

Feb. 28, 1939.

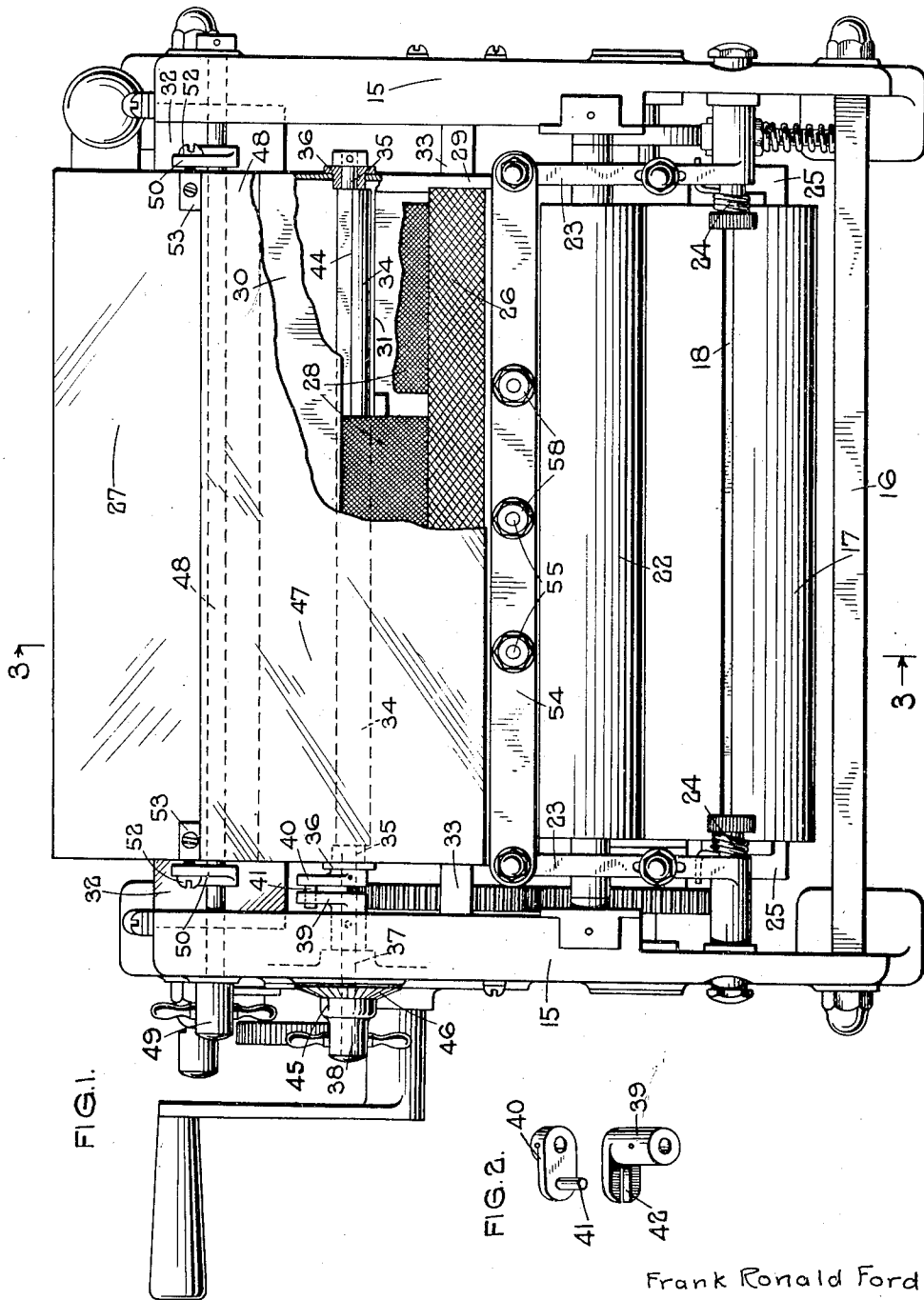
F. R. FORD

2,149,012

DUPLICATING MACHINE

Filed Oct. 9, 1937

8 Sheets-Sheet 1



Frank Ronald Ford  
INVENTOR

By *Edward Frank*  
his ATTY.

Feb. 28, 1939.

F. R. FORD

2,149,012

DUPLICATING MACHINE

Filed Oct. 9, 1937

8 Sheets-Sheet 2

FIG. 3.

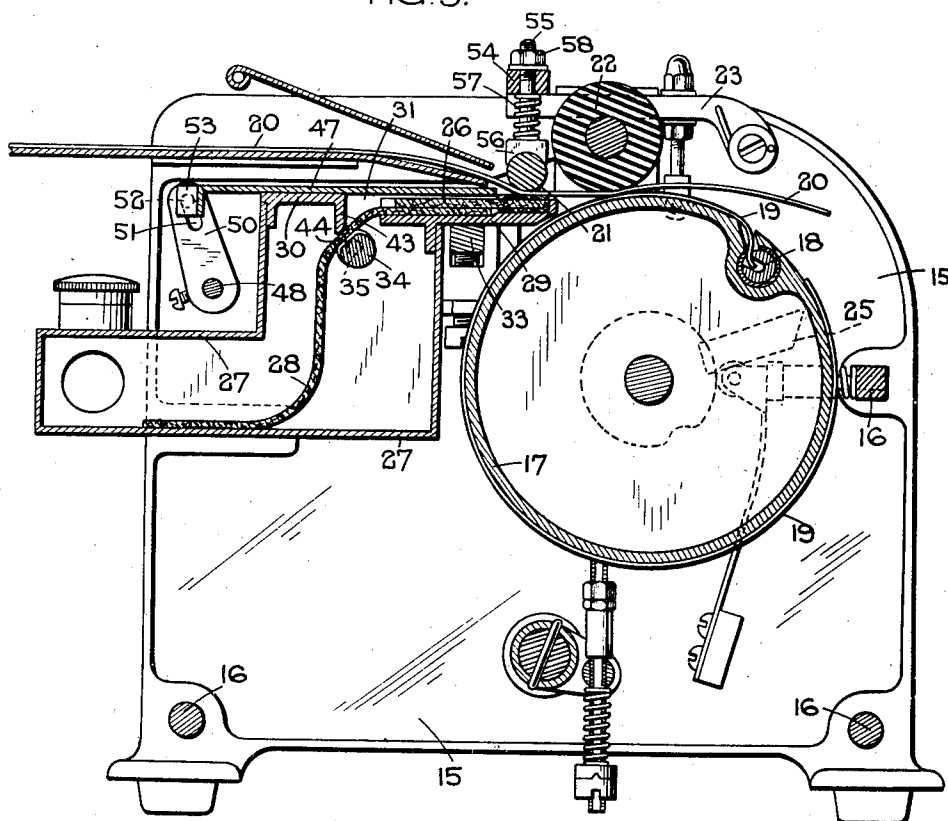
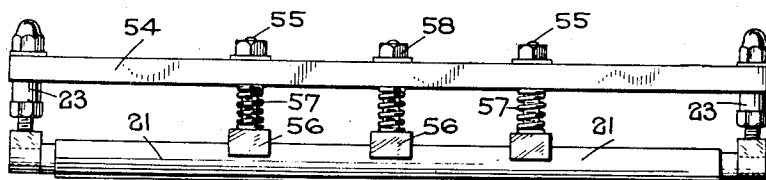


FIG. 4.



Frank Ronald Ford  
INVENTOR

By *Overman*  
his ATT'Y.

Feb. 28, 1939.

F. R. FORD

2,149,012

DUPLICATING MACHINE

Filed Oct. 9, 1937

8 Sheets-Sheet 3

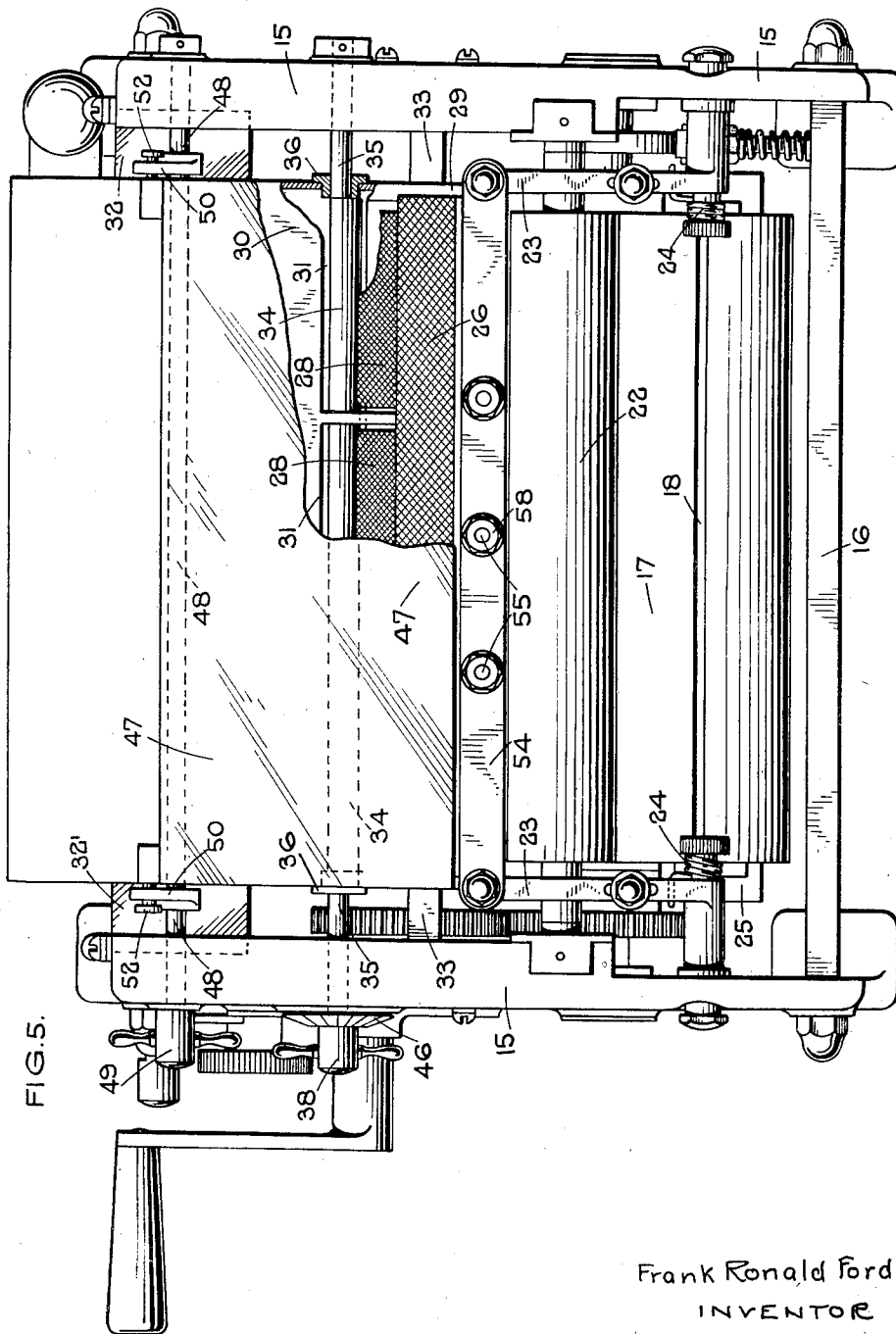


FIG. 5.

Frank Ronald Ford

INVENTOR

By *O. W. H. H. H.*

his ATTY.

Feb. 28, 1939.

F. R. FORD

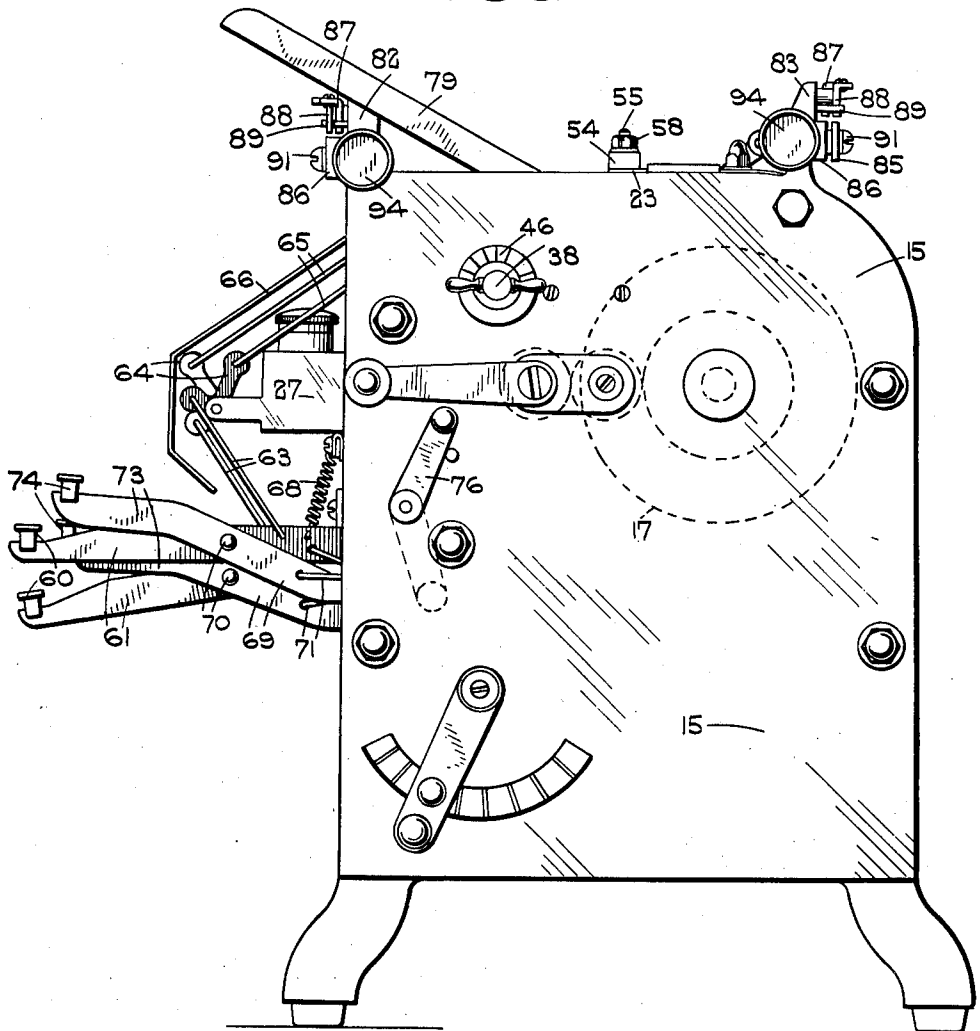
2,149,012

DUPLICATING MACHINE

Filed Oct. 9, 1937

8 Sheets-Sheet 4

FIG. 6.



Frank Ronald Ford  
INVENTOR  
By *Otto Kunk*  
his ATT'Y.

Feb. 28, 1939.

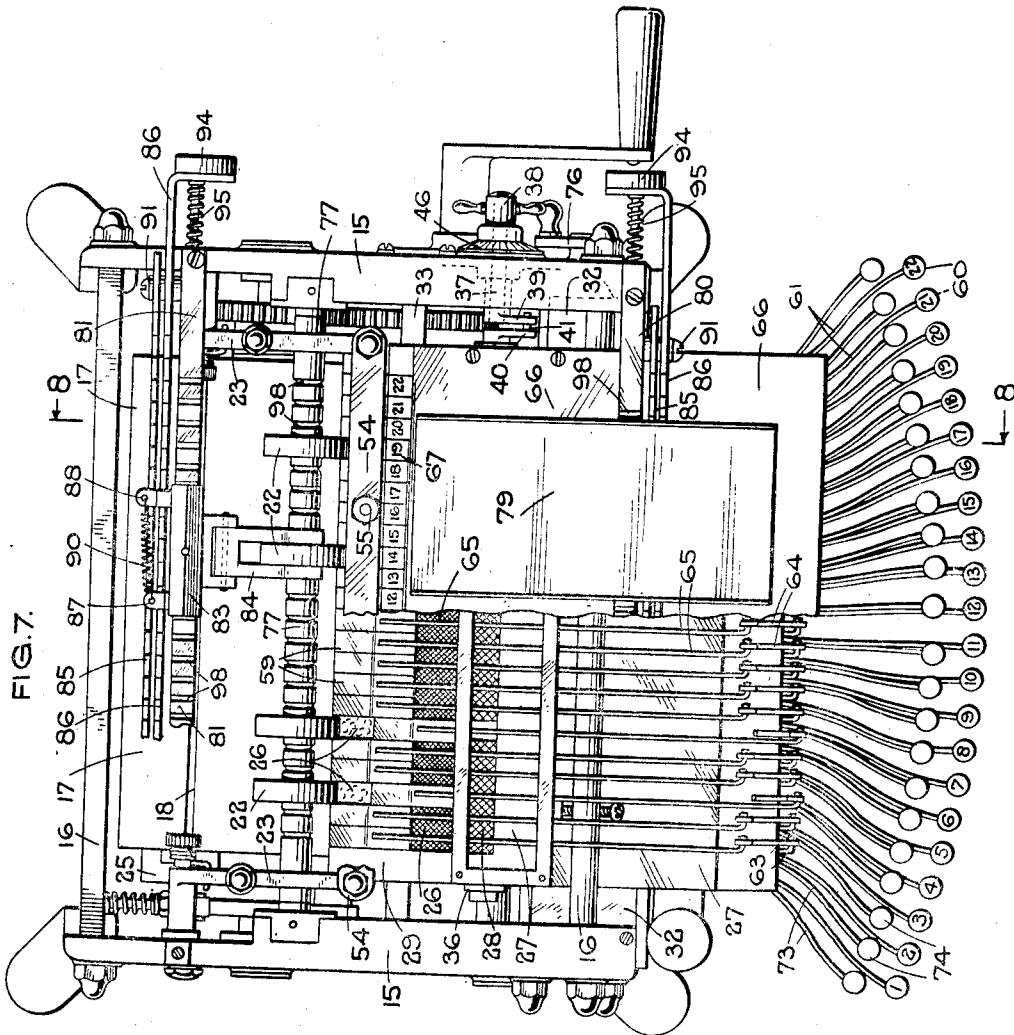
F. R. FORD

2,149,012

DUPLICATING MACHINE

Filed Oct. 9, 1937

8 Sheets-Sheet 5



Frank Ronald Ford  
INVENTOR

By *Oliver W. Mumford*  
his ATT'Y.

Feb. 28, 1939.

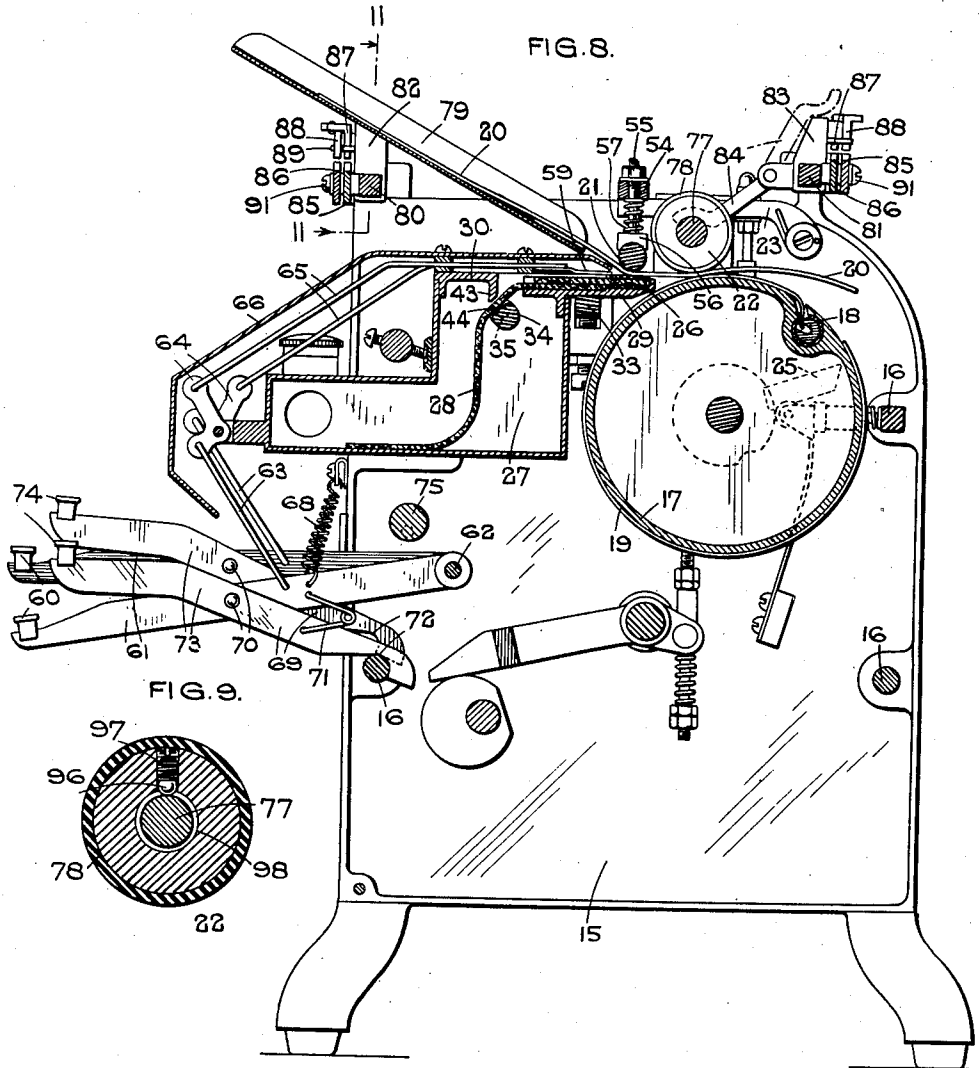
F. R. FORD

2,149,012

DUPLICATING MACHINE

Filed Oct. 9, 1937

8 Sheets-Sheet 6



Frank Ronald Ford

INVENTOR

By *O. O. O'Connell*

his ATT'Y.

Feb. 28, 1939.

F. R. FORD

2,149,012

DUPLICATING MACHINE

Filed Oct. 9, 1937

8 Sheets-Sheet 7

FIG. 11.

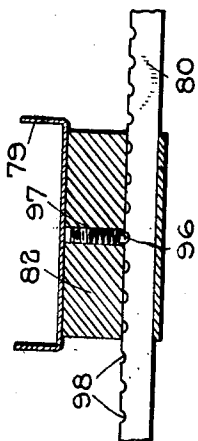
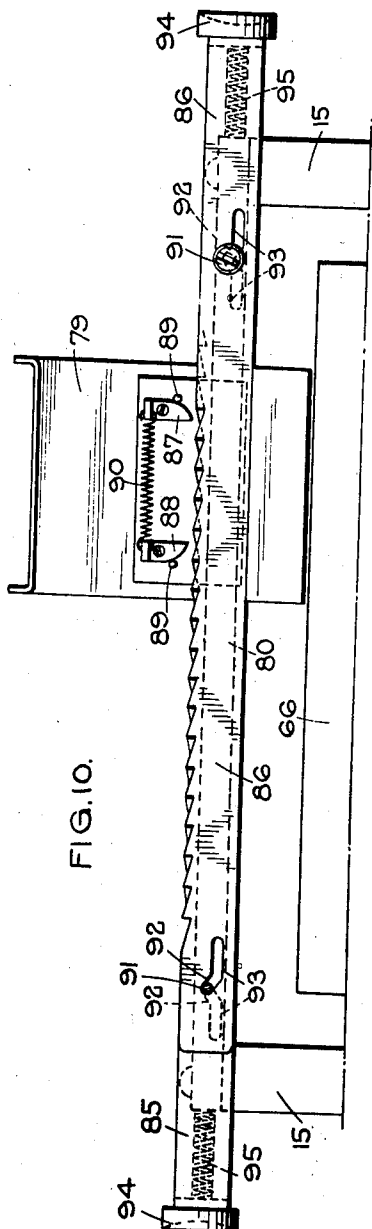


FIG. 10.



Frank Ronald Ford  
INVENTOR  
By *O. O. Oestrum*  
his ATTY.

Feb. 28, 1939.

F. R. FORD

2,149,012

DUPLICATING MACHINE

Filed Oct. 9, 1937

8 Sheets-Sheet 8

FIG. 12.

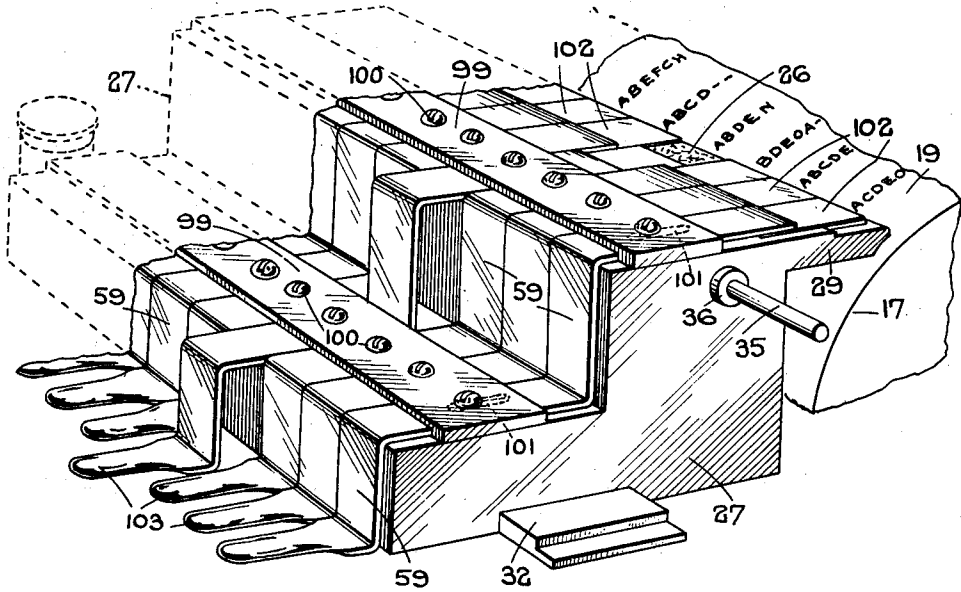
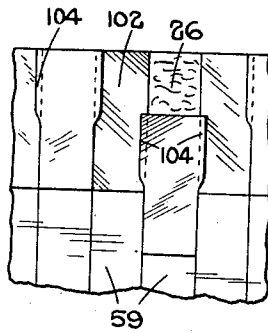


FIG. 13.



Frank Ronald Ford  
INVENTOR  
By *Otto H. ...*  
his ATT'Y.



# UNITED STATES PATENT OFFICE

2,149,012

## DUPLICATING MACHINE

Frank Ronald Ford, Small Heath, Birmingham,  
England

Application October 9, 1937, Serial No. 168,150  
In Great Britain October 14, 1936

8 Claims. (Cl. 91—38)

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 kind described in my prior 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 adjacent to which is a pressure roller, the copy sheets being moistened and fed between the pressure roller and the master sheet on the cylinder.

One of the objects of the present invention is to provide certain improvements in the moistening apparatus, whereby the passage of moistening fluid to the copy sheets or to a pad or member which moistens the copy sheets, can be controlled and regulated more accurately, and whereby the passage of moistening fluid to the moistening point can be cut off entirely when desired.

A further object of the present invention is to provide an improved construction of container and cover for the moistening fluid, whereby the cover can be more readily operated from a closed to an open position and vice versa.

A further object of the present invention is to provide for more uniform moistening across the width of the sheet.

A further object of the present invention is to provide means whereby the moistening of the copy sheets may be restricted to one or more pre-selected areas of the sheet in such a manner as to provide for line by line reproduction.

Referring to the drawings:

Figure 1 is a part-sectional plan view of a duplicating machine embodying the present invention.

Figure 2 is a perspective view of a detail thereof.

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

Figure 4 is a front elevation of a detail shown in Figure 3.

Figure 5 is a view corresponding to Figure 1, but showing an alternative arrangement.

Figure 6 is a side elevation of a duplicating machine having means for effecting line-by-line moistening of the copy sheets.

Figure 7 is a part-sectional plan view of the machine shown in Figure 6.

Figure 8 is a section on the line 8—8 of Figure 7.

Figure 9 is a sectional side elevation of a detail of Figure 7.

Figure 10 is a front elevation of part of the machine shown in Figure 7.

Figure 11 is a section on the line 11—11 of Figure 8.

Figure 12 is a perspective view showing an alternative arrangement of the moistening means.

Figure 13 is a fragmentary plan view showing a further modification.

In the construction illustrated in Figures 1 to 4, the apparatus comprises spaced side members 15 secured together by tie rods 16, and having mounted between them a transversely disposed impression cylinder 17 which is provided with a clamping device 18 for engagement with the leading edge of a master sheet 19 bearing in reversed or mirror script the matter to be reproduced. The clamping device may be constructed as described in prior specification No. 2,048,543 aforesaid.

After the master sheet 19 has been secured to the cylinder 17, the latter is rotated and a copy sheet (indicated at 20) may be fed, beneath a presser member 21 which is periodically raised and allowed to descend, to the nip between the cylinder 17 and a pressure roller 22 mounted above the latter, so that the copy sheet 20 is carried through in pressure contact with the master sheet 19 attached to the cylinder 17.

The presser member 21 is preferably constructed and operated as described in the above-mentioned prior specification, being carried by the ends of levers 23 which are independently loaded by means of adjustable torsion springs 24. The levers 23 are periodically raised by cams 25 on the cylinder 17 to allow insertion of a copy sheet 20 beneath the member 21 as aforesaid, afterwards descending under the action of the springs 24 so that the member 21 presses said sheet against a stationary moistening pad 26.

The moistening pad 26 forms part of a moistening device which may also be constructed in accordance with the aforesaid prior specification.

This moistening device comprises a reservoir or tank 27 of rectangular shape in plan, which is arranged between the side members 15 of the machine and contains a moistening liquid, the latter conveniently consisting of methylated spirit mixed with a plasticizer and a deodorant.

The liquid is fed by means of wicks 28 to an absorbent strip constituting the pad 26 which is supported in a tray-like carrier 29 forming part of the lid 30 of the reservoir 27. The car-

rier 29 is disposed somewhat lower than the rest of the lid 30, so that the upper surfaces of the lid 30 and the pad 26 are at substantially the same level. The wicks 28 pass through a slot or opening 31 in the lid 30 and have their upper ends disposed beneath the pad 26.

The pad carrier 29 projects beyond the back of the reservoir 27 and is disposed substantially tangentially in relation to the cylinder 17, its rear edge lying adjacent the surface of the latter. The reservoir 27 may be provided externally with lateral projections 32 which slidably engage the side members 15 of the machine, whilst the pad carrier 29 may be supported, as described in prior specification No. 2,048,543, upon an adjustable transverse rod or bolt 33.

Passing transversely through the upper part of the reservoir 27 is a circular-section rod 34 provided at its ends with trunnions 35 which are disposed on a common axis offset from that of the rod 34, so that the latter constitutes an eccentric.

The trunnions 35 are engaged in bearings in the side walls of the reservoir 27, one or (preferably) each of such bearings being constructed as a flanged bush 36 which fits into a circular hole in the reservoir wall. This hole may be of slightly greater diameter than the rod 34, so that the latter can be inserted endwise therethrough when being positioned within the reservoir 27.

Mounted in one of the side members 15 of the machine and in alignment with the adjacent trunnion 35 is a short spindle 37 carrying an operating handle 38. A crank arm 39 secured on the inner end of the spindle 37 is matched by a similar arm 40 on the trunnion 35, and the arm 40 is provided with a projecting peg 41 which engages an open ended longitudinal slot 42 in the arm 39 (see Figures 1 and 2).

The wicks 28 are passed between the rod 34 and an abutment 43 which is conveniently constituted by the edge of a depending lip at the front edge of the slot or opening 31 in the lid 30 of the reservoir 27.

When the angular position of the rod 34 is such that the "throw" of the eccentric formed thereby is directed away from the abutment 43, no pressure is exerted upon the wicks 28, and to provide additional clearance in this position of the rod 34, the latter may be formed with a flat surface 44.

The rod 34 may be adjusted angularly by means of the operating handle 38 so as to squeeze the wicks 28 against the abutment 43 with any desired degree of pressure, and means may be provided (for example, in connection with the handle 38) for ensuring retention of the rod 34 in its adjusted position. The handle 38 may bear an index mark 45 or pointer which co-operates with a graduated scale 46 concentric with the spindle 37.

The effect of pressure-clamping the wicks 28 in this manner is to stop or regulate the flow of liquid therethrough, so that the supply of moistening liquid to the absorbent pad 26 may be regulated in accordance with the thickness or kind of copy paper being used, or positively cut off to avoid wastage by evaporation when the machine is not in use. When it is desired to operate the machine after a period of idleness, the rod 34 may be turned back to the position shown, in which it exerts no pressure upon the wicks 28, and the absorbent pad 26 will then quickly receive a supply of the moistening liquid.

The provision of the above-described separable

connection between the rod 34 and its operating handle 38 enables the entire moistening device to be removed from between the side members 15 of the machine when required. To effect this, the handle 38 is turned until the slot 42 in the arm 39 associated therewith extends horizontally and towards the front of the machine, whereupon the reservoir 27 can be slidden forwardly, carrying the projection 41 clear of the slot 42.

Figure 5 illustrates an alternative arrangement in which the moistening device is fixed, the trunnions 35 being extended through the side members 15 of the machine, and the operating handle 38 being secured directly to one of the trunnions. In this construction, the abutment 43, with which the angularly adjustable rod 34 co-operates, is disposed at the front edge of the slot or opening 31.

Whatever the arrangement of the rod 34, the absorbent pad 26 may have associated therewith a metal plate 47 of rectangular shape which is supported on the lid 30 of the reservoir and arranged for sliding movement in a direction from front to rear of the machine. In its rear-most position the plate 47 completely covers the operative surface of the pad 26, and it can be adjusted forwardly to uncover the required amount of the pad. By this means, wastage of the moistening fluid is reduced to a minimum.

The position of the cover plate 47 is adjusted by rotation of an operating shaft 48 which is supported at its ends in the side members 15 of the machine and which is provided with a suitable handle 49.

This shaft 48 has secured thereon two upwardly extending arms 50 formed with longitudinal slots 51 through which pass screws or pins 52 carried by lugs 53 at the front corners of the plate 47.

It will be understood that, if desired, the operating shaft 48 with the handle 49 and arms 50 may be mounted on the reservoir 27, instead of on the frame of the machine.

The above arrangement allows the cover plate 47, in any position thereof, to be raised from the lid 30 of the reservoir 27 and swung forwardly about the axes of the pins 52, so as completely to uncover the pad 26 or to give access to the wicks 28.

At its front edge the cover plate 47 may extend downwardly adjacent the side of the reservoir 27 and then horizontally, so as to provide a finger piece by which it may be raised when desired.

For accurate control of the moistening, the presser member 21, usually a roller, associated with the moistening device, must be maintained parallel to the surface of the pad 26. In the construction illustrated, this is ensured by coupling together the levers 23 which carry the member 21, opposite ends of a rod or bar 54 being rigidly secured to such levers.

Bending of the presser roller or member 21, in the case of machines having long master cylinders 17, and consequent unsatisfactory moistening at the centre of the copy sheet 20, may be prevented by means of a spring support, or a plurality of spaced spring supports, for the member 21 acting substantially perpendicular to the sheet 20 and being disposed intermediate the ends of such member (see Figure 4).

The or each support may comprise a stem 55 slidably guided in a hole either in the coupling rod 54 aforesaid or in a suitable crossbar fixed

to the frame of the machine above the member 21, this stem 55 being provided at its lower end with a foot 56 adapted to embrace the upper side of the member 21, a coiled compression spring 57 acting between the foot 56 and the underside of the rod 54 or its equivalent. When a roller is used as the presser member, the foot 56 may comprise a crescent-shaped fork.

Instead of the stem 55 sliding in a plain hole in the supporting rod or bar, the latter may have an elongated guide screwed thereto, and in either case the downward movement of the stem 55 may be limited by a nut 58 on its upper end.

When it is desired to reproduce only one, two or any other selected number of lines of the writing or figures on the master sheet 19, the latter is engaged in the clamping device 18 in such a way that the lines in question extend circumferentially of the cylinder 17.

In order that the selected part of the matter on the master sheet 19 shall be reproduced, means (illustrated in Figures 6 to 13) are provided for confining the moistening of the copy sheet 20 to that strip or those strips of the latter which will come into contact with the selected matter aforesaid.

Such means comprise a shield mounted above the operative surface of the pad 27 (as shown in Figures 7, 8, 12 and 13) and constructed in a plurality of sections 59 which are movable individually to cover or uncover any desired part of the pad 26. The sections 59 take the form of parallel-sided strips of metal or other suitable material disposed side by side and each adapted for sliding movement in a direction parallel to the direction of movement of the copy sheet 20. Collectively these strips may cover the whole operative surface of the pad 26.

The shield sections 59, or the parts thereof nearest the cylinder 17, are very thin (i. e. only a few thousandths of an inch in thickness) so that, when some of the sections have been retracted to expose the moistening pad 26, the unretracted sections will not prevent the copy sheet 20 from making proper contact with the uncovered parts of the pad 26.

Each of the shield sections 59 is operable, in a direction to uncover the pad 26, by means of a key 60 provided at the end of a lever 61 as shown in Figures 6 to 8. The various operating levers 61 project from the front of the machine somewhat like the key levers of a typewriter and are pivoted on a common spindle 62 which extends transversely of the machine. Each operating lever 61 is coupled by a link 63 to one arm of a bell crank 64 whose other arm is suitably connected as at 65 to the shield section 59 associated therewith.

The connections between the shield sections 59 and the levers 61 may be covered by a plate 66, whose rear edge extends adjacent the sections 59 and is provided opposite each of the latter with a number or other distinguishing mark as at 67. In the construction shown, there are twenty-two shield sections numbered consecutively from left to right, and the key 60 connected to each section 59 bears a corresponding number or mark.

The shield sections are urged in the return direction by means of springs 68 or the equivalent acting on the levers 61, and means are provided for retaining any or all of the sections 59 retracted from the pad 26 against the action of the springs 68.

The retaining means aforesaid comprises a catch lever 69 which is pivoted at 70 to each operating lever 61 and is acted upon by a spring 71

so that, when the lever 61 is depressed to retract the shield section 59 associated therewith, a notch 72 in the catch lever 69 engages with one of the tie-rods 16 connecting the side members 15 of the machine, return of the levers 61 being thus prevented.

The various catch levers 69 are provided with extensions 73 beyond their pivots 70, the free end of each extension 73 carrying a release key 74 whose depression lifts the catch lever 69 clear of the tie-rod 16 so that the operating lever 61 associated therewith can rise under the action of its spring 68.

To obviate the necessity of depressing all the operating keys 60 when it is desired to reproduce the whole of the master sheet 14, the machine is provided with an eccentric 75 which is rotatably mounted in the side members 15 above the levers 61 and extends the full width of the machine. In the position shown in Figure 8, this eccentric is clear of the levers 61, but it may be turned through a dead-centre position by means of an external handle 76 so as to depress the levers 61 and to retain them in this position. Reverse movement of the handle 76 releases all the levers 61 simultaneously.

It will be understood that the master control for the operating levers 61 may be employed as an alternative, or in addition, to the individual release keys 74.

In machines of the kind described in my prior specification No. 2,048,543, it is usual for the pressure roller to be of substantially the same length as the cylinder 17 with which it co-operates. Such an arrangement is unsuitable, however, when only a part of the matter on the master sheet 19 is to be reproduced, as the long roller causes smudging of the copy sheet 20 adjacent the moistened strip or strips on the latter.

To obviate this, in the construction illustrated in Figures 6 to 9, the pressure roller may be made of a length substantially equal to the width of one line of the matter to be reproduced, or more conveniently it is formed in a plurality of (say, four) sections 22, each of the length aforesaid and all mounted on a common spindle 77.

The pressure roller, or each section 22 thereof, is moved longitudinally of the spindle 77, which extends parallel to the axis of the cylinder 17, so that pressure is applied only to that part, or those parts, of the copy sheet 20 which have been moistened. Preferably, the pressure roller or roller section 22 is provided with a rubber tire or covering 78.

In order that any part of the copy sheet 20 may be brought opposite to any line of writing on the master sheet 19, the sheet 20 is fed down a tray 79 which is also adjustable transversely of the machine.

Adjustment of the pressure roller or roller section 22 and/or of the tray 79 may be effected either directly by hand or through the medium of suitable step-by-step mechanism.

When the latter arrangement is employed, square-section rods 80, 81 may be fixed in suitable positions transversely of the machine and parallel to the axis of the cylinder 17, the rod 80 having slidably mounted thereon a block 82 to which the tray 79 is attached (Figure 11), while the rod 81 carries a corresponding block 83 having pivoted thereon a fork 84 adapted to embrace the pressure roller or any of the roller sections 22.

The step-by-step mechanism aforesaid may include a pair of parallel bars 85, 86 disposed transversely of the machine alongside each of

the rods 80, 81, the bars 85, 86 of each pair being provided with rack teeth of ratchet form. The teeth on the rack bars 85, 86 are disposed in opposite sense and are adapted for engagement respectively by pivoted pawls 87, 88 carried on the block 82, or on the block 83 as the case may be. These pawls 87, 88 are normally held against stops 89 by means of a connecting tension spring 90 as shown in Figure 10.

Each of the rack bars 85, 86 is supported on a pair of spaced pins 91 projecting laterally from the rod 80 or 81 as the case may be, the normal position of the rack bars being such that the teeth of the racks are clear of and below the pawls 87, 88.

The pins 91, however, pass through slots 92 in the rack bars 85, 86, each of said slots being downwardly inclined and terminating in a horizontal portion 93. Thus, when either of the rack bars 85, 86 is given an endwise movement, the pin-and-slot engagement aforesaid first produces a bodily upward motion of the rack bar which brings its teeth into engagement with the pawl 87 or 88 co-operating therewith, and a subsequent horizontal motion of the rack bar whereby the block 82 or 83 as the case may be, is shifted transversely of the machine owing to the pawl being pushed back against its stop 89.

The rack bars 85, 86 project at opposite sides of the machine, their outer ends being provided with finger-pieces 94 whereby each rack bar can be pushed endwise by hand for a limited stroke, whose length is determined by that of the slots 92, and is preferably equal to the width of a line of writing on the master sheet 19. When released, the rack bar is returned to its original position by means of a spring 95.

It will be understood that the rack bar 85 is operable by hand from left to right, and the other bar 86 from right to left (see Figure 10). Furthermore, when neither of the rack bars 85, 86 is in engagement with a pawl, the block 82 or 83 associated therewith may be operated directly by hand, the fork 84 carried by the block 83 being movable clear of the pressure roller or roller section 22 engaged thereby when it is desired to move the latter by hand.

The pressure roller or roller section 22, or the tray 79 as the case may be, is preferably provided with means whereby it is retained in its adjusted position, and such retaining means may take the form of a ball or other detent 96 mounted in a recess in the roller or roller section 22, or in the block 83, or in the block 82 associated with the tray 79, and acted upon by a compression spring 97 which presses it into engagement with one of a plurality of spaced grooves 98 in the roller spindle 77, rod 81, or tray-supporting rod 80 as the case may be. The grooves 98 may be aligned with the centres of the various shield sections 59 as shown, and in the case of the roller spindle 77, the grooves 98 are arranged circumferentially.

In the arrangement illustrated in Figure 7, it will be seen that the width of the tray 79 is considerably less than the length of the cylinder 17, and that the number of pressure roller sections 22 provided is such that when the copy sheet 20 is relatively narrow, those sections 22 which are not in use at any time can be moved towards the end of the spindle 77 so as to be out of the way.

Figure 12 shows an alternative arrangement of the shield sections 59 in which the operating levers 61 and other mechanism of the preceding construction are eliminated. The sections 59 in

this case are shaped so as to rest upon the top of the moistener tank 27 and are held in place thereon by means of transverse guide members 99 which extend over the top of the sections 59. These members 99 are secured to the tank 27 by means of screws 100 which pass through longitudinal slots 101 in the shield sections 59. Alternatively, other guiding means may be provided.

Each of the sections 31 is provided with a very thin end-piece 102 which co-operates with the pad 26, and has a suitable finger-piece 103 at its other extremity whereby it may be operated.

The above method of construction is applicable either to stationary or to moving moisteners.

Figure 13 illustrates a modification of the end-pieces 102 in which each alternate end-piece is made of greater width than the adjacent end-piece or pieces, so that it overlaps the same as at 104, thus ensuring that there is no possibility of moistening liquid reaching the copy sheet between those sections 59 which have not been withdrawn.

What I claim then is:

1. Moistening apparatus for rotary duplicators, comprising a container for the moistening fluid, said container having a tray-like portion, an absorbent pad in said tray-like portion, wicks extending from the container to said tray, a member for pressing the copy sheets on to said pad, a pair of supporting levers attached to the ends of said member, a bar connecting said levers, and one or more auxiliary supports extending between said bar and said copy pressing member.

2. Moistening apparatus for rotary duplicators, comprising a container for the moistening fluid, said container having a tray-like portion, an absorbent pad in said tray-like portion, wicks extending from the container to said tray, a roller for pressing the copy sheets on to said pad, a pair of supporting levers attached to the ends of said roller, a bar connecting said levers, one or more sliding crutches engaging said roller, and a spring operating between said bar and said crutch or each of said crutches.

3. Moistening apparatus for rotary duplicators, comprising a moistening member in the form of a pad, an abutment member co-operating with said moistening member so that copy sheets passed between said members receive moisture from said moistening member, and a shield for the operative surface of said moistening member adapted to prevent contact of said copy sheets with said surface, said shield being formed in a plurality of sections individually retractable in a direction lengthwise of the direction of movement of said copy sheets so that any selected area of said moistening area can be uncovered at will.

4. Moistening apparatus for rotary duplicators, comprising a moistening member in the form of a pad, an abutment member co-operating with said moistening member so that copy sheets passed between said members receive moisture from said moistening member, a shield for the operative surface of said moistening member adapted to prevent contact of said copy sheets with said surface, said shield being formed in a plurality of sections individually retractable in a direction lengthwise of the direction of movement of said copy sheets so that any selected area of said moistening member can be uncovered at will, guide bars extending transversely of said shield sections and members on said guide bars engaging slots in said shield sections.

5. Moistening apparatus for rotary duplicators

tors, comprising a moistening member in the form of a pad, an abutment member co-operating with said moistening member so that copy sheets passed between said members receive moisture from said moistening member, a shield for the operative surface of said moistening member and adapted to prevent contact of said copy sheets with said surface, said shield being formed in a plurality of sections which are individually retractable in a direction lengthwise of the direction of movement of said copy sheets to uncover any selected area of said pad, and operating levers each connected to one of said shield sections.

6. Moistening apparatus for rotary duplicators, comprising a moistening pad, a member for pressing the copy sheets on to said pad, a shield placed over said pad and formed in a plurality of sections, operating levers each connected to one of said sections and adapted to move same in a direction to uncover the part of said pad beneath it, and means biasing said sections in the return direction.

7. Moistening apparatus for rotary duplicators, comprising a moistening pad, a member for press-

ing the copy sheets on to said pad, a shield placed over said pad and formed in a plurality of sections, operating levers each connected to one of said sections and adapted to move same in a direction to uncover the part of said pad beneath it, means biasing said sections in the return direction, means for retaining any one of said sections in the position to which it is moved by the operating lever connected thereto, and means individual to said sections for releasing said retaining means.

8. Moistening apparatus for rotary duplicators, comprising a moistening pad, a member for pressing the copy sheets on to said pad, a shield placed over said pad and formed in a plurality of sections, operating levers each connected to one of said sections and adapted to move same in a direction to uncover the part of said pad beneath it, means biasing said sections in the return direction, and means for collectively retaining said sections in the positions to which they are movable by said operating levers, and for releasing all of said sections simultaneously.

FRANK RONALD FORD.