April 16, 1940. F. R. FORD 2,197,036

DUPLICATING MACHINE

Filed Sept. 21, 1939 3 Sheets-Sheet 1

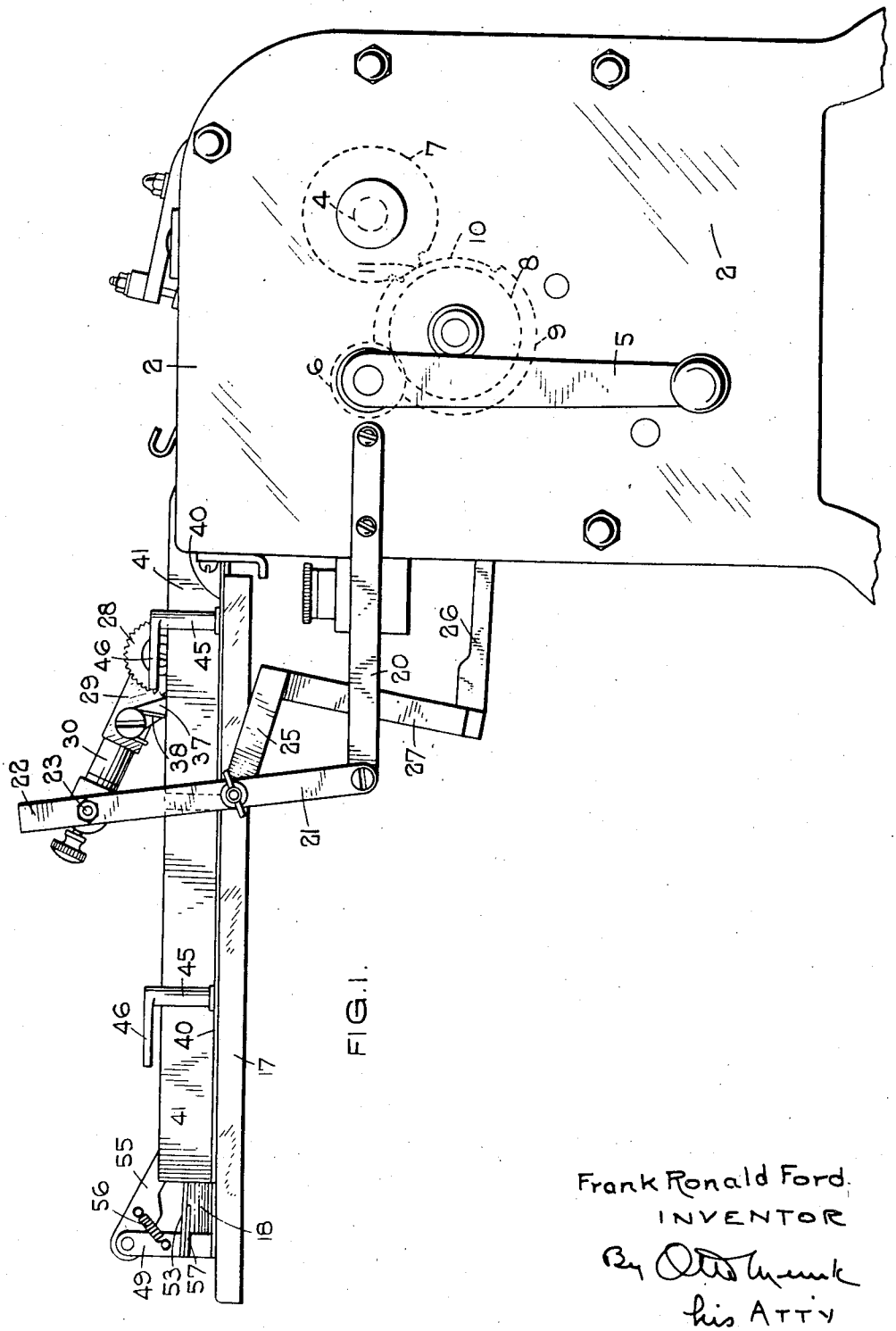


FIG. 1.

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DUPLICATING MACHINE

Filed Sept. 21, 1938 3 Sheets-Sheet 2

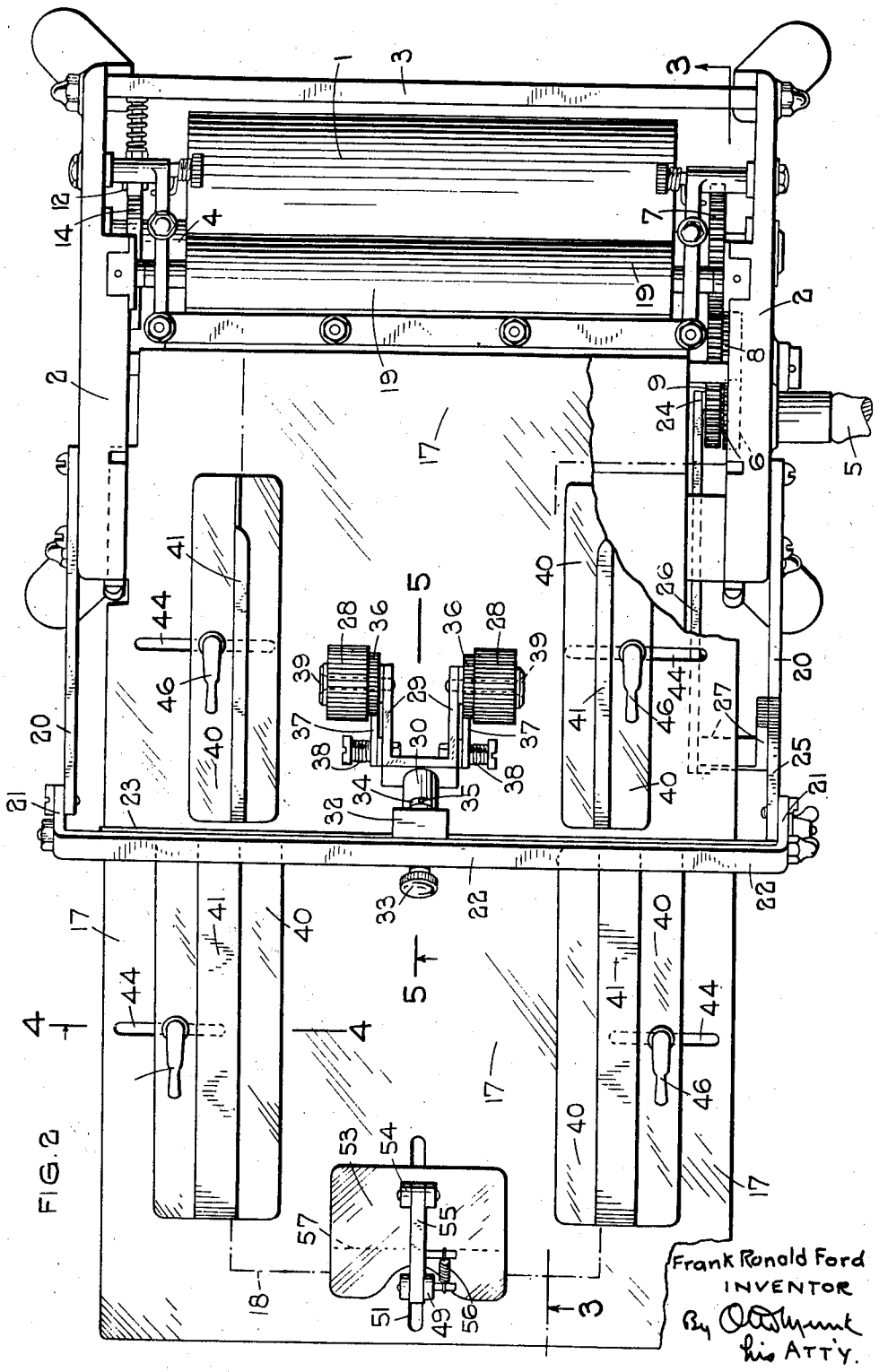


FIG. 2

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DUPLICATING MACHINE

Filed Sept. 21, 1939 3 Sheets-Sheet 3

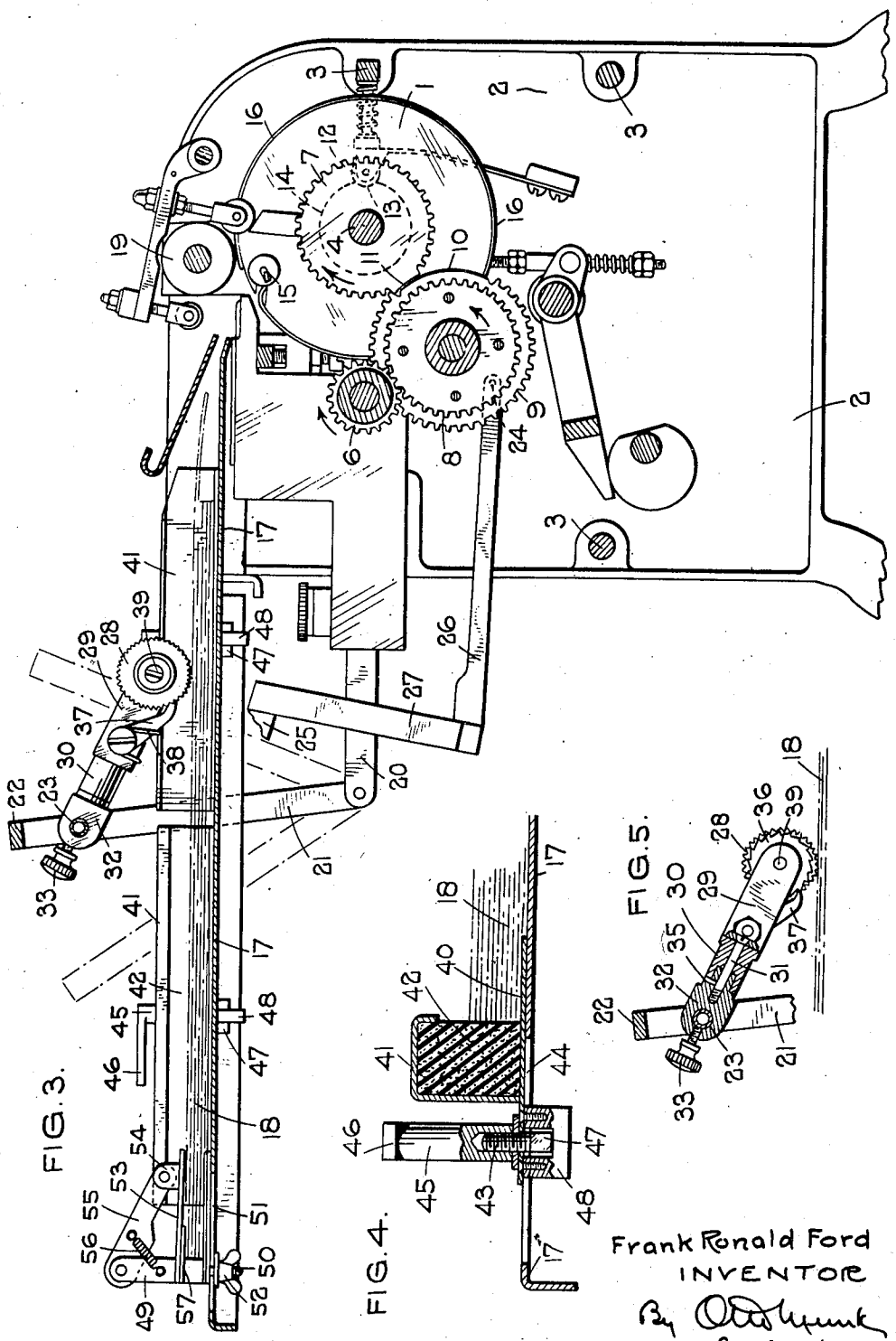


FIG. 3.

FIG. 4.

FIG. 5.

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Patented Apr. 16, 1940 2,197,036

UNITED STATES PATENT OFFICE

2,197,036

DUPLICATING MACHINE

Frank Ronald Ford, Small Heath, Birmingham, England

Application September 21, 1938, Serial No. 230,934
In Great Britain September 25, 1937

6 Claims. (Cl. 101—132)

This invention relates to duplicating machines of the type wherein the sheets upon which the copies are to be made are passed one by one through the nip between a cylinder and a pressure roller, where they are brought into pressure contact with the master sheet from which the copy is to be made, said master sheet being attached to the cylinder. The invention is particularly applicable to machines of the general class described in the specification of Letters Patent No. 1,982,017, issued to Alfred Oser.

In this type of machine, as hitherto constructed, the copy sheets are fed into the machine by hand, being placed on a platform or chute which has one end disposed adjacent the nip aforesaid. The machine is usually arranged so that the operator is given an indication as to when each copy sheet should be inserted in order that it may register correctly with the master sheet, and such indication may be given by suitable checking means which offer a definite resistance to the movement of the cylinder at a certain point in each revolution thereof.

Whilst hand feeding of the copy sheets is satisfactory when the cylinder is only being rotated at a slow speed, very considerable skill and judgment on the part of the operator is called for if a sheet is to be fed in correctly at each revolution of the cylinder when the latter is being continuously rotated at a rapid rate.

The chief object of the present invention is to enable sheets to be fed into the machine and copies made thereon much faster than has been possible hitherto and without the necessity for any skill on the part of the operator.

Referring to the drawings:

Figure 1 is a side elevation of a duplicating machine embodying the present invention.

Figure 2 is a plan view of the same.

Figures 3, 4 and 5 are sections on the lines 3—3, 4—4, and 5—5, respectively, of Figure 2.

In the construction of duplicating machine illustrated, a transversely disposed impression cylinder 1 is arranged between the side members 2, 2', which latter are secured together by tie-rods 3, 3. The cylinder 1 is mounted on a spindle 4 and is operated by a crank handle 5 through a train of spur gears, which may give a velocity ratio of two to one. The crank handle 5 is associated with a gear 6 and the cylinder spindle 4 with a gear 7, these driving and driven gears 6, 7 meshing, respectively, with the two parts 8, 9 of a compound idle gear.

The driven or cylinder gear 7 and the idle gear part 9 meshing therewith are mutilated so as to provide an intermittent drive. In a convenient arrangement, the teeth of the idle gear part 9 are removed for about one quarter of its circumference, leaving a gap 10 whose base is concentric with the pitch circle of the gear part. The driven gear 7 likewise has a portion of its periphery which is free from teeth and is formed instead with a projection 11 shaped to co-operate with the gap 10 in the gear part 9.

The machine is provided with means for arresting the cylinder 1 once in each revolution, and such means may include a spring-controlled detent 12 adapted to engage in a recess 13 in the periphery of a collar 14 mounted on the cylinder spindle 4, or formed on or attached to one end of the cylinder 1. Such a device is described in the specification of my co-pending application Serial No. 168,152, filed October 9, 1937.

The cylinder carries a mechanical clamp 15 which may be constructed as described and shown in the specification of Letters Patent No. 2,048,543, issued to me July 21, 1936, and which is adapted to engage one edge of a master sheet 16 from which the copies are to be made, the rest of the sheet 16 being wrapped around the cylinder 1.

Engagement of the spring detent 12 with the recess 13 indicates the moment at which a copy sheet should be fed into the machine for correct registration with the master sheet 16 on the cylinder 1, and the gears aforesaid are so arranged that, just before such indication is given, the meshing teeth of the mutilated gears 9, 7, are those which lie immediately adjacent the toothless portions 10, 11 of such gears.

Consequently, when the cylinder 1 is arrested as above mentioned, the driving connection between it and the crank handle 5 is temporarily interrupted, the next half-turn of the handle 5 having no effect on the cylinder 1. After this half-turn has been made, of course, the idle gear part 9 again drives the cylinder gear 7 and rotation of the cylinder 1 is continued.

In front of the cylinder 1 is arranged a horizontal table 17 upon which a pile of copy sheets 18 may be placed, the rear end of this table 17 being disposed close to the nip between the cylinder 1 and a pressure roller 19 which co-operates therewith.

The machine is provided with brackets 20, 20 projecting forwardly, one at either side of the table 17, and to each of these brackets 20, 20 a swinging arm 21 is pivoted. Preferably such arms are constituted by the limbs of a U-shaped member, whose central part 22 extends transversely of and above the table 17.

The swinging arms 20, 20 are connected by a hollow or other bar 23 on which is pivoted a feeding member adapted to rest upon the pile of copy sheets 18.

A suitable operative connection is provided between the cylinder 1 and the swinging arms 20, 20 so that the latter are continuously oscillated during the revolution of the crank handle 5 which drives the cylinder 1, such oscillation causing a movement of the feeding member backwards and forwards in relation to the pile of copy sheets 18.

The operative connection aforesaid is conveniently arranged by linking one of the arms 20, 20 to a crank pin 24 on the idle gear part 8 which meshes with the cylinder gear 7. The link employed may comprise two substantially horizontal portions 25, 26 fixedly connected at their adjacent ends by an upright portion 27.

Obviously, instead of the feeding member being carried by the oscillating arms 20, 20, it may be associated with a carrier which reciprocates horizontally along suitable guides.

The feeding member aforesaid conveniently comprises a pair of rollers 28, 28 rotatably mounted on the limbs of a fork 29 whose central portion is provided with a stem 30 pivoted on the transverse bar 23 which connects the swinging arms 20, 20. The fork stem 30, for example, may be attached by a screw 31 to a block 32 which is pivotally mounted centrally of the transverse bar 23 but, which can be locked thereto by means of a clamping screw 33, in order that the rollers 28, 28 may be held clear of the copy sheets 18 when it is not desired to use the automatic feed.

When this clamping screw 33 is slacked off, the rollers 28, 28 rest on the uppermost copy sheet 18, and in order that both rollers 28, 28 may bear equally on the latter, the fork stem 30 is preferably arranged to allow a swivelling movement of the fork 29 in relation to the pivoted block 32 associated therewith. For example, the fork stem 30 may be free to oscillate upon the screw 31 to an extent dependent upon the length of a circumferential recess or slot 34 formed in the stem 30 and into which projects a pin 35 on the block 32.

Attached to the side of each roller 28 is a ratchet wheel 36 which co-operates with a pivoted pawl 37 carried on the adjacent limb of the fork 29 and urged into contact with the ratchet wheel 36 by a suitable spring 38. The teeth of the ratchet wheels 36, 36 are so arranged that the rollers 28, 28 rotate freely on their spindles 39, 39 when the feeding member is moved away from the cylinder 1, but are prevented from rotating (and hence tend to carry the top copy sheet 18 with them) when the feeding member moves towards the cylinder 1. To increase the frictional effect of the rollers 28, 28 on the copy sheet 18, they may be formed or covered with rubber or other suitable material, and their peripheries may be serrated or roughened as shown.

If desired, a single long roller may be substituted for the two rollers 28, 28 aforesaid, in which case only one ratchet wheel and pawl is necessary.

The pile of copy sheets is located laterally on the table 17 by means of suitable stops, each of which may comprise a base plate 40 lying flat on the table 17 and an angle section member 41 secured to said base plate 40 in such a manner that there is provided between them an inwardly-facing channel. In some of these channels may be mounted strips 42, 42 of sponge rubber or other friction material which grip the sides of the pile 18 and prevent the latter from being moved bodily when the feeding member is acting upon the top sheet.

Each stop is adjustable transversely of the table 17 and may be secured thereto by a clamping device, which may take the form of a T-headed screw 43 whose stem extends upwardly through a slot 44 in the table 17 and through a hole in the base plate 40 of the stop, the end of the stem carrying a nut 45 formed with a suitable handle 46 by means of which the T-head 47 of the screw 43 may be drawn up against the underside of the table 17. Each stop may be provided with a bridge-piece 48 or other projection which extends through the slot 44 and is adapted to engage the T head 47 on the clamping screw 43 to prevent the latter from turning on its axis.

A similar stop, adapted for adjustment longitudinally of the table 17, may be provided on the latter for engagement with that end of the pile of copy sheets 18 which lies remote from the cylinder 1.

It is, however, preferred to provide at this position some means for lightly clamping the pile of copy sheets 18 to the table 17, which means, when the height of the pile has been so reduced that the frictional strips 42 of the side stops have little or no grip thereon, will still locate the remaining sheets on the table 17 without preventing their forward movement under the action of the feeding member.

The clamping means aforesaid may comprise an upright post 49 having at its lower end a screwed stem 50 which extends through a central longitudinal slot 51 in the table and is provided below the latter with a wing nut 52 for securing it in any desired position.

A pressure plate 53 adapted to bear upon the upper surface of the pile 18 is provided at the end adjacent the cylinder 1 with an upstanding bracket 54 which is connected by a link 55 to the upper end of the post 49, the latter normally being adjusted to a position abutting the end of the pile 18. The end of the plate 53 carrying the bracket 54 is pressed against the pile 18 by means of a suitable light spring 56 acting on the link 55, whilst the opposite (or front) end of the plate 53 merely rests upon the copy sheets and may be faced with rubber or other friction material as at 57.

The operation of the automatic feed is as follows:

The pile of copy sheets 18 is placed on the table 17 with its forward end in the correct position relative to the cylinder 1 and with its sides parallel to the edges of the table 17. The side stops and the end clamping means just described are then moved up and secured in place.

The cylinder 1 is rotated until operation of the arresting device 12 occurs, indicating that the master sheet 16 is in the correct position for the application of a copy sheet thereto.

As already mentioned, the drive between the crank handle 5 and the cylinder 1 is interrupted at this position of the latter, and the arrangement of the parts is such that the feeding member is now at the end of its stroke farthest from the cylinder 1. If the handle 5 has already been moved inadvertently to the full extent of its free travel, as will probably be the case, it must be turned backwardly so as to bring the feeding member into the position aforesaid.

The feeding member is then lowered into contact with the top copy sheet and, on turning the handle 5 forwardly to the full extent of its free

travel, the feeding member will carry the top sheet towards the cylinder 1.

A further backward and forward movement of the handle 5 may be necessary before the leading edge of the copy sheet is brought hard up to the nip between the cylinder 1 and pressure roller 19, which position of the sheet will be indicated by the latter bulging upwardly.

The crank handle 5 is now rotated in the ordinary way to carry the copy sheet through the machine, and in each subsequent revolution of the cylinder 1 the latter will pause whilst the operating handle 5 makes half a turn, during which idle movement of the handle the feed mechanism will operate as above described to advance a copy sheet at the correct instant.

It will be seen that, once the first copy sheet has been brought up to the nip, the feeding of the sheets is fully automatic and copies will be made as fast as the handle 5 can be rotated, the friction strips 42 of the side stops co-operating with the pressure plate 53 to ensure that only one sheet at a time is advanced.

What I claim then is:

1. A duplicating machine comprising a stationary frame, a rotatable cylinder having means for attaching a master sheet thereto, a roller co-operating with said cylinder and adapted to bring a moistened copy sheet into pressure contact with the master sheet thereon, a table adapted to support a pile of copy sheets, a feeding member adapted to engage frictionally with the top sheet of said pile, and means operatively connecting said cylinder to said feeding member so that, at a predetermined point in each revolution of said cylinder, a copy sheet is automatically fed in the machine, said connecting means including levers mounted for oscillation at opposite sides of said table, a crossbar having its ends attached to said levers, a block pivotally mounted on said crossbar and carrying said feeding member, and means on said block for positioning said feeding member angularly of said crossbar.

2. A duplicating machine comprising a stationary frame, a rotatable cylinder having means for attaching a master sheet thereto, a roller co-operating with said cylinder and adapted to bring a moistened copy sheet into pressure contact with the master sheet thereon, a table adapted to support a pile of copy sheets, lateral guides on said table for said pile of copy sheets, a feeding member adapted for oscillation towards and away from said cylinder and engaging frictionally with the top sheet of said pile, means operatively connecting said cylinder to said feeding member so that, at a predetermined point in each revolution of said cylinder, a copy sheet is automatically fed in the machine, means associated with said guides for frictionally resisting longitudinal movement of said pile as a whole during feeding of said top sheet, a bracket mounted on said table at the rear end of said pile, a plate resting on the top of said pile adjacent the rear end thereof to assist the last-mentioned means in locating said pile, and a link connecting said bracket to the front part of said plate.

3. A duplicating machine comprising a stationary frame, a rotatable cylinder having means for attaching a master sheet thereto, a roller co-operating with said cylinder and adapted to bring a moistened copy sheet into pressure contact with the master sheet thereon, a table adapted to support a pile of copy sheets, lateral guides in said table for said pile of copy sheets, a feeding member adapted for oscillation towards and away from said cylinder and engaging frictionally with the top sheet of said pile, means operatively connecting said cylinder to said feeding member so that, at a predetermined point in each revolution of said cylinder, a copy sheet is automatically fed in the machine, means associated with said guides for frictionally resisting longitudinal movement of said pile as a whole during feeding of said top sheet, a bracket mounted on said table at the rear end of said pile, a plate resting on the top of said pile adjacent the rear end thereof to assist the last-mentioned means in locating said pile, and a link connected at its upper extremity to said bracket and extending forwardly therefrom, its lower extremity being pivoted to said plate at a position spaced from the rear end of said pile.

4. A duplicating machine comprising a stationary frame, a rotatable cylinder having means for attaching a master sheet thereto, a roller co-operating with said cylinder and adapted to bring a moistened copy sheet into pressure contact with the master sheet thereon, a table adapted to support a pile of copy sheets, lateral guides on said table for said pile of copy sheets, a feeding member adapted for oscillation towards and away from said cylinder and engaging frictionally with the top sheet of said pile, means operatively connecting said cylinder to said feeding member so that, at a predetermined point in each revolution of said cylinder, a copy sheet is automatically fed in the machine, means associated with said guides for frictionally resisting longitudinal movement of said pile as a whole during feeding of said top sheet, a bracket mounted on said table and forming a stop for the rear end of said pile, an arm pivoted to said bracket and extending towards said cylinder, a plate pivoted to the free end of said arm and adapted to engage the top of said pile to assist the last mentioned means in locating the latter, a spring connecting said arm to said bracket and urging said plate against said pile and friction material provided on the underside of said plate at a position rearwardly of the pivotal attachment of said arm to said plate.

5. A duplicating machine comprising a stationary frame, a rotatable cylinder having means for attaching a master sheet thereto, a roller co-operating with said cylinder and adapted to bring a moistened copy sheet into pressure contact with the master sheet thereon, a table adapted to support a pile of copy sheets, lateral guides on said table for said pile of copy sheets, a feeding member adapted for oscillation towards and away from said cylinder and engaging frictionally with the top sheet of said pile, means operatively connecting said cylinder to said feeding member so that, at a predetermined point in each revolution of said cylinder, a copy sheet is automatically fed in the machine, means associated with said guides for frictionally resisting longitudinal movement of said pile as a whole during feeding of said top sheet, a bracket mounted on said table at the rear end of said pile, a plate resting on the top of said pile adjacent the rear end thereof to assist the last-mentioned means in locating said pile, a link connected at its upper extremity to said bracket and extending forwardly therefrom, its lower extremity being pivoted to said plate at a position spaced from the rear end of said pile, and a friction facing on said table disposed beneath said plate and engaging the underside of said pile.

6. A duplicating machine comprising a sta-

tionary frame, a rotatable cylinder having means for attaching a master sheet thereto, a roller co-operating with said cylinder and adapted to bring a moistened copy sheet into pressure contact with the master sheet thereon, a table adapted to support a pile of copy sheets, lateral guides on said table for said pile of copy sheets, a feeding member adapted for oscillation towards and away from said cylinder and engaging frictionally with the top sheet of said pile, means operatively connecting said cylinder to said feeding member so that, at a predetermined point in each revolution of said cylinder, a copy sheet is automatically fed in the machine, means associated with said guides for frictionally resisting longitudinal movement of said pile as a whole during feeding of said top sheet, a bracket mounted on said table and forming a stop for the rear end of said pile, an arm pivoted to said bracket and extending towards said cylinder, a plate pivoted to the free end of said arm and adapted to engage the top of said pile to assist the last mentioned means in locating the latter, a spring connecting said arm to said bracket and urging said plate against said pile, friction material provided on the underside of said plate at a position rearwardly of the pivotal attachment of said arm to said plate, a second plate fixed to said bracket and engaging said table beneath the rear end of said pile, and friction material provided on said second plate for co-operation with the underside of said pile.

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