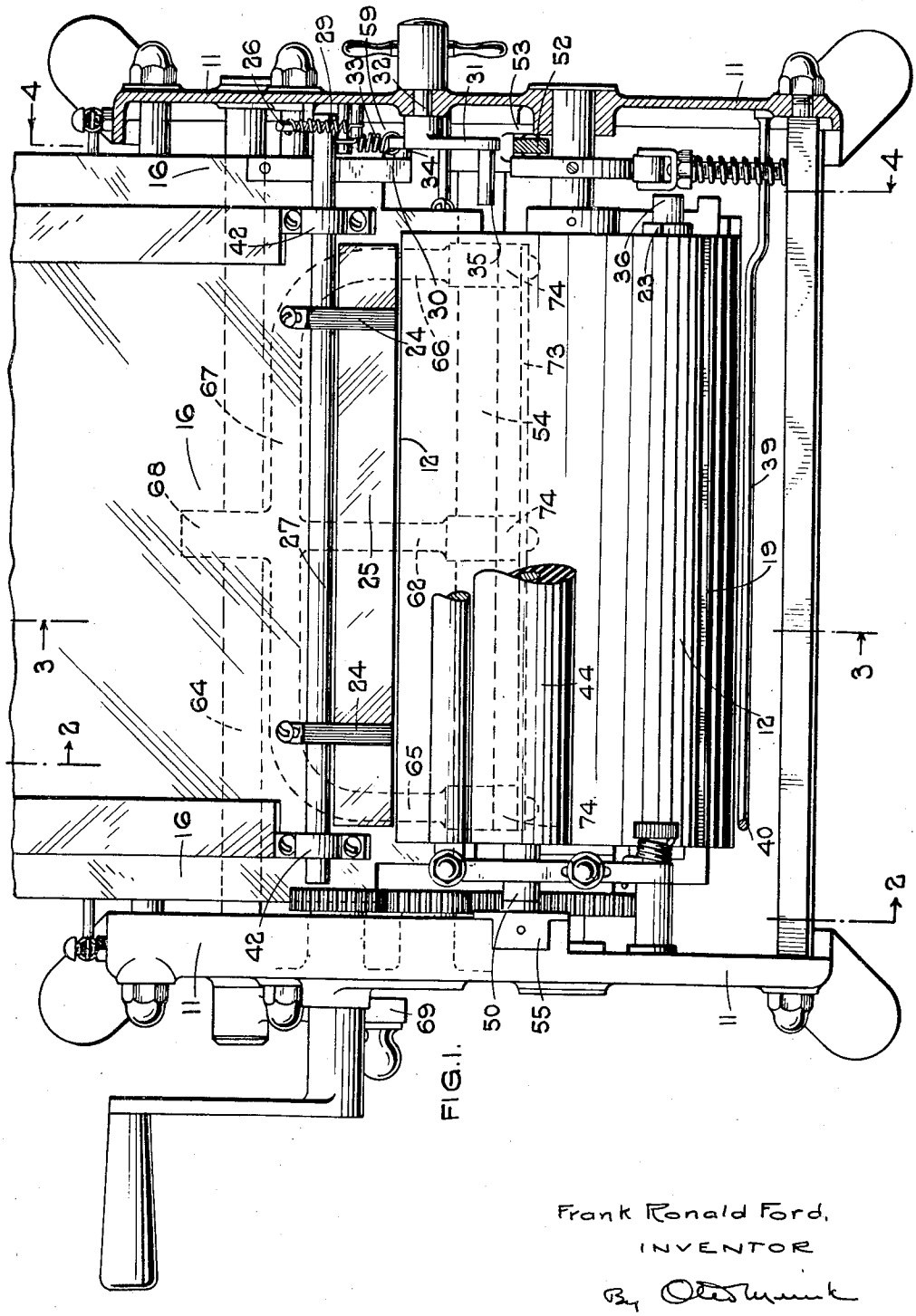



FIG. 1.

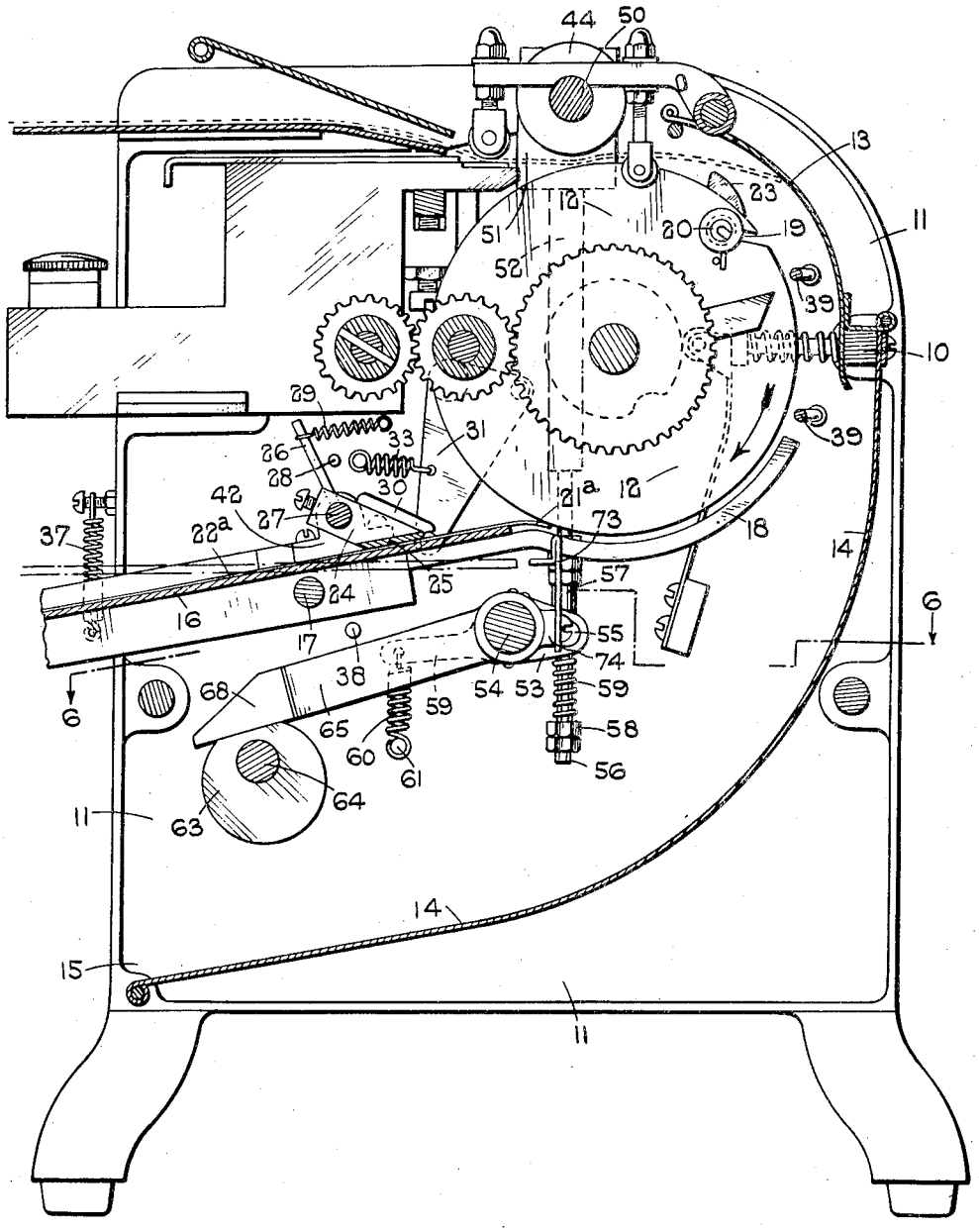
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DUPLICATING MACHINE

Filed Sept. 21, 1937 5 Sheets-Sheet 2

FIG. 2.



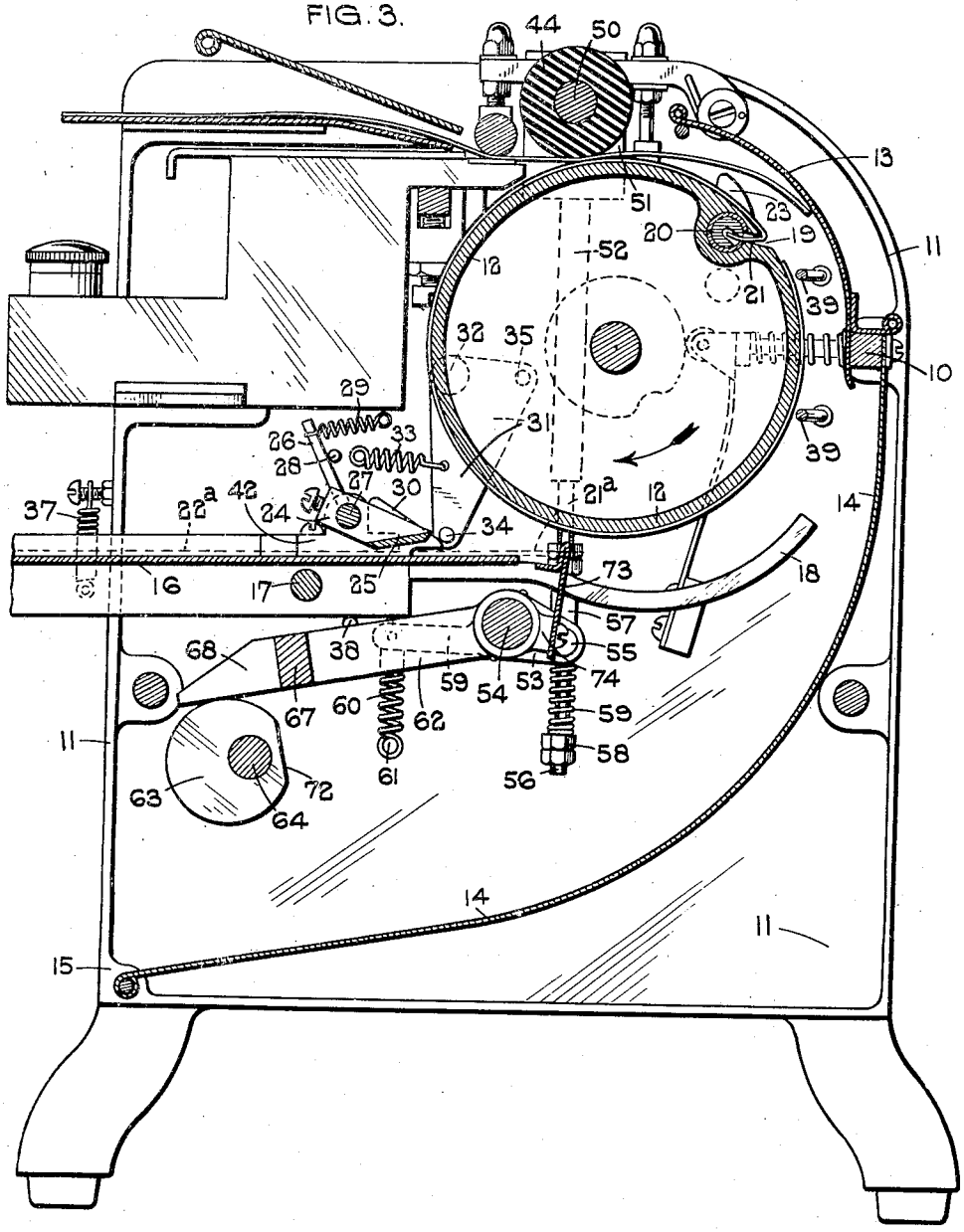

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DUPLICATING MACHINE

Filed Sept. 21, 1937 5 Sheets-Sheet 3

FIG. 3.




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DUPLICATING MACHINE

Filed Sept. 21, 1937 5 Sheets-Sheet 4

FIG. 4.

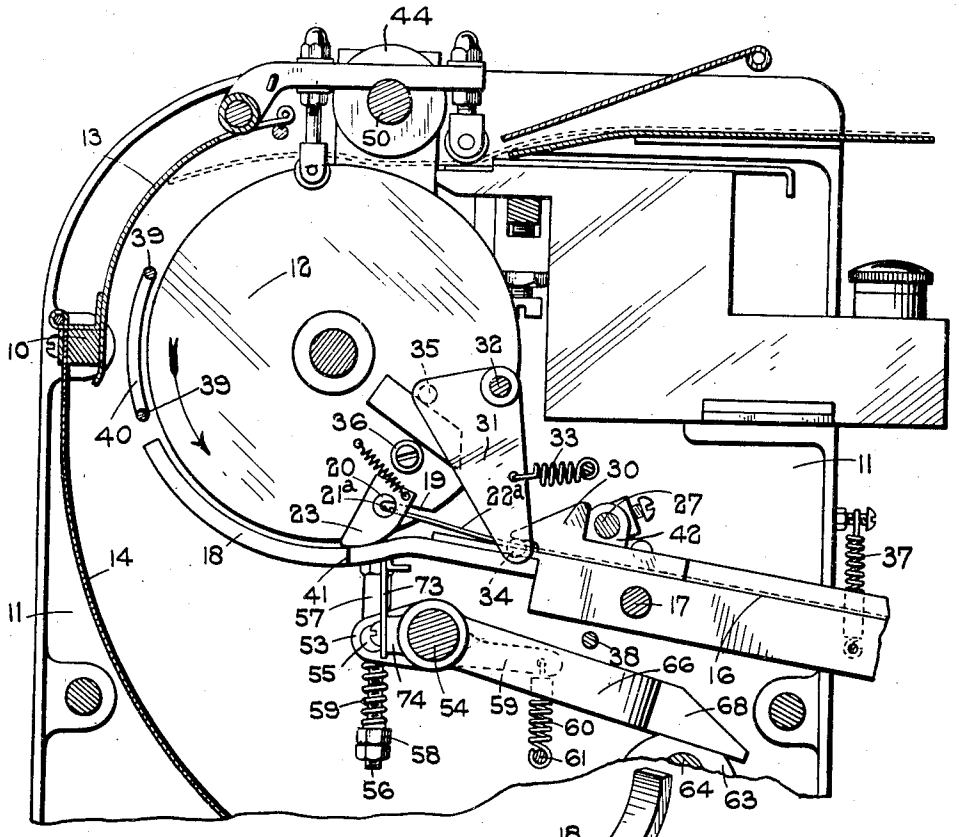
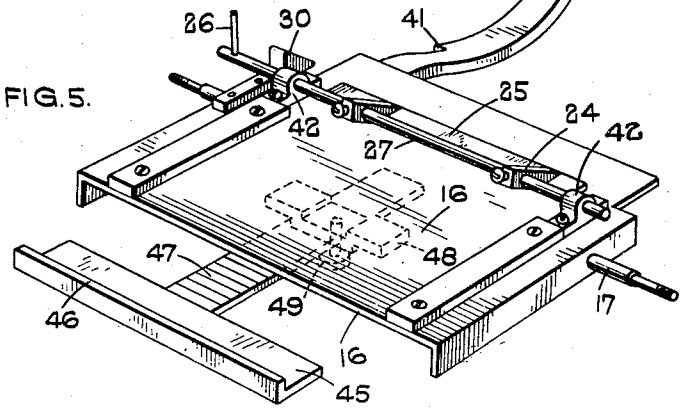



FIG. 5.




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July 4, 1939. F. R. FORD 2,164,707

DUPLICATING MACHINE

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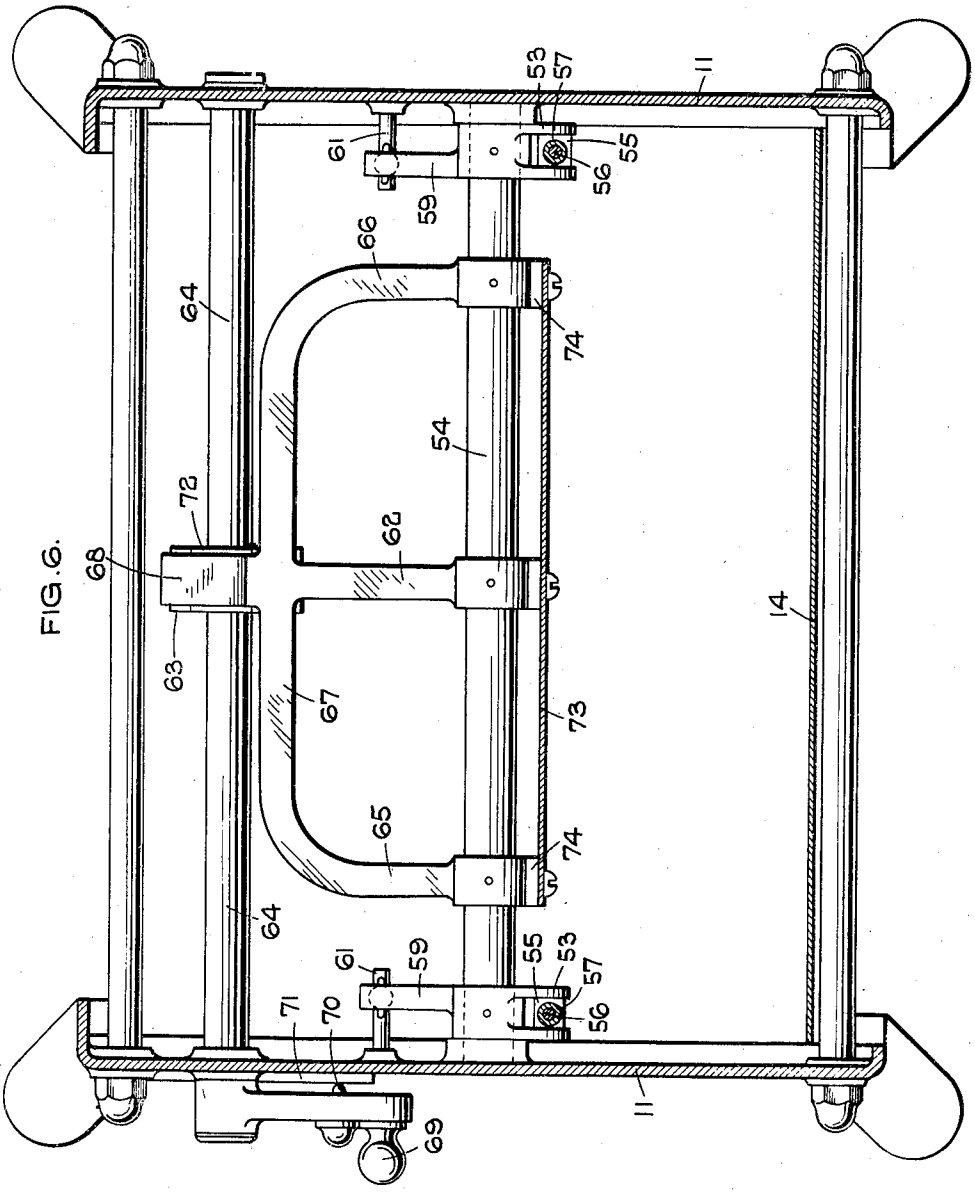



FIG. 6.

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Patented July 4, 1939 2,164,707

# UNITED STATES PATENT OFFICE

2,164,707

## DUPLICATING MACHINE

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Application September 21, 1937, Serial No. 164,864
In Great Britain September 24, 1936

7 Claims. (Cl. 101—132)

This invention relates to duplicating machines of the kind wherein the sheets upon which the copies are to be made are fed into the machine and brought into pressure contact with the matter from which the copy is to be made, and then delivered from the machine.

The invention is, for instance, particularly applicable to machines of the type described in specification No. 2,048,543, wherein the matter to be copied is typed or otherwise marked on a master sheet with a carbon sheet bearing copying ink or the like at the back, so that the written matter appears on the back of the master sheet in reverse, this master sheet being mounted on a cylinder above which is a pressure roller, the copy sheets being moistened and fed between the pressure roller and the master sheet on the cylinder.

In such machines, where the pressure roller is disposed above the cylinder, the written matter on the master sheet is reproduced on the undersides of the copy sheets so that normally the latter are delivered from the machine face downwards.

One of the objects of the present invention is to provide means whereby the sheets will be delivered from the machine with the writing on the upper side, so that it can be seen by the operator.

Another object of the present invention is to improve the construction of the machine whereby the act of removing a master sheet from the cylinder and mounting a fresh one thereon is greatly simplified.

In machines of the type described in the aforesaid prior specification, the pressure roller is adjustable towards or away from the cylinder to permit regulation of the pressure exerted on the copy sheets as they pass between said roller and the cylinder.

A third object of the present invention is to ensure that an even pressure is obtained along the whole length of the roller.

One feature of the present invention consists in the provision of a guide extending around the back of, and beneath, the cylinder, said guide being spaced away from said cylinder, so that the copy sheets as they leave the latter are guided first downwardly and then forwardly, being thereby turned over and delivered with the writing uppermost.

According to another feature of the present invention, the apparatus comprises means for holding a master sheet with its edge portion presented substantially tangentially to the cylinder surface, a movable cam capable of being brought to and retained in an operative position within the orbit of the operating member of the clip on the cylinder, so that rotation of the cylinder automatically unfastens the clip and keeps it unfastened for a portion of the revolution of the cylinder, and means for moving and retaining the cam into and out of its operative position.

The apparatus may further include means for resisting backward movement of the master sheet when the clip on the cylinder has been opened and the motion of the cylinder is reversed.

According to a third feature of the present invention, the distance between the axes of the pressure roller and cylinder is controlled through the medium of a shaft which is movable angularly by means of an operating lever attached to said shaft intermediate the ends of the latter, so that when said lever is operated both of said ends will be rocked substantially to the same extent.

Referring to the drawings:

Figure 1 is a plan view partly in section and with the tank removed of a machine constructed in accordance with the present invention.

Figure 2 is a section on line 2—2 of Figure 1.

Figure 3 is a section on line 3—3 of Figure 1.

Figure 4 is a section on line 4—4 of Figure 1.

Figure 5 is a perspective view of the tray for supporting the master sheet.

Figure 6 is a section on line 6—6 of Figure 2.

In the drawings the machine includes a bar 10 extending from one side frame 11 of the machine to the other, this bar being placed at the back of the cylinder 12 and approximately on a level with the axis thereof. The bar 10 is spaced away from the surface of the cylinder and it serves as a support for upper and lower members 13 and 14 constituting the guide for the copy sheets.

The upper member 13 of the guide consists of a curved plate substantially concentric with the surface of the cylinder, and its lower part is hinged to the said bar 10. Its upper part may receive support from suitable stops or projections on the side frames. The arrangement is such that this plate can be swung on its hinge away from the cylinder so that easy access can be allowed thereto.

The lower plate 14 forming the second part of the guide is fixed to the outer side of the bar 10 and forms a continuation of the curve of the upper plate 13 extending downwardly and forwardly to the delivery point 15.

The pressure roller is shown at 44 and is disposed above the cylinder 12. The master sheet is clamped to the surface of the cylinder 12 with

the matter to be reproduced on the outer side. When the copy sheets are passed between the plate 14 and the cylinder 12, the copies are made on the undersides of the copy sheets. As the copy sheets leave the cylinder, their leading edges come into contact with the upper part 13 of the guide and are directed downwardly. Subsequently the copy sheets come into contact with the part 14 of the guide and are thereby inverted and brought forwardly to the delivery point 15 with the matter which has been produced thereon disposed upwardly.

A tray 16 is pivoted on a spindle 17 secured to the side frames 11 of the machine, and at its inner edge and at one side the tray is provided with a cam 18 which takes the form of a rigid strip of metal which is curved to a somewhat larger radius than that of the master cylinder 12.

The master cylinder 12 is provided with a longitudinal slot 19 in which is situated a pivoted mechanical clip 20 for holding the leading edge 21 of a master sheet 22, and this clip is normally spring-closed, but at one end of the cylinder a lever 23 is provided by which the clip may be opened against spring pressure.

This lever 23 projects beyond the periphery of the cylinder 12, so that when the cylinder is rotated and the cam 18 carried by the tray is in its operative position, the lever 23 is rocked by contact with the cam so that the clip 20 in the cylinder slot is opened and is kept open for an appreciable part of a revolution of the cylinder 12.

The tray 16, which is pivoted to the side frames of the machine and is adapted to carry the master sheet, is provided with a spindle 27 extending across and above its surface and mounted in bearings 42 on the tray, and this spindle carries a pair of retaining levers 24 carrying a strip 25 which is capable of moving downwardly to grip a master sheet on the tray.

The tray 16 has two main positions. In the initial position (see Figure 3) it is substantially horizontal, and the cam 18 carried by it is spaced away from the orbit of the operating lever 23 of the cylinder clip. In this position the cylinder can be rotated without its clip 20 being opened.

The spindle 27 carrying the levers 24 is provided with an arm 26 which is acted upon by a spring 29 tending to press the strip 25 against the tray 16. When, however, the tray 16 is moved to the position shown in Figure 3, the cam 18 being then inoperative, the arm 26 comes up against a stud 28 on the adjacent side frame 11, so that the surface of the tray 16 moves clear of the strip 25.

Thus, if a master sheet is placed on the tray when in its initial position, it is not held there by the strip 25 but if, after placing the master sheet on the tray, the tray is moved into its operative position by pressing the edge nearest the operator downwardly, then the strip 25 grips the master sheet under pressure of the spring 29.

At its inner edge, i. e. the edge adjacent the cylinder, and on the same side as that where the cam 18 is situated, the tray is provided with an upwardly projecting bracket 30. On the inner side of the side frame of the machine adjacent this bracket 30 is a catch 31 pivoted at 32 and acted upon by a spring 33, and this catch is provided with a laterally projecting catch pin 34 which is adapted to ride under the bracket 30 on the tray when the tray is tilted or moved into its operative position, as already described. This catch acts so as to retain the tray in its operative position when the edge nearest the operator is pressed downwardly.

The catch 31 is also provided with a laterally extending release pin 35, and the master cylinder is provided with an axially projecting member 36 which may be a roller fixed on its one end which, when the master cylinder reaches a predetermined position, engages the release pin 35 on the catch 31 and rocks the catch so that its catch pin 34 is moved clear of the bracket 30, thus allowing the tray to return to its normal or inoperative position under tension of a spring 37, the tray coming to rest on a stud 38 fixed in the side frame.

The clip 20 in the cylinder slot which is to hold the master sheet is opened while the tray 16 is still in its operative position, and it remains open for a considerable period. The clip is closed when the operating lever 23 of the clip moves clear of the cam 18, and actually the clip 20 is timed to close simultaneously with, or just before, the release of the tray, so that the forward part of the master sheet is gripped by the clip 20 in the cylinder at the same moment as, or just before, the sheet is released by the strip 25 on the tray. The operative part of the cam 18 terminates at a lateral shoulder 41.

At the back of the master cylinder I provide a pair of horizontal bars 39 which may be formed as part of a wire frame 40 carried by one of the side frames of the machine. These bars 39 are situated parallel to the axis of the cylinder and just clear of its surface.

In order to ensure that the leading edge 21*a* of a new master sheet 22*a*, which it is desired to insert, will be disposed in the correct relationship to the periphery of the master cylinder, an adjustable gauge 45 is provided on the tray. This gauge is provided with a lip 46 and a shank 47. Beneath the tray 16 a bridge-like guide piece 48 is provided, and the shank 47 slides between the centre part of this member 48 and the underside of the tray. A set screw 49 is provided in the member 48 for locking the shank 47 in any desired position.

The master sheets will usually be one of the well known standard sizes, such as foolscap or quarto, and the shank 47 is marked on the upper surface so that the operator can determine the correct position of the gauge for the particular master sheet to be used. The master sheet 22*a* is placed on the tray with the back edge against the lip 46 and when in this position, the leading edge 21*a* will automatically be disposed in the correct relationship to the periphery of the master cylinder.

The arrangement is such that when it is desired to change the master sheet, the new master sheet 22*a* is first placed on the tray and the tray is then tilted into its operative position so that the new master sheet 22*a* is held on the tray by the strip 25. The moving of the tray into the operative position brings the cam 18 into its operative position, so that, after a part of the revolution of the cylinder 12, the clip 20 which holds the original master sheet 22 on the cylinder is automatically opened. The slot 19 in the master cylinder is now directed substantially downwards, and if the cylinder is now given a short backward turn, the upward motion of the master sheet 22 is arrested by the bars 39, so that the leading edge 21 of said sheet automatically drops out of the cylinder slot 19, and the sheet 22 falls away below the machine into a tray provided for its reception.

The rotation of the cylinder is now continued in the normal direction until the slot 19 in the cylinder picks up the leading edge 21a of the new master sheet 22a on the tray 16 which, it will be remembered, is disposed tangentially against the surface of the cylinder. This edge 21a of the sheet 22a passes into the slot 19 and beneath or into the clip member situated therein, and in due course this clip member turns or closes on to the edge 21a of the master sheet 22a, the tray is released from its operative position, and in passing back to its normal position, the strip 25 associated with the tray is released from the sheet 22a. Continued operation of the cylinder 12 causes the new master sheet 22a to become automatically wound around its circumference, and of course, subsequent rotations of the cylinder can take place without the operating member 23 of its clip coming into contact with the cam, because the cam carried by the tray has now been moved into its inoperative position.

The ends of the spindle 50 of the pressure roller 44 engage in bearings 51 which are slidably mounted on the side frames 11 of the machine so that they can be moved towards or away from the axis of the cylinder 12.

Each of the bearings 51 is connected by a downwardly-extending rod 52 to a crank arm 53 on a control shaft 54 disposed transversely of the machine, the crank arms 53 being arranged at the ends of the shaft 54 immediately adjacent the side frames 11.

The ends of the arms 53 may be forked, and their connections to the rods 52 are preferably similar to those described in specification No. 2,048,543 aforesaid, that is to say, each crank arm may carry a swivelling crank pin 55 through which the threaded end 56 of the rod 52 passes transversely and which is disposed between nuts 57, 58 thereon. A compression spring 59 may be interposed betwen the crank pin 55 and the lower nut 58.

In the arrangement shown each crank arm 53 forms part of a rocking lever, the other arm 59 of which is acted upon by a tension coil spring 60 connected to a peg 61 on the adjacent side frame 11 of the machine.

The control shaft 54 is operated by means of a centrally disposed lever 62 extending in a direction substantially opposite to the crank arms 53, this lever 62 being actuated by a cam 63 on a shaft 64 running parallel to the control shaft 54.

Instead of, or in addition to, the lever 62, the shaft 54 may have two or more levers at spaced positions along its length. For example, in the arrangement shown, two auxiliary levers 65, 66 are mounted on the shaft 54 at opposite sides of the central lever 62 and equidistant therefrom, the three levers 65, 62, 66 all extending into the same direction and having their free ends connected by an integral bar 67 formed or provided with a projecting lug 68 on which acts the cam 63 aforesaid.

It will be understood that the control shaft 54 may carry any other suitable arrangement of spaced operating levers, for the purpose of ensuring that both of its ends are rocked to exactly the same extent.

The shaft 64 carrying the cam 63 is extended through one of the side frames 11 of the machine and is provided with a crank handle 69 by means of which it may be turned to any desired angular position.

Projecting from the inner side of this crank handle 69 is a spring-loaded pin 70 which is adapted to enter any one of a series of recesses formed in an external quadrant 71 on the adjacent side frame 11, so as to retain the handle 69 in any position to which the latter may be adjusted.

In using the mechanism above described, the handle 69 may first be moved in one direction substantially to the full extent of its travel, so as to raise the pressure roller 44 clear of the cylinder 12 as shown whilst a master sheet is being secured to the latter.

After attachment of the master sheet, the handle 69 is turned in the opposite direction to bring the pressure roller 44 down into contact with the cylinder 12 or the master sheet thereon, and the required degree of pressure between the roller 44 and cylinder 12 is imparted by suitable adjustment of the handle. The above mentioned recesses in the quadrant 71 may be numbered, and the operator may be instructed as to the correct adjustment for various classes of work and thicknesses of paper.

The cam 63 on the shaft 64 may be provided with one or more flats 72 for engaging the lug 68 on the bar 67 which connects the operating levers 65, 62, 66 carried by the control shaft 54. When two such flats are provided, one of these may be in engagement with the lug 68 when the presure roller 44 is definitely clear of the cylinder 12, whilst the other may come into operation when the roller 44 is in contact with the cylinder 12 but exerting minimum pressure thereon.

An upstanding plate 73 may be attached to lugs 74 on the shaft 54 so as to serve as a stop for positioning the leading edge 21a of the new master sheet 22a when the latter is placed on the tray 16, movement of the tray to its operative position raising the edge 21a of the sheet 22a above the level of the plate 73.

What I claim then is:

1. A duplicating machine comprising a stationary frame, a rotatable cylinder, attachment means on said cylinder for one edge of a master sheet, a roller co-operating with said cylinder and adapted to bring a moistened copy sheet into pressure contact with the master sheet on said cylinder, a transverse bar disposed behind and spaced from said cylinder and forming part of said frame, a guide plate hinged to said bar and extending upwardly therefrom, and a second guide plate also attached to said bar and extending first downwardly therefrom and then forwardly, said guide plates collectively serving to deliver sid copy sheet from the machine face upwards.

2. A duplicating machine comprising a stationary frame, a rotatable cylinder, a mechanical clip on said cylinder adapted when open to receive the edge of a master sheet and when closed to secure same to said cylinder, said clip being biased to the closed position, a tray adapted to support a master sheet with one edge presented substantially tangentially to the surface of said cylinder, said tray being so arranged that a master sheet thus presented automatically enters said clip when the latter is open, an actuating member associated with said clip and projecting beyond the periphery of said cylinder, a cam member fixed to said tray, said tray being biased to a position in which said cam member is outside the orbit of said clip-actuating member and being tiltable about an axis parallel to that of said cylinder so as to bring said cam member into an operative position for engagement by said clip-actuating member, whereby said clip is opened and kept

open for a portion of a revolution of said cylinder, the clip subsequently closing, and means for automatically retaining said cam member in its operative position.

3. A duplicating machine comprising a stationary frame, a rotatable cylinder, a mechanical clip on said cylinder adapted when open to receive the edge of a master sheet and when closed to secure same to said cylinder, said clip being biased to the closed position, a tray adapted to support a master sheet with one edge presented substantially tangentially to the surface of said cylinder, said tray being so arranged that a master sheet thus presented automatically enters said clip when the latter is open, an actuating member associated with said clip and projecting beyond the periphery of said cylinder, a cam member fixed to said tray, said tray being tiltable about an axis parallel to that of said cylinder so as to bring said cam member into or out of an operative position within the orbit of said clip-actuating member, said cam member being so arranged that contact of said clip-actuating member therewith causes said clip to be opened and kept open for a portion of a revolution of said cylinder, the clip subsequently closing, means for moving said cam member into its operative position against spring action, and automatic means for retaining it in such position, said retaining means being automatically released simultaneously with or just after the closing of said clip.

4. A duplicating machine comprising a stationary frame, a rotatable cylinder, a mechanical clip on said cylinder adapted when open to receive the edge of a master sheet and when closed to secure same to said cylinder, said clip being biased to the closed position, a tray adapted to support a master sheet with one edge presented substantially tangentially to the surface of said cylinder, said tray being so arranged that a master sheet thus presented automatically enters said clip when the latter is open, an actuating member associated with said clip and projecting beyond the periphery of said cylinder, a cam member fixed to said tray, said tray being tiltable against spring action about an axis parallel to that of said cylinder so as to bring said cam member into an operative position within the orbit of said clip-actuating member, said cam member being so arranged that contact of said clip-actuating member therewith causes said clip to be opened and kept open for a portion of a revolution of said cylinder, the clip subsequently closing a catch member adapted to retain said tray tilted with said cam member in its operative position, and a striker member rotatable with said cylinder and adapted to displace said catch member so as to release said tray simultaneously with or just after the closing of said clip.

5. A duplicating machine comprising a stationary frame, a rotatable cylinder, a mechanical clip on said cylinder adapted when open to receive the edge of a master sheet and when closed to secure same to said cylinder, said clip being biased to the closed position, means for holding a master sheet with one edge presented substantially tangentially to the surface of said cylinder, said means being so arranged that a master sheet thus presented automatically enters said clip when the latter is open, an actuating member associated with said clip and projecting beyond the periphery of said cylinder, a cam member biased to an inoperative position outside the orbit of said clip-actuating member, means for moving such cam member to an operative position within said orbit for engagement by said clip-actuating member, whereby said clip is opened and kept open for a portion of a revolution of said cylinder, the clip subsequently closing, and means for automatically retaining said cam member in such operative position.

6. A duplicating machine comprising a stationary frame, a rotatable cylinder, a mechanical clip on said cylinder adapted when open to receive the edge of a master sheet and when closed to secure same to said cylinder, said clip being biased to the closed position, a tray adapted to support a master sheet with one edge presented substantially tangentially to the surface of said cylinder, said tray being so arranged that a master sheet thus presented auotmatically enters said clip when the latter is open, a gripper member cooperating with said tray and adapted to secure said master sheet thereon, an actuating member associated with said clip and projecting beyond the periphery of said cylinder, a cam member biased to an inoperative position outside the orbit of said clip-actuating member, means for moving such cam member to an operative position within said orbit for engagement by said clip-actuating member, whereby said clip is opened and kept open for a portion of a revolution of said cylinder, the clip subsequently closing, means for automatically releasing said master sheet from said gripper member simultaneously with or just after the closing of said clip, and means for automatically retaining said cam member in such operative position.

7. A duplicating machine comprising a stationary frame, a rotatable cylinder, a mechanical clip on said cylinder adapted when open to receive the edge of a master sheet and when closed to secure same to said cylinder, said clip being biased to the closed position, means for holding a master sheet with one edge presented substantially tangentially to the surface of said cylinder, said means being so arranged that a master sheet thus presented automatically enters said clip when the latter is open, an actuating member associated with said clip and projecting beyond the periphery of said cylinder, a cam member biased to an inoperative position outside the orbit of said clip-actuating member, means for moving such cam member to an operative position within said orbit for engagement by said clip-actuating member, whereby said clip is opened and kept open for a portion of a revolution of said cylinder, the clip subsequently closing, means for resisting backward movement of a master sheet carried by said cylinder when said clip has been opened and said cylinder is moved in the reverse direction, and means for automatically retaining said cam member in such operative position.

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