March 10, 1942. M. P. NEAL 2,275,455

DUPLICATING MACHINE

Filed Sept. 16, 1938 11 Sheets-Sheet 1

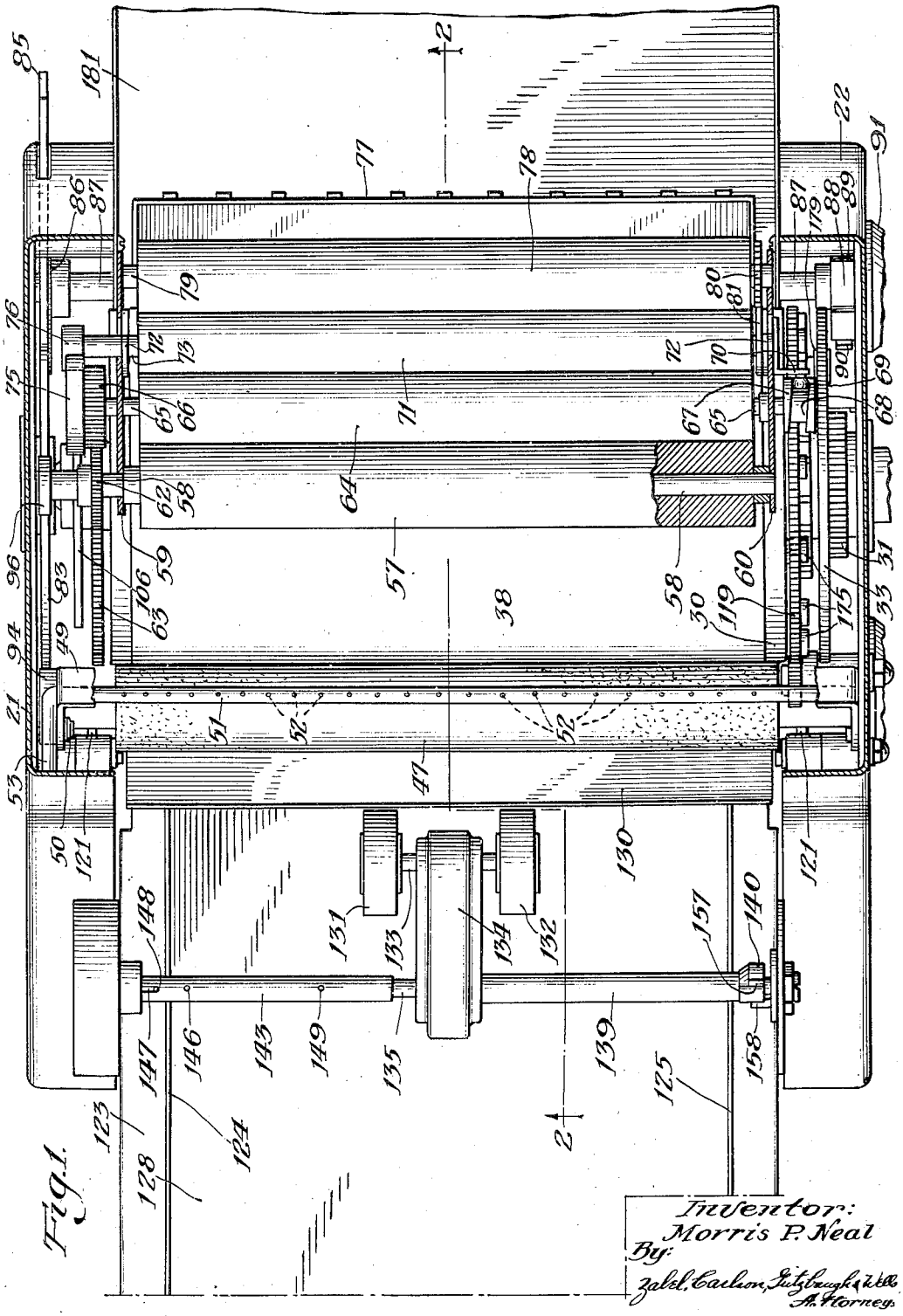

Fig. 1.

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DUPLICATING MACHINE

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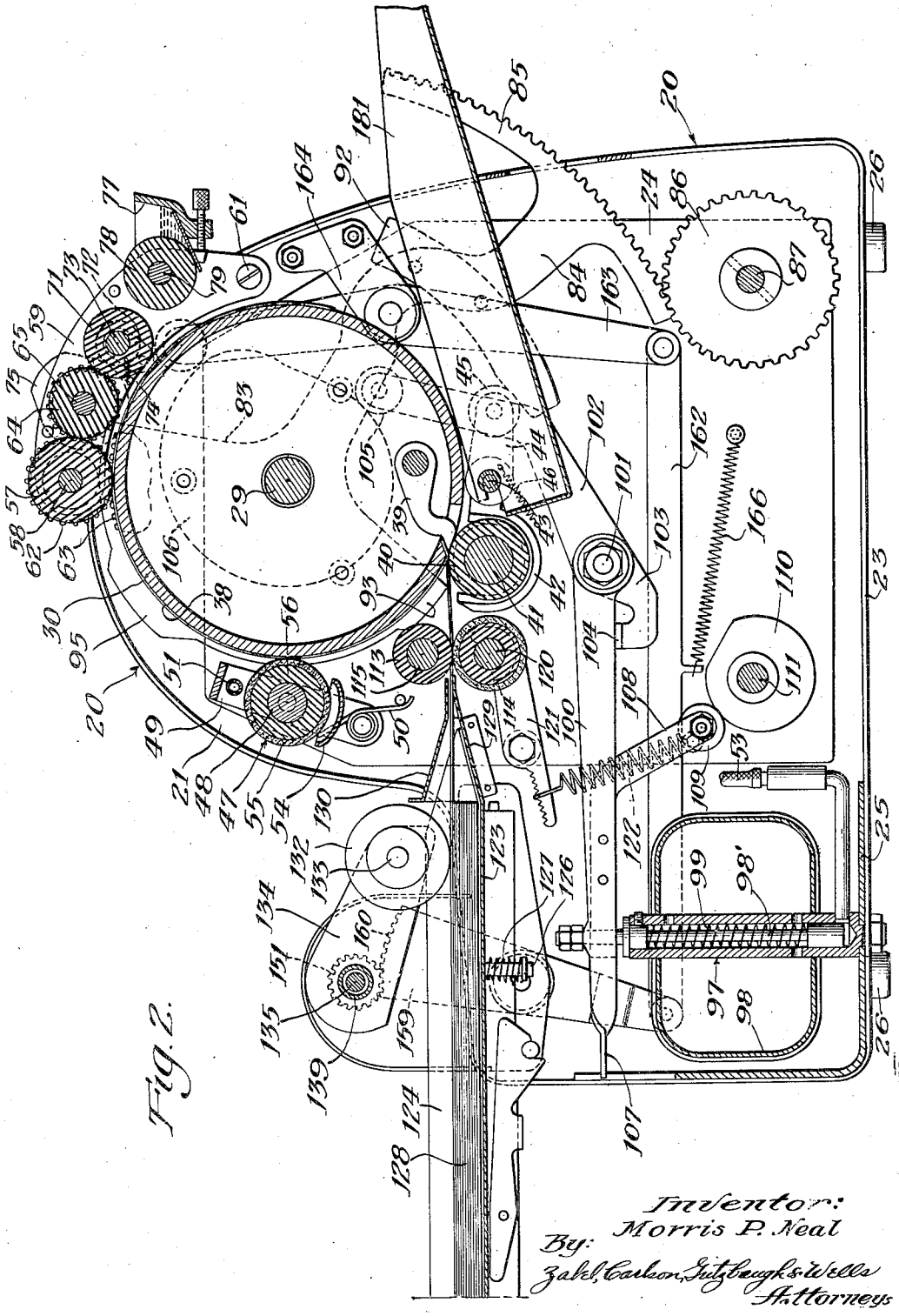

Fig. 2.

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DUPLICATING MACHINE

Filed Sept. 16, 1938 11 Sheets-Sheet 3

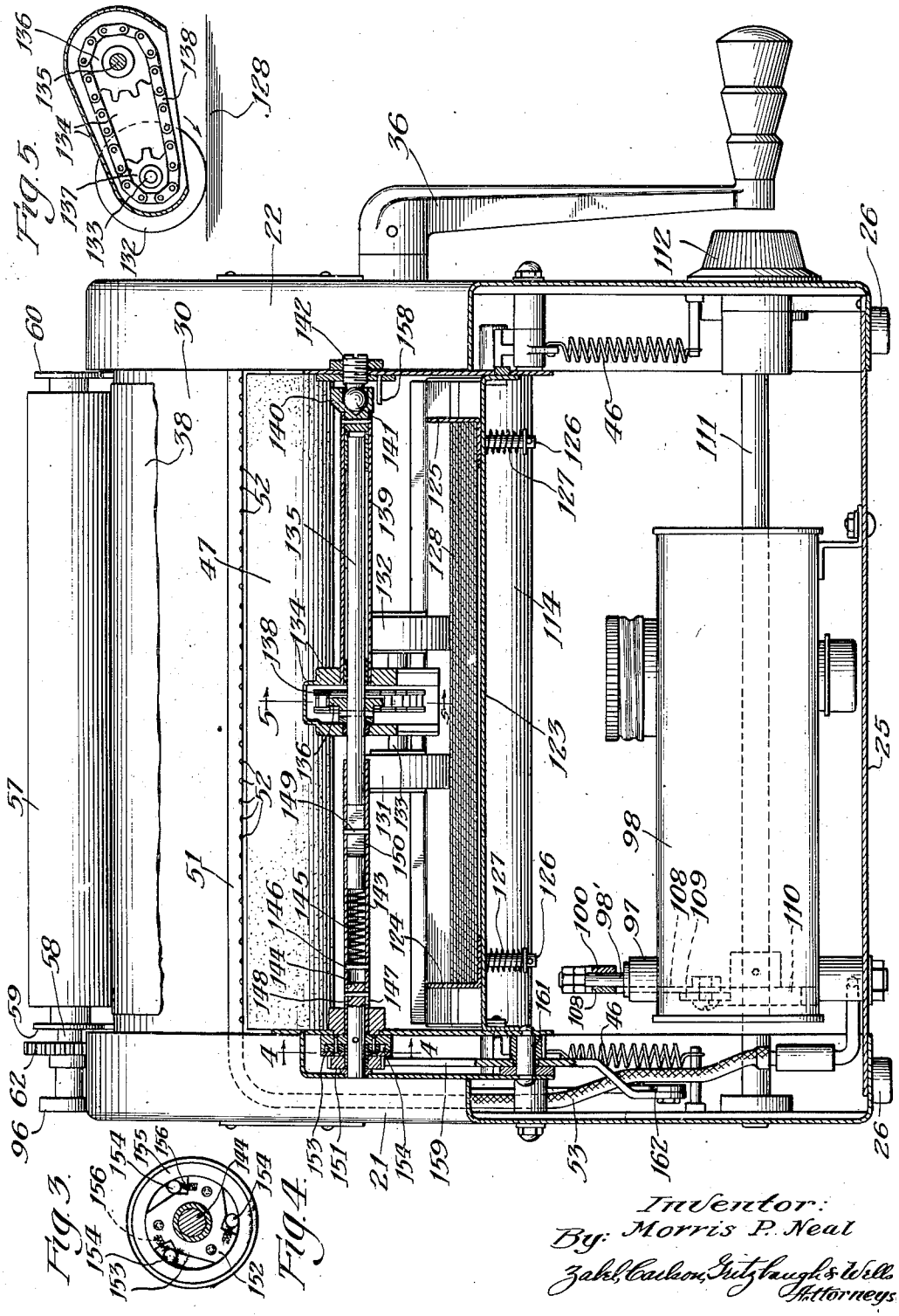

Fig. 5.

Fig. 3.

Fig. 4.

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DUPLICATING MACHINE

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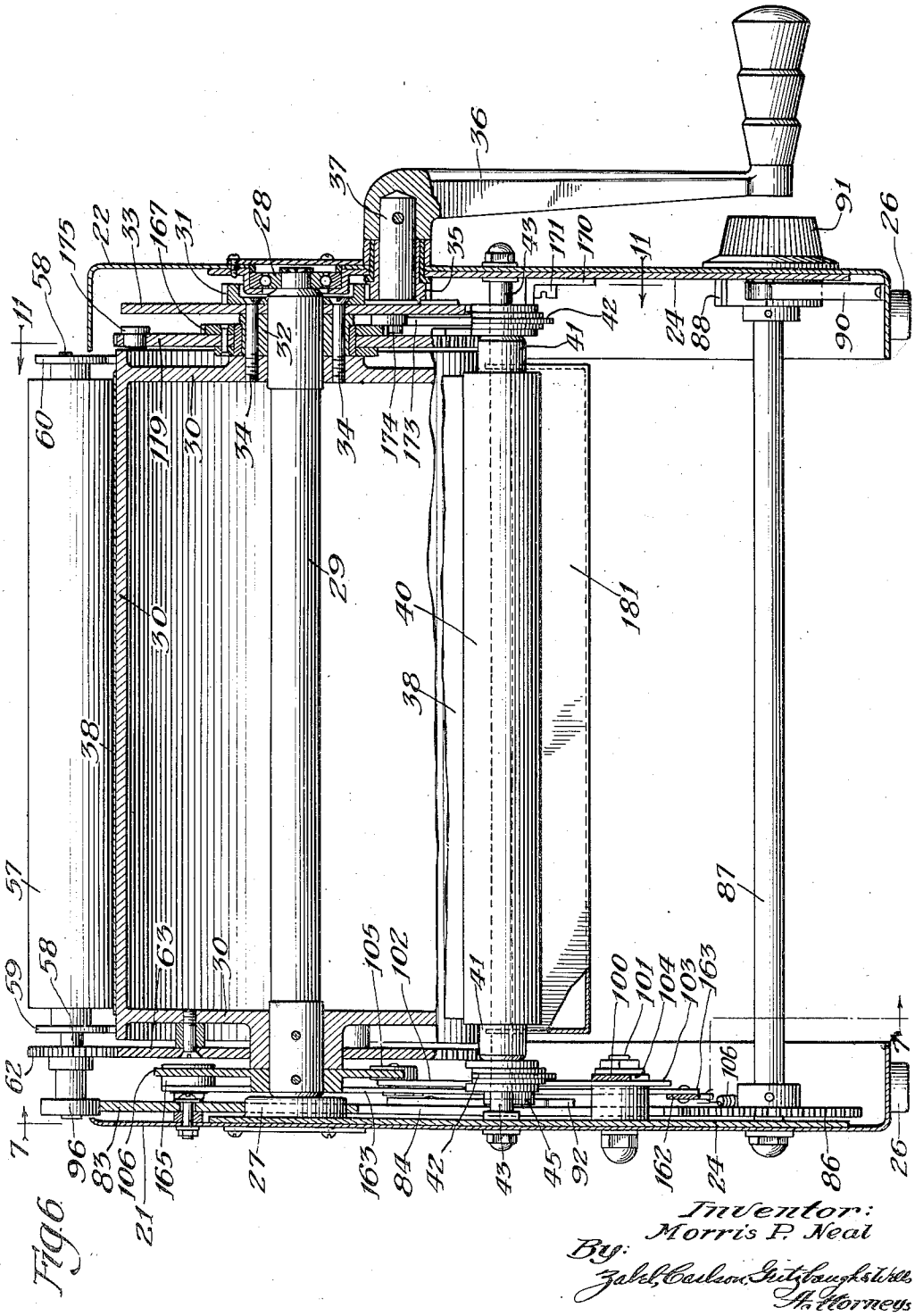

Fig 6

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DUPLICATING MACHINE

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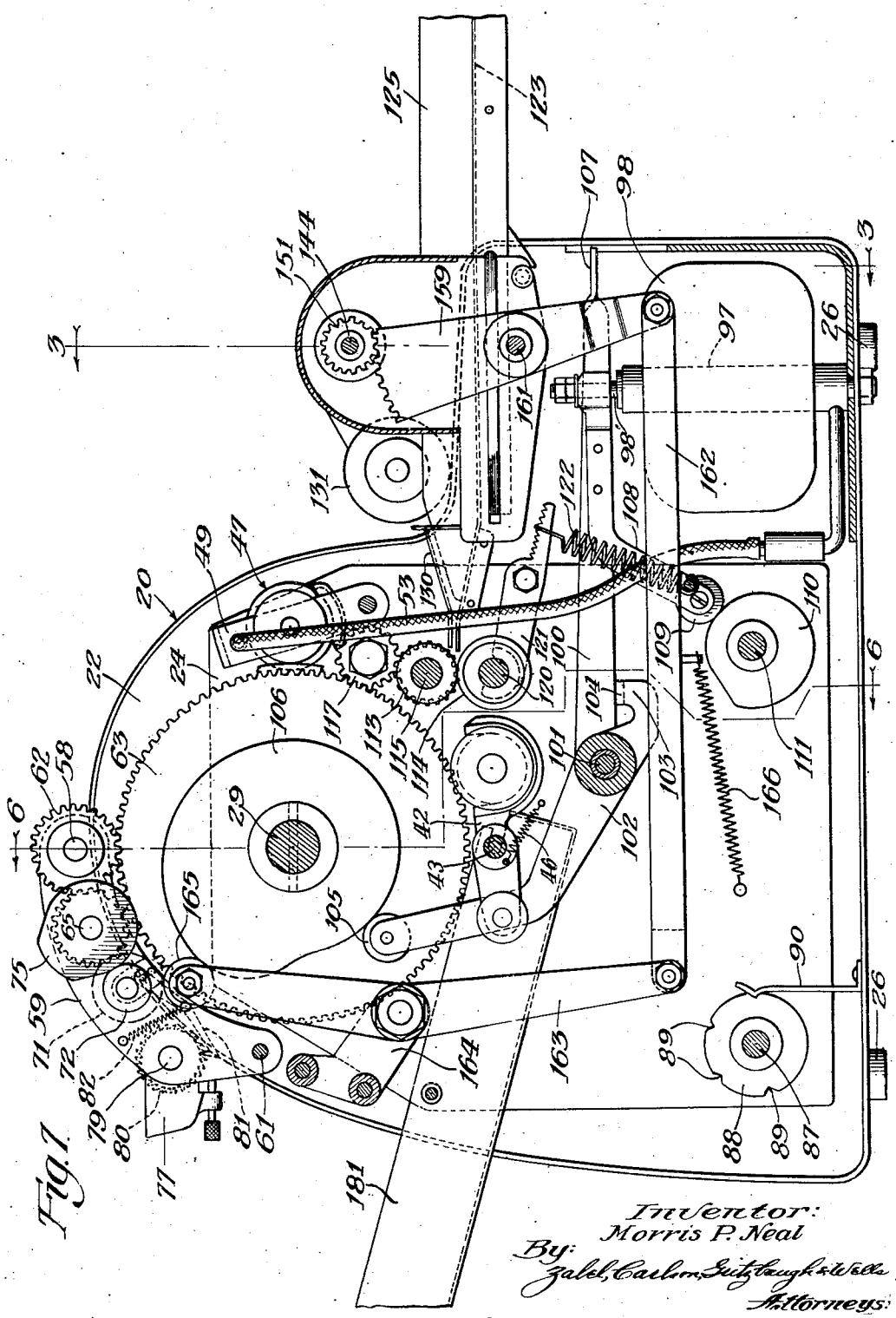

Fig. 7.

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DUPLICATING MACHINE

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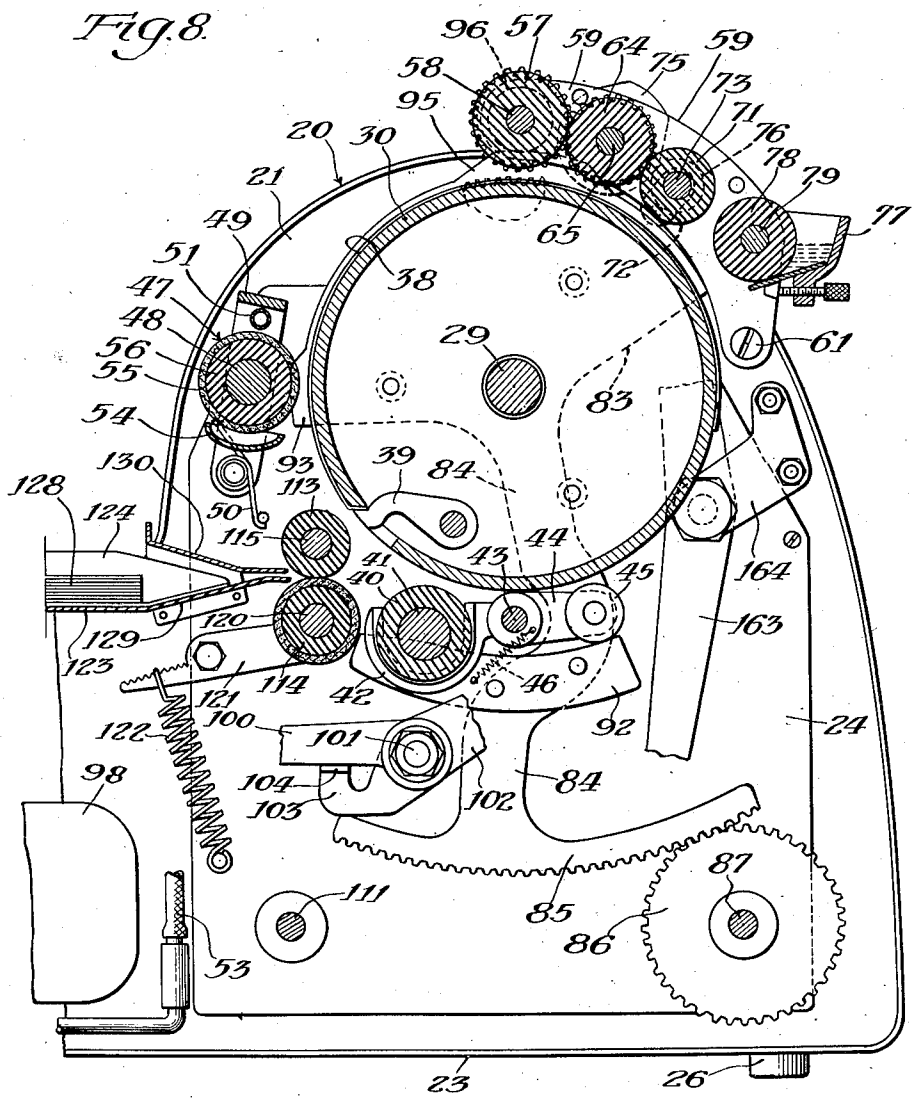
Fig. 8.



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DUPLICATING MACHINE

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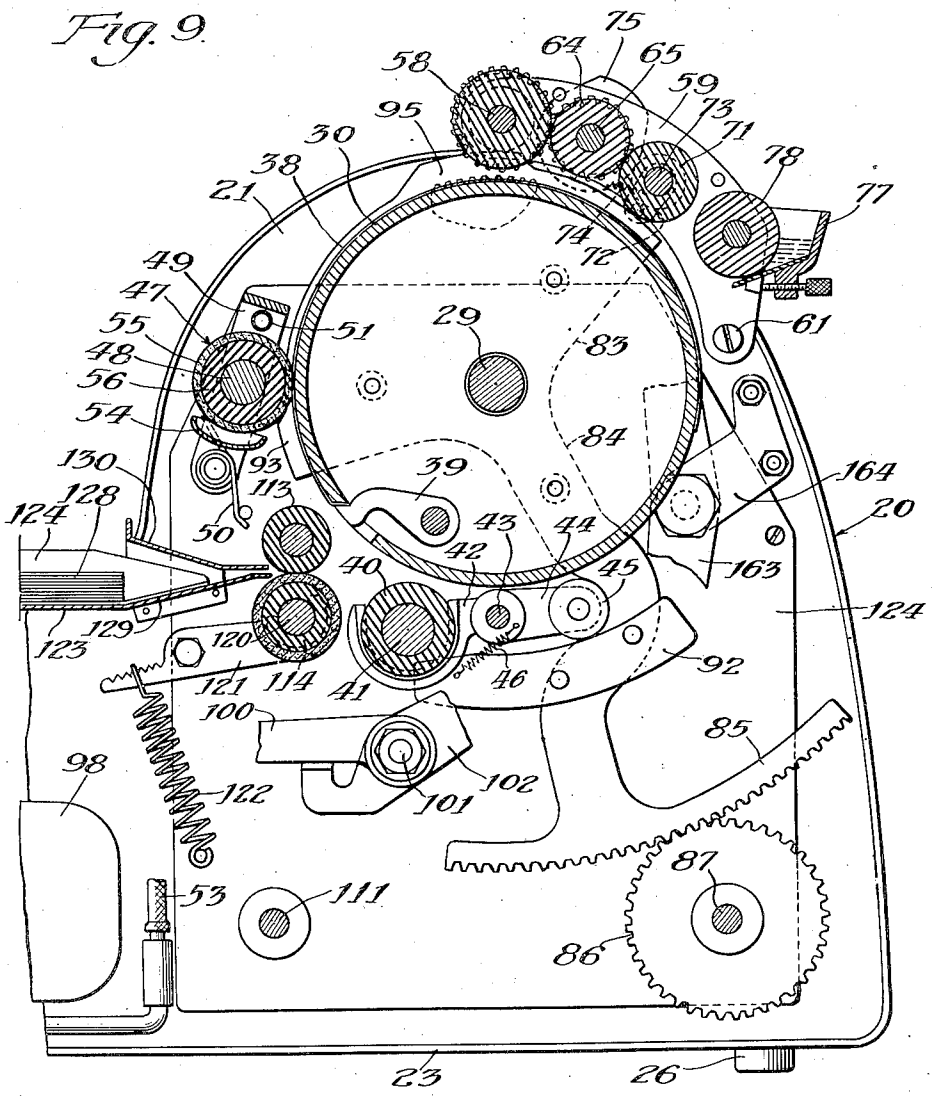
Fig. 9.



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DUPLICATING MACHINE

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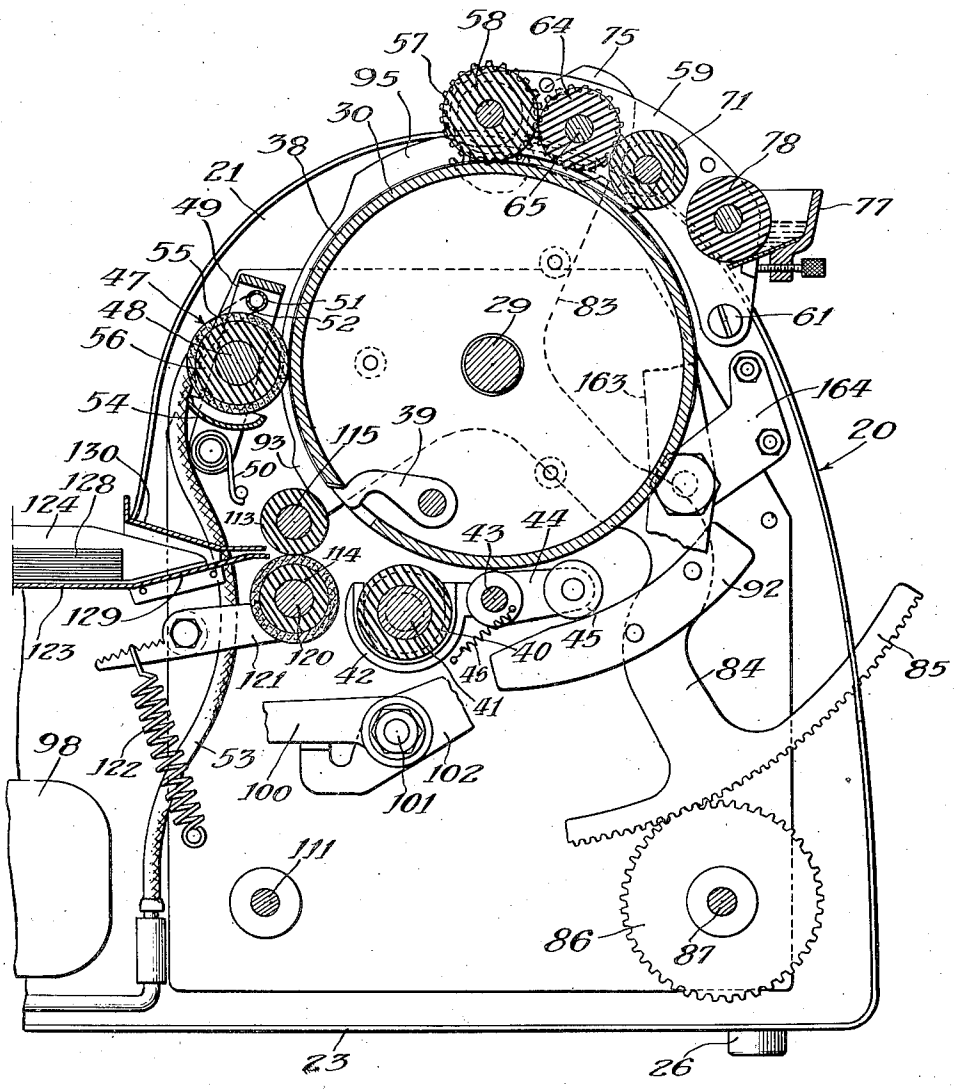
Fig. 10.



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DUPLICATING MACHINE

Filed Sept. 16, 1938 11 Sheets-Sheet 9

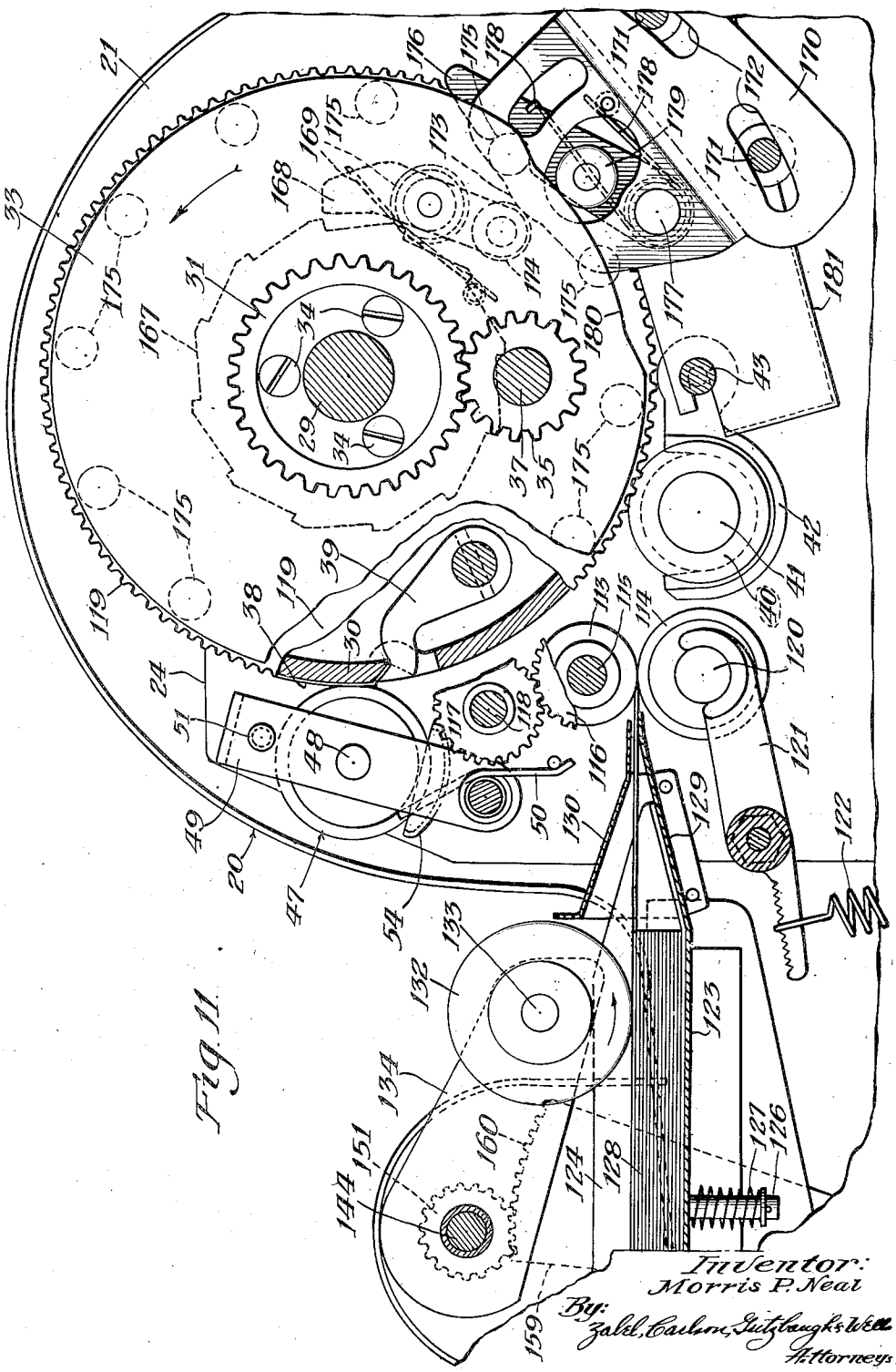

Fig. 11.

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DUPLICATING MACHINE

Filed Sept. 16, 1938 11 Sheets-Sheet 10

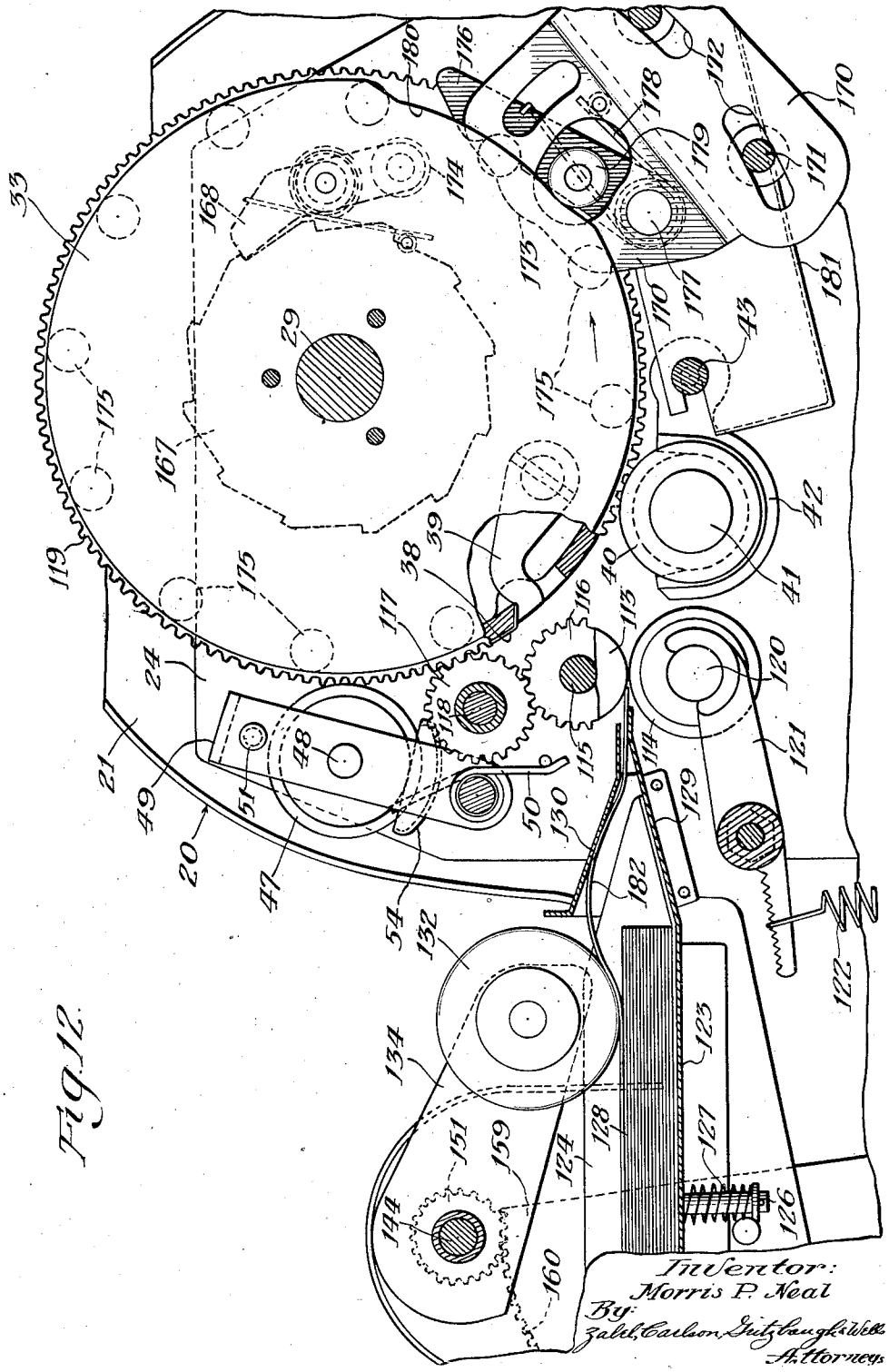

Fig 12.

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DUPLICATING MACHINE

Filed Sept. 16, 1938 11 Sheets-Sheet 11

Fig. 13.

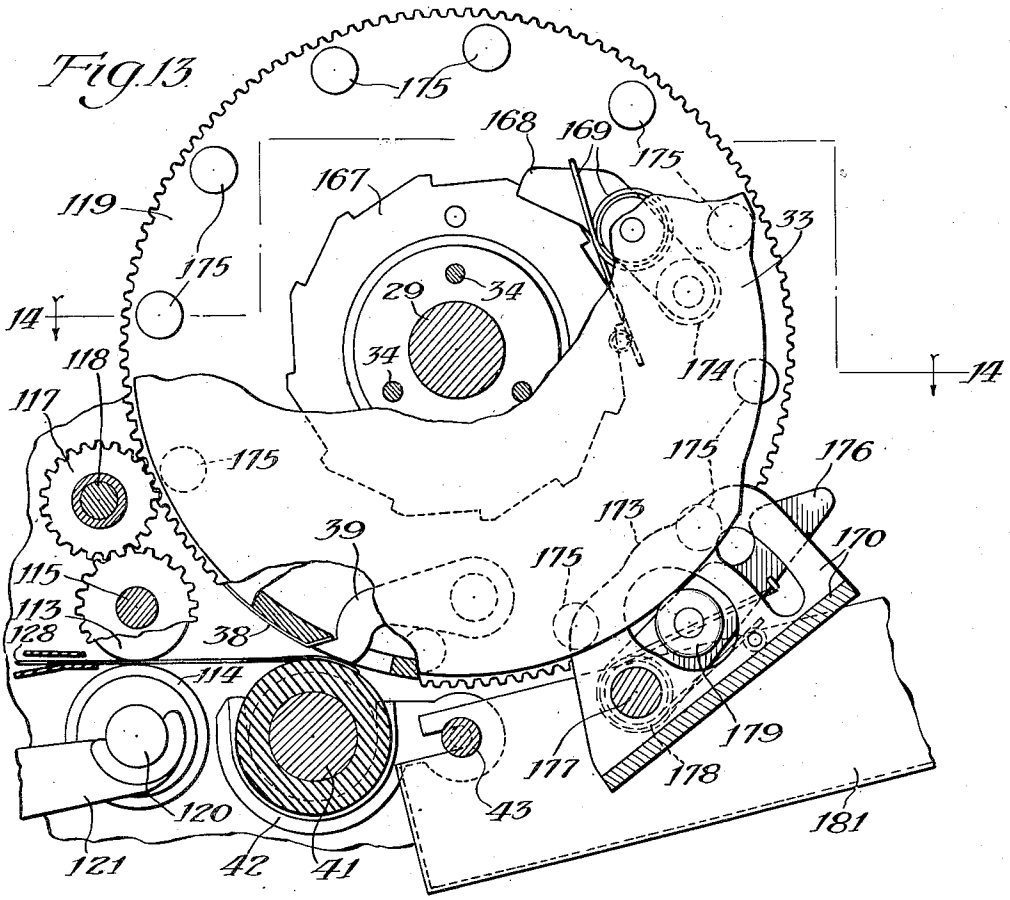
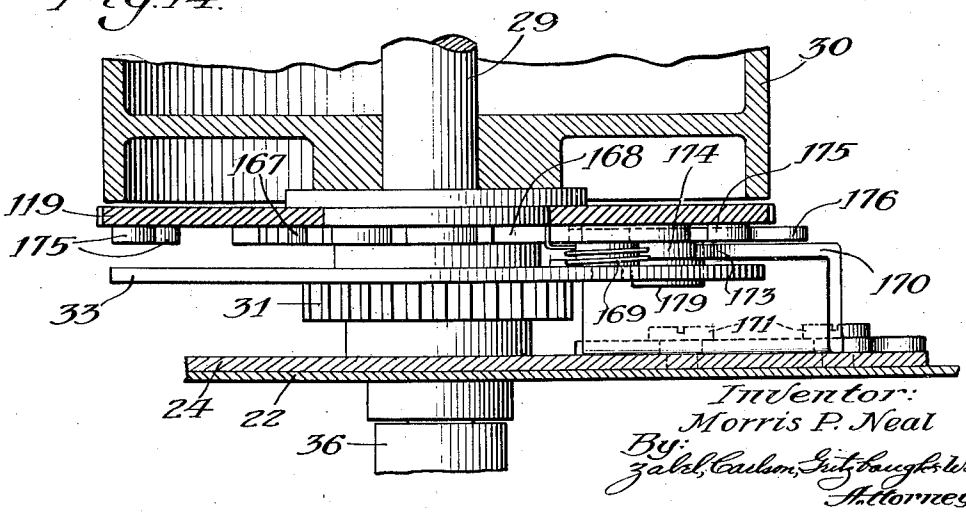


Fig. 14.



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Patented Mar. 10, 1942

2,275,455

UNITED STATES PATENT OFFICE

2,275,455

DUPLICATING MACHINE

Morris P. Neal, Villa Park, Ill., assignor to Ditto, Incorporated, Chicago, Ill., a corporation of West Virginia

Application September 16, 1938, Serial No. 230,172

17 Claims. (Cl. 101—141)

My invention relates to improvements in duplicating machines, being illustrated in connection with a machine of the type employing a master sheet in the form of a thin sheet of aluminum or a sheet of parchment paper, or the like, upon which water or other suitable ink repellent is adapted to spread and adhere when applied thereto, such master sheet being inked before each impression so as to make a good copy upon a copy sheet brought into effective pressure relationship thereto. My present improvements are not to be restricted to use in connection with this type of machine, however, so far as they are applicable for use with other types of duplicating machines.

My invention relates among other things to an improved driving arrangement for the drum and its cooperating parts by which the drum may be kept constantly in motion at an even rate of speed while the cooperating rollers by which the copy sheets are forwarded to the drum are driven intermittently, the arrangement being such that the copy sheets are presented to the forwarding rollers at the time when such rollers are stationary and that the rear portion of each of the copy sheets as presented to the forwarding rollers is slightly overdriven for causing the sheet to become slightly bowed or buckled by reason of its engagement with the forwarding rollers so as to apply a yielding pressure on the forward edge of the sheet through the resiliency of the bowed portion of the sheet for bringing such forward edge into precise transverse alignment between the forwarding rollers regardless of any slight deviation of the sheet from proper alignment longitudinally as it approaches the forwarding rollers.

To this end, it has been one of the objects of my invention to provide an improved arrangement by which a gear rotatable with the drum and employed for driving the sheet forwarding rollers may be shifted backwardly a short distance with respect to the driving means upon each complete rotation of the drum, such gear being momentarily held stationary during a comparatively small fractional portion of each succeeding rotation of the drum. For accomplishing this purpose, I have provided a novel arrangement of gearing comprising a series of pins mounted in evenly spaced relation about the axis of a driven part in position for engagement successively with suitable latching means, such driven part being provided with a ratchet wheel having teeth corresponding in number with the number of said pins so that said teeth are brought into operative position successively for cooperation with the driving pawl which is carried around evenly without stops during the rotation of the drum. Such improved driving means is of course arranged in critically timed relation with respect to the feed of the copy sheets to the forwarding rollers whereby the copy sheets are buckled as above suggested.

My invention relates further to improved means for feeding water or other ink repellent as the drum rotates, together with improved means for applying ink on the master sheet. Improved means is also provided for moving the moistening means and the inking means successively into and out of operative position and for applying pressure to the copy sheets through a platen roller which likewise may be moved into and out of operative position under the control of the operator.

It is still another object of my invention to improve duplicating machines of this type in sundry details hereinafter pointed out. The preferred means by which I have accomplished my several objects are illustrated in the drawings and are hereinafter specifically described.

In the drawings—

Fig. 1 is a top plan view of my improved machine, partially broken away at its end portions, and with certain of the other parts either broken away or omitted for clearness of illustration;

Fig. 2 is a longitudinal vertical sectional view taken substantially at the line 2—2 of Fig. 1;

Fig. 3 is a transverse vertical sectional view taken substantially at the line 3—3 of Fig. 7;

Figs. 4 and 5 are fragmentary vertical sectional views taken substantially at the lines 4—4 and 5—5, respectively, of Fig. 3;

Fig. 6 is a transverse vertical sectional view taken substantially at the line 6—6 of Fig. 7;

Fig. 7 is a longitudinal vertical sectional view taken substantially at the line 7—7 of Fig. 6;

Figs. 8, 9 and 10 are views similar to a portion of Fig. 2 but with certain of the parts omitted, Fig. 8 showing the parts in their rest position, Fig. 9 showing the water applying roller in operative position, and Fig. 10 showing both the water and the ink applying rollers in operative position, as compared with Fig. 2 which shows the water and ink applying rollers and the impression roller all in operative position;

Fig. 11 is a longitudinal vertical sectional view on a slightly enlarged scale taken substantially at the line 11—11 of Fig. 6, showing the position of the parts at the start of a momentary pause

in the drive of the ratchet and the forwarding rollers;

Fig. 12 is a view substantially similar to Fig. 11, with the cooperating forwarding rollers and the ratchet from which such rollers are driven in the same position as Fig. 11, but with the drum and the paper feeding means in slightly changed position just ready for the reestablishment of the driving connections for the forwarding rollers;

Fig. 13 is a view substantially similar to a portion of Fig. 12 but showing the position of the parts shortly after the reestablishment of the drive for the forwarding rollers; and

Fig. 14 is a horizontal sectional view taken substantially at the line 14—14 of Fig. 13.

Referring now to the several figures of the drawings, in which corresponding parts are indicated by the same reference characters, 20 indicates a housing comprising standard portions 21 and 22 at opposite sides of the machine connected by a transversely extending bottom wall portion 23, as is best shown in Fig. 3, such parts comprising the major portions of the framework of my improved machine. As is best shown in Fig. 1, the housing members 21 and 22 are reinforced by large heavy plates 24 at their inner face portions, other reinforcing parts being employed at other points, such as the reinforcing member 25 as shown at the bottom left hand portion in Fig. 2. The housing is supported in the arrangement shown by blocks 26 of rubber or other suitable material.

As is best shown in Fig. 6, the frame portions 21 and 22 are provided at opposite sides of the machine with ball bearing assemblies 27 and 28, respectively, by which a heavy shaft 29 is rotatably mounted in position, said shaft 29 having a drum 30 fixedly mounted thereon. As is best shown in said Fig. 6, a gear 31 is rigidly mounted upon the end portion of the drum at the right in said Fig. 6, a heavy collar 32 and a cam 33 as hereinafter described being interposed between the gear and the end wall of the drum. In the arrangement shown, the gear 31, the cam 33 and the collar 32 are connected with the drum by means of machine screws 34. Immediately below the gear 31, a pinion 35 is rotatably mounted in position upon the standard 22, such pinion 35 being fixedly connected with a crankhandle 36, such connection being effected through the medium of a short shaft 37. The arrangement is such that the operator is enabled to drive the drum 30 continuously through any desired number of successive revolutions through the medium of the crank 36 and its associated parts as above described.

In the preferred arrangement of my improved machine, the drum 30 is provided with a master sheet 38 formed of a thin sheet of aluminum or other suitable material adapted to cause water or other suitable ink repellent to spread over the surface and to adhere to the surface, such master sheet 38 being secured in position by means of grippers 39 of any suitable type which preferably press the leading edge of the master sheet against a portion of the drum, as is shown in Fig. 2 and many other figures. The grippers 39 are preferably spring mounted so as normally to hold the master sheet in position, any suitable means to be provided as is well understood in the art for releasing the grippers 39 when desired for expediting the substitution of a new master sheet in place of one in use.

As is usual in machines of this type, an impression roller 40 is rotatably mounted in position so as to be movable into and out of operative position with respect to the drum. In the arrangement shown, the impression roller 40 is rotatably mounted in position by means of a shaft 41 which is journaled in the end portions of levers 42 which in turn are fixedly mounted upon a shaft 43 rotatably mounted between the standards 21 and 22. Upon the shaft 43, there is fixedly mounted an arm 44 upon the forward end of which a roller 45 is rotatably mounted for controlling the position of the roller 40 as hereinafter described. A coiled spring 46 is connected at one end with the arm 44 and at its opposite end with a suitable portion of the framework, serving normally to draw the arm 44 downward for causing the impression roller 40 to press against the drum.

At the left side of the drum as shown in Fig. 2, I have mounted a roller 47 rotatably in position, such roller being mounted by means of a shaft 48 between the arms of a swingingly mounted bracket 49, a spring 50 being provided in connection with the bracket 49 serving normally to press the roller 47 toward the right in Fig. 2 for operative engagement with the master sheet 38 on the drum. Above the roller 47, there is a transversely extending pipe 51 having a series of openings 52 in its bottom wall portion, as is best shown in Fig. 1, such pipe being connected by means of a rubber hose 53 or the like with a suitable source of water or other ink repellent under pressure as hereinafter described. A trough 54 of any suitable type is provided on the bracket 49 underneath the roller 47 for carrying away excess water or other ink repellent not taken up by the master sheet 38. In the preferred arrangement, the roller 47 is provided with an outer face portion 55 of felt or other suitable absorbent material mounted in position over a base portion 56 of rubber.

The inking means of my improved machine comprises an inking roller 57 journaled by means of a shaft 58 between arms 59 and 60 which are pivotally mounted at their forward ends by means of pins 61, as is best shown in Fig. 2. In the arrangement shown, the inking roller 57 is provided with a pinion 62 which meshes with a gear 63 fixedly mounted upon the end of the drum at the left in Fig. 3, such gear being best shown in Figs. 1 and 6. The arrangement is such that the inking roller 57 is driven continuously during the rotation of the drum.

Adjacent to the inking roller 57 so as to bear against said roller, there is an ink-cutting roller 64 mounted between the arms 59 and 60 by means of a shaft 65. At one end, the shaft 65 is provided with a comparatively wide gear 66 which meshes with the gear 62 carried by the inking roller 57. At its opposite end, the shaft 65 is provided with a drum 67 having a cam groove 68 in its face. A roller 69 rotatably mounted in position upon a bracket 70 engages the cam groove 68 so as to cause the roller 64 to be reciprocated longitudinally transversely of the machine during its rotation, the gear 66 being of such thickness axially as to permit such movement without breaking its driving connection with the gear 62. The bracket 70 is mounted upon the adjacent arm 60.

Adjacent to the ink-cutting roller 64, I have provided a vibrating roller 71 rotatably mounted upon the upper ends of pivotally mounted arms 72 by means of a shaft 73 (see Fig. 2). As is clearly shown in Fig. 2, the arms 72 are urged

toward the left in said figure by means of a spring 74 for holding the roller 71 normally in contact with the ink-cutting roller 64. The roller 71 is moved periodically toward the right in said Fig. 2 out of engagement with the roller 64 by means of a cam 75 mounted upon the shaft 65 of the roller 64, such cam 75 cooperating with a roller 76 upon the shaft 73 of the roller 71. The arrangement is such that as the cutting-roller 64 rotates the vibratory roller 71 is moved alternately into and out of engagement with the roller 64.

Adjacent to the vibratory roller 71, I have provided an ink fountain 77 of any approved type with a roller 78 forming the inner side face of the fountain, such roller 78 being mounted by means of a shaft 79 journaled in the arms 59 and 60. At one end, the shaft 79 is provided with a ratchet 80 fixedly mounted thereon arranged to be actuated by a pawl 81 pivotally mounted upon one of the arms 72 by which the roller 71 is mounted movably in position. The arrangement is such that when the arm 72 is swung toward the left in Fig. 7 the pawl 81 slides under one or more teeth of the ratchet 80 and that as the arm swings again toward the right in said Fig. 7 the fountain roller 78 is given a slight rotary movement in counter clockwise direction in said Fig. 7. A spring 82 normally holds the pawl 81 up in engagement with the ratchet 80.

The means for throwing the moistening roller 47, the inking roller 57, and the impression roller 40 into and out of operative position with respect to the drum 30 and the master sheet 38 carried thereby comprises a cam member 83 rotatably mounted on the shaft 29 of the drum at the left side of the machine as shown in Fig. 6. This cam member 83 is provided with a downwardly extending arm 84 (see Fig. 8) which terminates at its lower end in a toothed segmental portion 85 which meshes with a gear 86 mounted by means of a transverse shaft 87 journaled in the side frames 21 and 22. At the end opposite that at which the gear 86 is mounted, the shaft 87 is provided with a head member 88 having a plurality of notches 89 therein with one or another of which a spring detent 90 engages, the arrangement being such that the detent 90 holds the cam member 83 yieldingly against rotary movement about the shaft 29 of the drum. Upon its outer end, the shaft 87 is provided with a setting head 91 in the form of a knob by which the shaft 87 can be turned for giving the cam member 83 a rotary movement as hereinafter described.

As is clearly shown in Fig. 8, the arm 84 of the cam member 83 is provided with a cam bar 92 fixedly mounted in position with respect to the arm 84 so as to engage the roller 45 by which the position of the impression roller 40 is controlled. In the arrangement shown in Fig. 8, the cam bar 92 holds the roller 45 in raised position for holding the impression roller 40 out of engagement with the drum. The cam 83 is provided with a high portion 93 at the left in Fig. 8 adapted by engagement with a roller 94 carried by the shaft 48 of the moistening roller 47 to hold the moistening roller displaced toward the left against the action of the spring 50, as shown in said Fig. 8. The cam member 83 further is provided with a high portion 95 adapted by engagement with a roller 96 carried by the shaft 58 of the inking roller to hold the inking roller 57 out of engagement with the drum 30 and the master sheet 38 thereon.

The arrangement of the cam member 83 and its associated parts in such that when the parts are in the position as shown in Fig. 8, the impression roller 40, the moistening roller 47, and the inking roller 57 are all out of operative position. When the setting head 91 has been rotated slightly for bringing the detent 90 into engagement with the next adjacent notch 89 of the head 88, the parts are moved to the position as shown in Fig. 9, in which the impression roller 40 and the inking roller 57 are still out of engagement with the drum, while the moistening roller 47 stands in operative engagement with the master sheet 38 on the drum. When the setting head 91 has been turned still farther so as to bring the parts into the position as shown in Fig. 10, the moistening roller 47 and the inking roller 57 are then both in operative position, while the impression roller 40 is still held in inoperative position. When thereafter the setting head 91 has been turned to bring the spring detent 90 into engagement with the last one of the series of notches 89 of the head 88, the parts are brought to the position as shown in Fig. 2, with the moistening roller 47, the inking roller 57, and the impression roller 40 all in operative position with respect to the drum 30 and the master sheet 38.

The means for delivering water or other ink repellent to the roller 47 through the tube 53 comprises a pump 97 mounted within a receptacle 98 adapted to hold a supply of water or other suitable repellent for the ink, the pump being arranged so as to deliver a stream of liquid from the receptacle through the tube 53 upon downward movement of a plunger 98', such downward movement being effected through the medium of a spring 99. The upward preparatory stroke of the plunger 98' against the pressure of the spring 99 is effected through the medium of a lever 100 which is pivotally mounted upon the end frame 21 by means of a bolt 101 (see Fig. 6 at the left). The lever 100, in turn is actuated by a second lever 102 which is pivotally mounted upon said bolt 101 and which has an arm 103 extending underneath the lever 100 with a turned end portion 104 in position to engage said lever 100. The lever 102 extends upwardly and forwardly from the bolt 101 as shown in Figs. 2 and 7, being provided at its upper end with a roller 105 in position to engage a cam 106 fixedly mounted upon the shaft 29 of the drum. The arrangement is such that upon each rotation of the drum 30 the lever 102 is moved downwardly by the cam 106, serving to raise the lever 100 and with it the plunger 98' of the pump. In the arrangement shown, the lever 100 is provided with a handle portion 107 by which the lever can be manipulated manually for actuating the pump whenever such operation is desirable.

In the arrangement shown, the lever 100 is provided with a downwardly extending arm 108 provided at its lower end with a roller 109 which is in position to engage a cam 110 for limiting the downward movement of the lever 100. The cam 110 is rotatably mounted in position by means of a shaft 111 which is provided upon its outer end with a turning head 112 (see Fig. 3) by which the cam can be set at any desired position for limiting the downward movement of the roller 109. In this way, the length of the stroke of the pump 97 is regulated so as to control the amount of fluid delivered through the tube 53.

The means for feeding copy sheets to the drum and for forwarding the sheets in timed relation to the movement of the master sheet 38 com-

prises a pair of forwarding rollers 113 and 114 which are rotatably mounted in cooperative relation to each other adjacent to the impression roller 40. In the arrangement shown, the forwarding roller 113 is mounted in position by means of a shaft 115 which is journaled between the side frames 21 and 22. As is best shown in Fig. 12, the shaft 115 is provided at one end with a gear 116 which meshes with an idler gear 117 carried by a shaft 118, the idler gear 117 being in mesh with a gear 119 loosely mounted upon the collar 32 which is interposed between the gear 31 and the drum 30 (see Fig. 6). The arrangement is such that when the gear 119 is driven the rollers 113 and 114 are rotated in cooperative relation for carrying a copy sheet toward the right in Fig. 8 toward the drum 30.

In the arrangement shown, the roller 114 is rotatably mounted in position by means of a shaft 120 which is supported at its opposite ends by arms 121 pivotally mounted on the adjacent frame standards 21 and 22 respectively, each of said arms 121 being pressed upwardly by means of a spring 122 for holding the roller 114 yieldingly in cooperative relation to the roller 113. The roller 114 is driven by frictional engagement with the roller 113 or with the copy sheet interposed between said two rollers.

For holding a supply of copy sheets to be fed one at a time to the rollers 113 and 114, I have provided a table 123 extending across from the frame standard 21 to the frame standard 22, as is best shown in Fig. 3. Upon the table 123 I have provided adjustable guides 124 and 125 each in the form of an angle, such guides being held in position by means of pins 126 extending downwardly from the guides through suitable slots in the table 123, such pins 126 being provided with coiled springs 127 thereon for causing the guides to have a frictional grip on the face of the table 123. In the arrangement shown, a pile 128 of copy sheets is supported in position on the table 123 between the guides 124 and 125. As is best shown in Fig. 12, the forward edge portion of the table 123 is obliquely disposed at 129 for directing a copy sheet from the pile 128 to the bite of the rollers 113 and 114. For assisting in directing the forward edge of a copy sheet to the rollers, I have provided an obliquely disposed guide plate 130 immediately above the obliquely disposed portion 129 of the table.

For feeding copy sheets one at a time from the pile 128 upon the table 123 into the bite of the rollers 113 and 114, I have provided paper feeding means comprising intermittently driven rollers 131 and 132 fixedly mounted upon a shaft 133 journaled in an arm 134 adapted to swing about the axis of a shaft 135 (see Figs. 1 and 2). The means for driving the rollers 131 and 132 comprises sprocket gears 136 and 137 mounted upon the shafts 135 and 133 respectively and operatively connected together by means of a sprocket chain 138, as is clearly shown in Fig. 5.

In my improved arrangement, the shaft 135 carrying the arm 134 and the rollers 131 and 132 is removably mounted in position. For accomplishing this purpose, a sleeve 139 is mounted upon the shaft 135 at the right in Fig. 3, being connected at one end with one side wall portion of the arm 134, which is shown in the form of a housing, and connected at its opposite end with a socket member 140 which is removably mounted upon the rounded head portion 141 of a pin 142 carried by the frame standard 22. At its opposite end portion, at the left in Fig. 3, the shaft 135 is slidably mounted in a sleeve 143, the opposite end portion of which is slidably mounted upon the inner end of a short shaft section 144 journaled in a suitable bearing carried by the frame standard 21. A coiled spring 145 is interposed between the shaft 135 and a pin 146 carried by the sleeve 143, serving normally to hold the sleeve 143 at the limit of its motion toward the left in said Fig. 3. The end portion of the sleeve 143 is notched longitudinally at 147 so as to have releasable engagement with a pin 148 carried by the shaft section 144. The sleeve 143 is also provided with a pin 149 extending through a longitudinally positioned slot 150 in the shaft 135. The arrangement is such that the shaft 135 is caused to rotate with the shaft section 144 when in operative position as shown in Fig. 3. Whenever the rollers 131 and 132 are to be removed from position, the sleeve 143 is moved toward the right in Fig. 3 for freeing the notches 147 from the pin 148 and for carrying the end of such sleeve toward the right for clearing the end of the shaft section 144, after which the shaft assembly as a whole can be moved toward the left in said figure for clearing the socket member 140 from the pin 142.

The means for rotating the shaft section 144 and the shaft 135 comprises a pinion 151 loosely mounted upon the outer end portion of the shaft section 144, such pinion being connected with the shaft section 144 by means of a clutch comprising a plate 152 having notches 153 therein within which roller bearing devices 154 operate, such roller bearing devices being confined within a shell 155 (see Fig. 4). The roller bearing devices 154 are normally held by springs 156 in clutching engagement with the shell 155, the arrangement being such that the plate 152 is adapted to drive the shell 155 in clockwise direction in Fig. 4 but is adapted to rotate in counterclockwise direction in said figure independently of movement of the shell.

As is best shown in Figs. 1 and 3, the socket member 140 is provided with a shoulder 157 which is adapted by engagement with a pin 158 carried by the frame standard 22 to limit movement of the arm 134 in counter clockwise direction in Fig. 2. The arrangement is such that the arm 134 and the rollers 131 and 132 can be lifted from operative position as shown in Fig. 2 and swung upwardly and backwardly into a past center position whenever a fresh supply of copy sheets is to be mounted in position upon the table 123.

The means for driving the pinion 151 in counter clockwise direction in Fig. 2 for giving the rollers 131 and 132 a corresponding rotary movement for carrying the top sheet from the pile 128 forward toward the right in said figure into the bite of the rollers 113 and 114 comprises an arm 159 provided with a series of teeth 160 at its upper end meshing with the pinion 151, such arm being pivotally mounted at about its middle portion upon a horizontally disposed pin 161 carried by the frame standard member 21, as is best shown in Fig. 3. At its lower end, the arm 159 is pivotally connected with a long link 162, the forward end of which is pivotally connected with the lower end of a lever 163 which is pivotally mounted upon a bracket 164 carried by the frame standard 22 (see Fig. 7). At its upper end, the lever 163 is provided with a roller 165 in position to engage the cam 106 carried by the drum shaft 29. A coiled spring 166 serves normally to press the link 162 forwardly toward the left in Fig. 7

for holding the roller 165 yieldingly against the cam 106. The arrangement is such that as the drum 30 is rotated the lever 163 is swung about its intermediate pivotal axis for giving the arm 159 corresponding swinging movements. When the lever 163 and the arm 159 are swung in clockwise direction in Fig. 2 against the action of the spring 156 into the position as shown in Fig. 2, the pinion 151 and the shaft 135 are driven in counter clockwise direction in said Fig. 2 for forwarding a copy sheet from the pile 128.

The means for driving the gear 119 and the forwarding rollers 113 and 114 intermittently as compared with the continuous rotation of the drum 30 will now be described. This means comprises a ratchet 167 fixedly mounted upon the gear 119, as is best shown in Fig. 6. Opposite the ratchet 167, I have provided a pawl 168 pivotally mounted upon the cam member 33, a spring 169 being mounted in position in connection with the pawl for holding it normally at the limit of its motion in counterclockwise direction in Fig. 11. Upon the frame member 21 below and at the right of the drum as shown in Fig. 11, I have mounted a heavy bracket 170 (see Fig. 14) which is adjustably held in position by means of machine screws 171 extending through arc shaped slots 172 whereby the position of the bracket can be adjusted as may be required. Upon the upper edge portion of the bracket 170, I have provided a cam portion 173 in position to engage a roller 174 carried by the pawl 168. The arrangement is such that the roller 174 is brought into engagement with the cam 173 momentarily upon each rotation of the drum, such cam portion being adapted in each instance to give the pawl 168 a slight rotary movement in clockwise direction in Fig. 11 for causing the pawl to be disengaged from the ratchet 167 so as to permit the pawl 168 and the cam 33 upon which it is mounted to rotate in counterclockwise direction in said Fig. 11 independently of rotation of ratchet 167 and the gear 119. Immediately after the pawl 168 has been disengaged, the roller 174 passes out of engagement with the cam portion 173, and the spring 169 brings the pawl back into position to engage the next succeeding tooth of the ratchet 167. By the provision of this arrangement, the pawl 168 and cam 33 gain one tooth distance upon the ratchet 167 and the gear 119 during each rotation of the drum 30.

Means is provided in connection with the gear 119 for holding the gear stationary each time it is released by the pawl 168 as above described. Such means comprises a plurality of pins 175 mounted upon the outer face of the gear 119, such pins being mounted in equally spaced relation about the gear, and being equal in number to the number of the teeth in the ratchet 167. For engaging one or another of the pins 175, I have provided a pawl 176 pivotally mounted upon the bracket 170 by means of a pin 177, a spring 178 being provided adapted normally to hold the pawl turned to the limit of its motion in counterclockwise direction in Fig. 11. The pawl 176 is provided upon its outer face with a roller 179 in position to engage the cam 33. The cam 33 is so positioned and so shaped as to serve during the major portion of the rotation of the cam to hold the pawl 176 out of the path of movement of the pins 175 but so as to permit the pawl 176 to move into engagement with one of the pins 175 when the roller 179 is brought into engagement with a low portion 180 of the cam as shown in Figs. 11 and 12. The arrangement is such that just at the time when the pawl 168 is forced out of engagement with the ratchet 167 the pawl 176 is permitted to move inwardly to engage one of the pins 175 for stopping the rotation of the gear 119. The arrangement further is such that when the pawl 168 reaches a position as shown in Fig. 12 so as to reengage the ratchet 167, the cam 33 by its action upon the roller 179 forces the pawl 176 out of engagement with the pin 174 so as to permit the cam 33 and the gear 119 again to rotate in unison.

In the operation of the machine, one copy sheet at a time is fed from the pile 128 on the table 123 to the forwarding rollers 113 and 114, by which the sheet is forwarded between the drum 30 and the impression roller 40. As the copy sheet moves toward the right in Fig. 11 from the impression roller 40, the sheet is delivered to a tray 181 which is removably mounted in position by any suitable means below the drum immediately at the right of the impression roller as shown in said Fig. 11.

The operating parts as above described are so arranged in timed relation to each other that the rollers 131 and 132 bring the forward edge of the copy sheet into engagement with the rollers 113 and 114 very shortly after the rotation of the forwarding rollers 113 and 114 has stopped. The arrangement is such that at this point of the operation the rollers 131 and 132 are still in active operation for forwarding the copy sheet toward the right in said Fig. 11. As the movement of the portion of the copy sheet underneath the rollers 131 and 132 continues after the leading edge of the sheet has been stopped by the rollers 113 and 114, the sheet is brought into buckled or bowed condition as shown in Fig. 12, the continued rotation of the rollers 131 and 132 being merely sufficient for introducing the desired arching of the paper substantially as shown in said figure. As a result of this arrangement and cooperative action, the forward edge of the sheet, designated in Fig. 12 by the reference character 182, is pressed quite firmly by the resiliency of the paper so as to be brought into precise transverse alignment with respect to the forwarding rollers 113 and 114. In this way, even if the sheet 182 be delivered slightly out of normal aligned position, the leading edge is brought into exact transverse alignment so as to insure that the sheet shall be forwarded by the forwarding rollers in the desired aligned position.

With the parts in the position as shown in Fig. 8, when an operator desires to use the machine, the drum is rotated through the medium of the crank handle 36. If desired, the pump 97 can be given an operative stroke or two by the use of the handle 107 on the lever or arm 100 so as to be sure that the roller 47 is provided with a film of moisture about its face. The head 91 is then given a slight rotary movement for carrying the cam member 83 to the position as shown in Fig. 9, whereupon the drum 30 is given one or more complete revolutions for insuring that the face of the master sheet 38 is thoroughly moistened by engagement with the roller 47. The head 91 is then given an additional slight movement for bringing the parts to the position as shown in Fig. 10, whereupon the drum is given one or more revolutions for insuring that the master plate shall be thoroughly inked. The head 91 is then given a further rotary movement for bringing the parts to the position as shown in Fig. 2, in which position the machine is ready for operation. For the preliminary

movement of the drum as above described, the arm 134 is preferably raised for carrying the rollers 131 and 132 out of contact with the pile 128 of copy sheets, the rollers 131 and 132 being brought again to their operative position as shown in Fig. 2 after the conditioning of the parts as above described.

Upon the continued rotation of the drum by means of the handle 36, a copy sheet is delivered to the forwarding rollers 113 and 114 and thence to the drum 30 and the impression roller 40 upon each complete rotation of the drum 30. The drum 30 is driven continuously at an even speed of rotation, while the forwarding rollers 113 and 114 are driven intermittently as above described in such timed relation with respect to the action of the feeding rollers 131 and 132 as to cause each copy sheet in turn to be buckled for insuring the proper alignment of the sheet as it is pulled forward by the rollers 113 and 114 after the termination of the forwarding movement of the sheet by the feeding rollers 131 and 132. My improved machine and its cooperating parts comprising the master sheet 38 of aluminum or of parchment are such that any desired number of copies may be run as may be desired, the master sheet being provided with a fresh supply of ink for each production of a copy therefrom.

By the use of my improved construction, a very efficient machine is provided, which is comparatively simple in construction and arrangement and which is so arranged as to cause the wear and tear on the mechanism to be kept to a minimum. The machine is so arranged as to be capable of being produced at a comparatively low cost, while at the same time being adapted to do highly effective work.

With respect to the position of the moistener roll 47 at the left of the drum as shown in Fig. 2, it will be understood that this roll and its cooperating mechanism might be shifted to any other desired position relative to the drum, if such changed position should be deemed advisable. It is to be understood that if this moistening mechanism should be shifted, a corresponding change would be made in the position of the high portion 93 of the cam member 83. Whether the moistener is kept at the left of the drum as shown in Fig. 2 or is transferred to the opposite side of the drum, as might well be done, the arrangement is still to be kept such that upon the rotation of the setting head 91 for shifting the position of the cam 83 the inking mechanism is thrown out of operation ahead of the moistening device and is in turn thrown again into operation upon the reverse rotation of the setting head after the completion of the movement of the parts for throwing the moistening device into operative position.

While I prefer to employ the form and arrangement of parts as shown in the drawings and as above described, it is to be understood that my invention is not limited to the construction shown except so far as the claims may be so limited, it being understood that changes might well be made in the form and arrangement of the parts without departing from my invention.

I claim:

1. In a diplicating machine, the combination of a drum, means for mounting a master sheet removably in position on said drum, forwarding rollers adapted by rotation in cooperative relation to each other to forward a copy sheet into impression relationship to said master sheet, driving means adapted normally to rotate said drum continuously through a series of revolutions, means comprising a gear for rotating said forwarding rollers, means adapted by operative connection with said driving means to rotate said gear and said forwarding rollers during the greater portion of each rotation of the drum, and means for disconnecting said gear from said driving means during a comparatively small fractional portion of each rotation of the drum for permitting said gear and said rollers to remain stationary.

2. In a duplicating machine, the combination of a drum, means for mounting a master sheet removably in position on said drum, forwarding rollers adapted by rotation in cooperative relation to each other to forward a copy sheet into impression relationship to said master sheet, driving means adapted normally to rotate said drum continuously through a series of revolutions, means comprising a gear for rotating said forwarding rollers, means adapted by operative connection with said driving means to rotate said gear and said forwarding rollers during the greater portion of each rotation of the drum, means for disconnecting said gear from said driving means during a comparatively small fractional portion of each rotation of the drum, and means for holding said gear and said rollers stationary while disconnected from said driving means.

3. In a duplicating machine, the combination of a drum, means for mounting a master sheet removably in position on said drum, forwarding rollers adapted by rotation in cooperative relation to each other to forward a copy sheet into impression relationship to said master sheet, driving means adapted normally to rotate said drum continuously through a series of revolutions, means comprising a gear for rotating said forwarding rollers, means adapted by operative connection with said driving means to rotate said gear and said forwarding rollers during the greater portion of each rotation of the drum, means for disconnecting said gear from said driving means at a predetermined point in each successive rotation of the drum, latch means adapted automatically to engage said gear when released from said driving means for holding the gear and said forwarding rollers stationary, and means actuated in timed relation with said driving means for releasing said latch means and reconnecting said gear with said driving means when the drum has moved through a comparatively small fractional portion of a rotation following the disconnection of the gear from the driving means.

4. In a duplicating machine, the combination of a drum, means for mounting a master sheet removably in position on said drum, forwarding rollers adapted by rotation in cooperative relation to each other to forward a copy sheet into impression relationship to said master sheet, driving means adapted normally to rotate said drum continuously through a series of revolutions, means comprising a gear for rotating said forwarding rollers, pawl and ratchet mechanism normally connecting said gear with said driving means, and means adapted automatically at a predetermined point in each rotation of said drum to disengage said pawl from the then operative tooth of said ratchet and thereafter to reengage the pawl with a different tooth so as to cause said gear and the forwarding rollers to remain stationary during a comparatively small fractional portion of each rotation of the drum.

5. In a duplicating machine, the combination of a drum, means for mounting a master sheet removably in position on said drum, forwarding rollers adapted by rotation in cooperative relation to each other to forward a copy sheet into impression relationship to said master sheet, driving means adapted normally to rotate said drum continuously through a series of revolutions, means comprising a gear for rotating said forwarding rollers, pawl and ratchet mechanism normally connecting said gear with said driving means, means adapted automatically at a predetermined point in each rotation of the drum to disengage said pawl from the then operative tooth of said ratchet for stopping the drive of said gear and thereafter to reengage the pawl with a different one of said teeth for reestablishing the drive after a comparatively small fractional portion of a rotation of the drum, and means for holding said gear stationary during the discontinuance of the driving relations.

6. In a duplicating machine, the combination of a drum, means for mounting a master sheet removably in position on said drum, forwarding rollers adapted by rotation in cooperative relation to each other to forward a copy sheet into impression relationship to said master sheet, driving means adapted normally to rotate said drum continuously through a series of revolutions, means comprising a gear for rotating said forwarding rollers, pawl and ratchet mechanism normally connecting said gear with said driving means, means adapted automatically at a predetermined point in each rotation of the drum to disengage said pawl from the then operative tooth of said ratchet for stopping the drive of said gear and thereafter to reengage the pawl with a different one of said teeth for reestablishing the drive after a comparatively small fractional portion of a rotation of the drum, and latch means serving at any of the various positions of the gear at which said pawl is disengaged from said ratchet automatically to engage said gear for holding it stationry during the discontinuance of the driving relations.

7. In a duplicating machine, the combination of a drum, means for mounting a master sheet removably in position on said drum, forwarding rollers adapted by rotation in cooperative relation to each other to forward a copy sheet into impression relationship to said master sheet, driving means adapted normally to rotate said drum continuously through a series of revolutions, means comprising a gear for rotating said forwarding rollers, pawl and ratchet mechanism normally connecting said gear with said driving means, means adapted automatically at a predetermined point in each rotation of the drum to disengage said pawl from the then operative tooth of said ratchet for stopping the drive of said gear and thereafter to reengage the pawl with a different one of said teeth for reestablishing the drive after a comparatively small fractional portion of a rotation of the drum, and latch means serving at any of the various positions of the gear at which said pawl is disengaged from said ratchet automatically to engage said gear for holding it stationary and serving automatically to release the gear when driving relations are reestablished.

8. In a duplicating machine, the combination of a drum, means for mounting a master sheet removably in position on said drum, forwarding rollers adapted by rotation in cooperative relation to each other to forward a copy sheet into impression relationship to said master sheet, driving means adapted normally to rotate said drum continuously through a series of revolutions, means comprising a gear for rotating said forwarding rollers, pawl and ratchet mechanism normally connecting said gear with said driving means, means adapted automatically at a predetermined point in each rotation of the drum to disengage said pawl from the then operative tooth of said ratchet for stopping the drive of said gear and thereafter to reengage the pawl with a different one of said teeth for reestablishing the drive after a comparatively small fractional portion of a rotation of the drum, a plurality of pins mounted in evenly spaced relation to each other about said gear, and a latch device movably mounted adjacent to said gear adapted automatically to engage one of said pins for holding said gear stationary when said driving relations are broken.

9. In a duplicating machine, the combination of a drum, means for mounting a master sheet removably in position on said drum, forwarding rollers adapted by rotation in cooperative relation to each other to forward a copy sheet into impression relationship to said master sheet, driving means adapted normally to rotate said drum continuously through a series of revolutions, means comprising a gear for rotating said forwarding rollers, pawl and ratchet mechanism normally connecting said gear with said driving means, means adapted automatically at a predetermined point in each rotation of the drum to disengage said pawl from the then operative tooth of said ratchet for stopping the drive of said gear and thereafter to reengage the pawl with a different one of said teeth for reestablishing the drive after a comparatively small fractional portion of a rotation of the drum, a plurality of pins mounted in evenly spaced relation to each other about said gear, a latch device movably mounted adjacent to said gear adapted automatically to engage one of said pins for holding said gear stationary when said driving relations are broken, and means for automatically disengaging said latch device from said pin when said driving relations are reestablished.

10. In a duplicating machine, the combination of a drum, means for mounting a master sheet removably in position on said drum, forwarding rollers adapted by rotation in cooperative relation to each other to forward a copy sheet into impression relationship to said master sheet, driving means adapted normally to rotate said drum continuously through a series of revolutions, means comprising a gear for rotating said forwarding rollers, pawl and ratchet mechanism normally connecting said gear with said driving means, means adapted automatically at a predetermined point in each rotation of the drum to disengage said pawl from one of the teeth of said ratchet for stopping the drive of said gear and thereafter to reengage the pawl with the next adjacent tooth for reestablishing the drive of the gear, pins mounted on said gear in evenly spaced relation to each other thereabout and corresponding in number with the number of the teeth in said ratchet, a latch device movably mounted adjacent to said gear adapted automatically to engage one of said pins for holding said gear stationary when said driving relations are broken, and means for automatically disengaging said latch device

from said pin when said driving relations are reestablished.

11. In a duplicating machine, the combination of a drum, means for mounting a master sheet removably in position on said drum, forwarding rollers adapted by rotation in cooperative relation to each other to forward a copy sheet into impression relationship to said master sheet, driving means adapted normally to rotate said drum continuously through a series of revolutions, means comprising a gear for rotating said forwarding rollers, a ratchet connected with said gear, a cam fixedly connected with said drum so as to rotate therewith, a pawl movably mounted on said cam adapted by engagement with said ratchet to cause said gear to rotate with the drum, means adapted automatically at a predetermined point in each rotation of the drum to disengage said pawl from the then operative tooth of said ratchet for stopping the drive of said gear and thereafter to reengage the pawl with a different one of said teeth for reestablishing the drive after a comparatively small fractional portion of a rotation of the drum, latch means adapted by an operative stroke at any of the several positions of the gear at which said pawl is disengaged from said ratchet to engage said gear, and means adapted by cooperation with said cam to move said latch into engagement with said gear when said driving connections for the gear are broken and then to move the latch again out of engagement with the gear when said driving connections are reestablished.

12. In a duplicating machine, the combination of a drum, means for mounting a master sheet removably in position on said drum, forwarding rollers adapted by rotation in cooperative relation to each other to forward a copy sheet into impression relationship to said master sheet, driving means adapted normally to rotate said drum continuously through a series of revolutions, means comprising a gear for rotating said forwarding rollers, a ratchet connected with said gear, a cam fixedly connected with said drum so as to rotate therewith, a pawl movably mounted on said cam adapted by engagement with said ratchet to cause said gear to rotate with the drum, means adapted automatically at a predetermined point in each rotation of the drum to disengage said pawl from the then operative tooth of said ratchet for stopping the drive of said gear and thereafter to reengage the pawl with a different one of said teeth for reestablishing the drive after a comparatively small fractional portion of a rotation of the drum, pins mounted on said gear in evenly spaced relation to each other thereabout corresponding in number with the number of the teeth in said ratchet, a latch device movably mounted adjacent to said gear adapted by an operative stroke to engage one of said pins for holding the gear stationary, and means adapted by cooperation with said cam to move said latch device into engagement with one of said pins when said driving connections are broken and then to move the latch device again out of engagement with said pin when said driving connections are reestablished.

13. In a duplicating machine, the combination of a drum, means for mounting a master sheet removably in position on said drum, forwarding rollers adapted by rotation in cooperative relation to each other to forward a copy sheet into impression relationship to said master sheet, driving means adapted normally to rotate said drum continuously through a series of revolutions, means comprising a gear for rotating said forwarding rollers, a ratchet connected with said gear, a plate fixedly connected with said drum so as to rotate therewith, a pawl movably mounted on said plate in position to engage said ratchet for causing said gear to rotate with the drum, yielding means normally holding said pawl in engagement with a tooth of said ratchet, and means adapted at a predetermined point in each rotation of the drum and plate to move said pawl out of engagement with the then operative tooth of said ratchet and thereafter promptly to release the pawl for permitting it to engage the next adjacent tooth of the ratchet.

14. In a duplicating machine, the combination of a drum, means for mounting a master sheet removably in position on said drum, forwarding rollers adapted by rotation in cooperative relation to each other to forward a copy sheet into impression relationship to said master sheet, driving means adapted normally to rotate said drum continuously through a series of revolutions, means comprising a gear for rotating said forwarding rollers, a ratchet connected with said gear, a plate fixedly connected with said drum so as to rotate therewith, a pawl movably mounted on said plate in position to engage said ratchet for causing said gear to rotate with the drum, yielding means normally holding said pawl in engagement with a tooth of said ratchet, and a cam in fixed position in the path of movement of said pawl adapted automatically at each rotation of the drum and plate to move said pawl out of engagement with the then operative tooth of the ratchet and thereafter to release the pawl for permitting it to engage the next adjacent tooth of the ratchet.

15. In a duplicating machine, the combination of a frame, a drum rotatably mounted on said frame, means for mounting a master sheet removably in position on said drum, forwarding rollers adapted by rotation in cooperative relation to each other to forward a copy sheet into impression relationship to said master sheet, a gear fixedly connected with said drum at one end thereof, driving means adapted normally by engagement with said gear to rotate said drum continuously through a series of revolutions, a second gear loosely mounted on the axis of said drum between said first-named gear and the drum, a ratchet rigidly connected with said second gear on its outer face, a plate fixedly connected with said drum so as to rotate therewith adjacent to said ratchet, a pawl movably mounted on said plate in position to engage said ratchet for causing said second gear to rotate with the drum, yielding means normally holding said pawl in engagement with a tooth of said ratchet, driving connections between said second gear and said forwarding rollers, and means adapted automatically at a predetermined point in each rotation of the drum and plate to move said pawl out of engagement with the then operative tooth of said ratchet for breaking the driving connections for said forwarding rollers and adapted automatically promptly thereafter to release the pawl for permitting it to engage the next adjacent tooth of the ratchet for reestablishing the drive for said forwarding rollers.

16. In a duplicating machine, the combination of a drum, means for mounting a master sheet removably in position on said drum, forwarding rollers adapted by rotation in cooperative relation to each other to forward a copy sheet into impression relationship to said master sheet,

means for driving said forwarding rollers intermittently and operating to cause said rollers to be stationary at a predetermined fractional portion of each rotation of the drum, and means for feeding a copy sheet into the bite of said forwarding rollers at each period when said rollers are stationary.

17. In a duplicating machine, the combination of a drum, means for mounting a master sheet removably in position on said drum, forwarding rollers adapted by rotation in cooperative relation to each other to forward a copy sheet into impression relationship to said master sheet, driving means adapted normally to rotate said drum continuously through a series of revolutions, means comprising a gear for rotating said forwarding rollers, means adapted by operative connection with said driving means to rotate said gear during the greater portion of each rotation of the drum, means for disconnecting said gear from said driving means during a comparatively small fractional portion of each rotation of the drum for permitting said gear and said rollers to remain stationary momentarily, and means for feeding a copy sheet into the bite of said forwarding rollers at each period when said rollers are stationary and arranged so as to cause the copy sheets to be buckled for insuring that the sheets shall be presented evenly and squarely into the bite of the rollers.

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