Aug. 24, 1937. R. F. MORRISON ET AL 2,090,849

DUPLICATING MACHINE

Filed Nov. 16, 1934 8 Sheets-Sheet 1

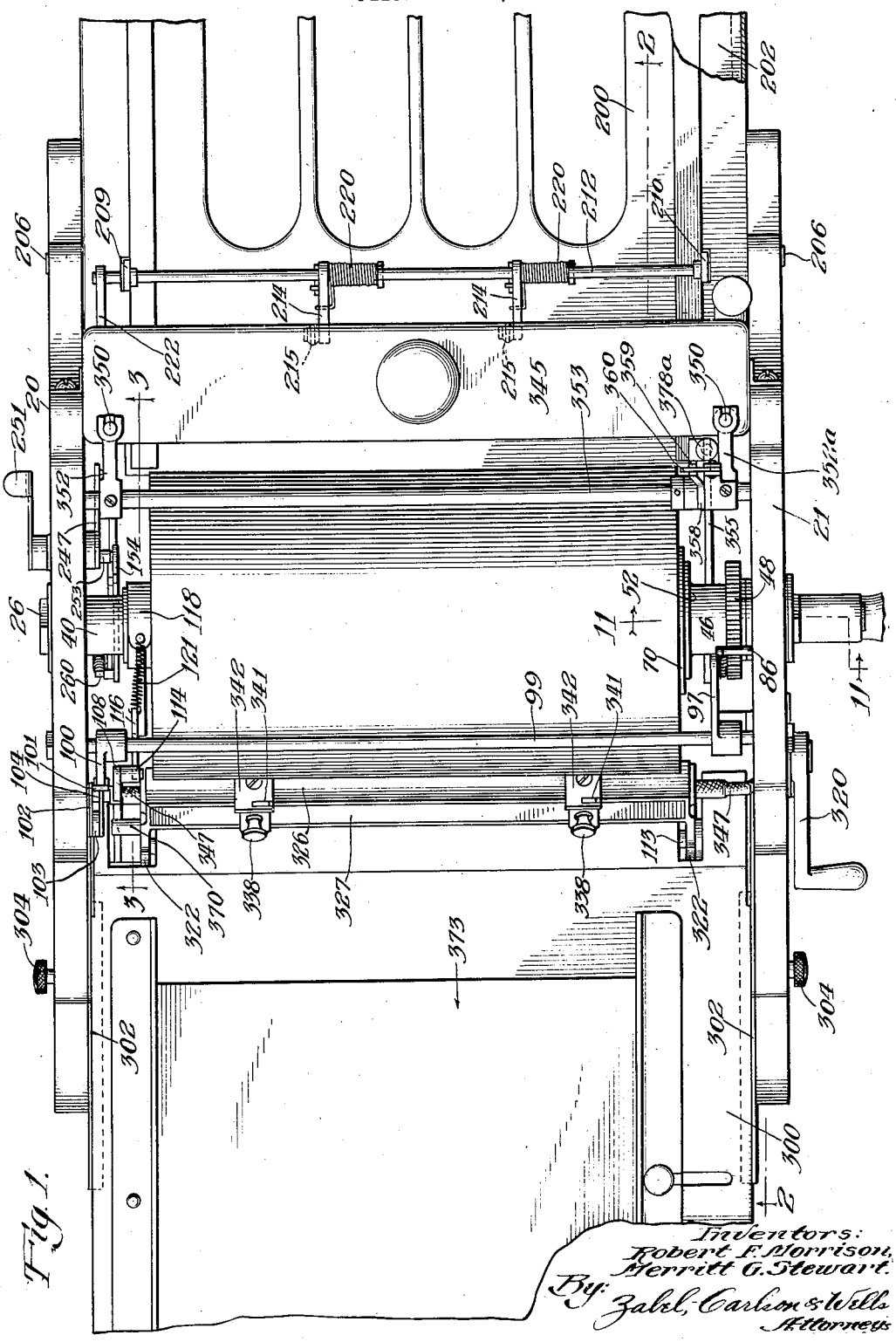


Fig. 1.

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DUPLICATING MACHINE

Filed Nov. 16, 1934 8 Sheets-Sheet 2

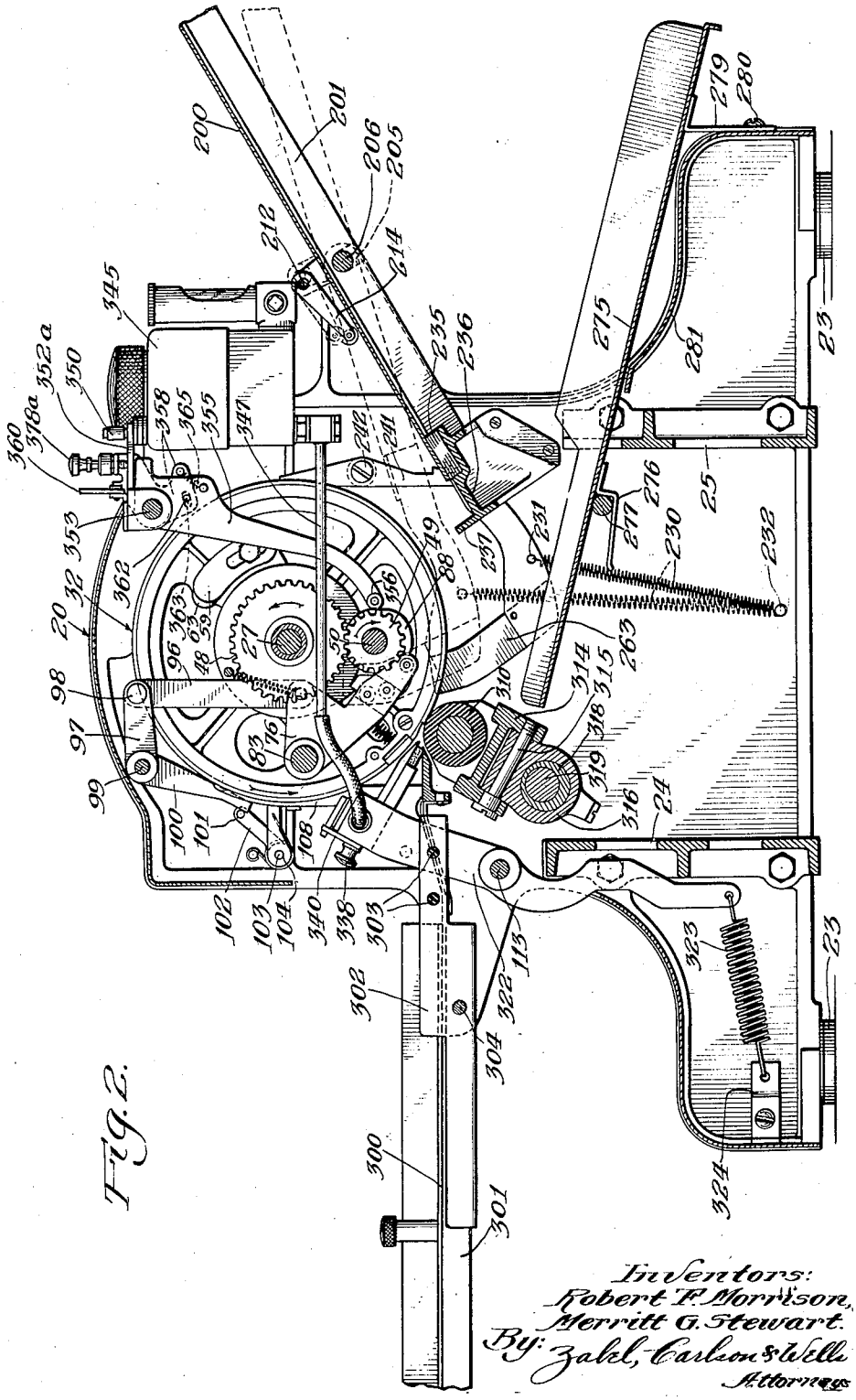


Fig. 2.

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DUPLICATING MACHINE

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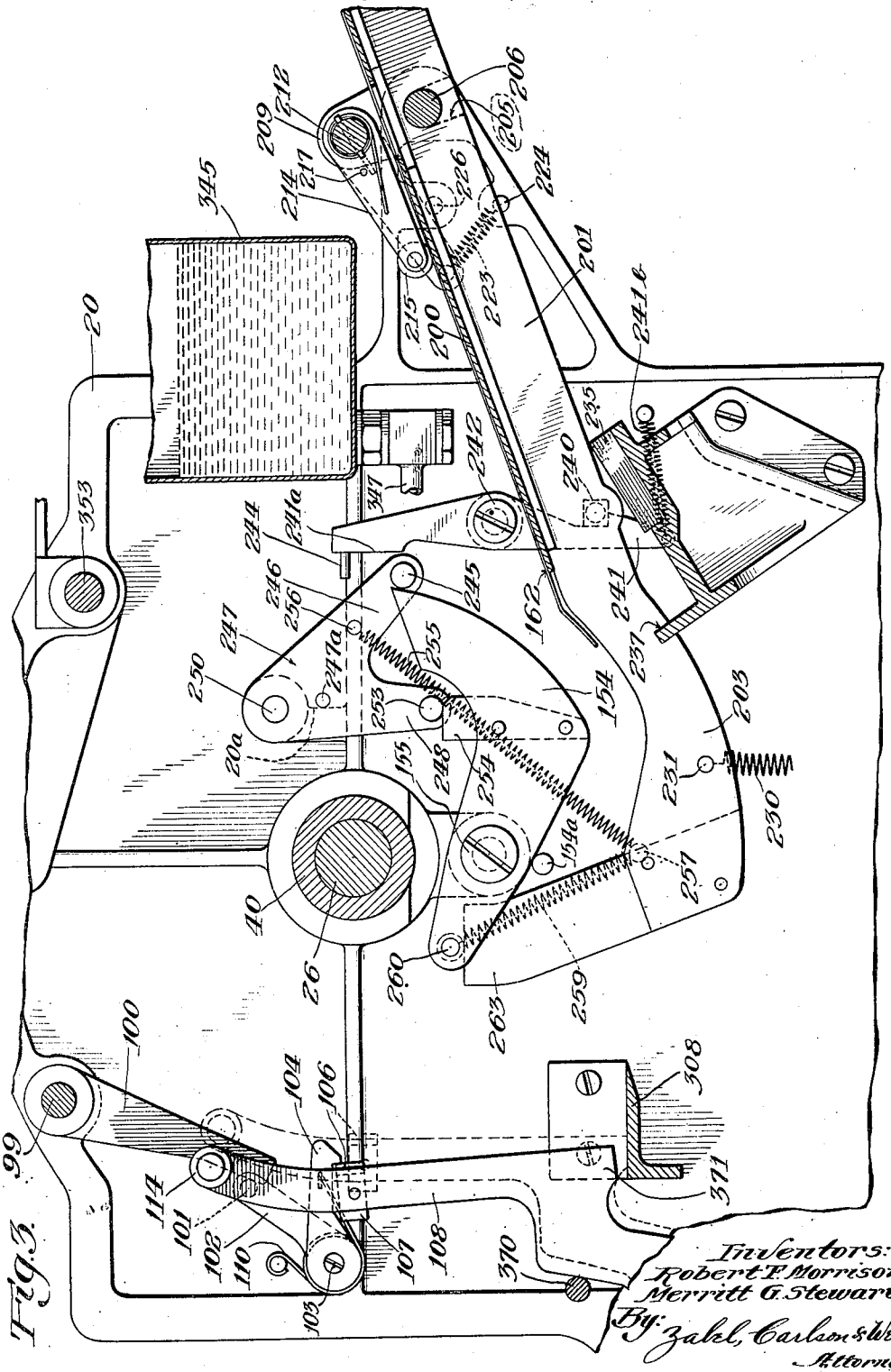


Fig. 3.

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DUPLICATING MACHINE

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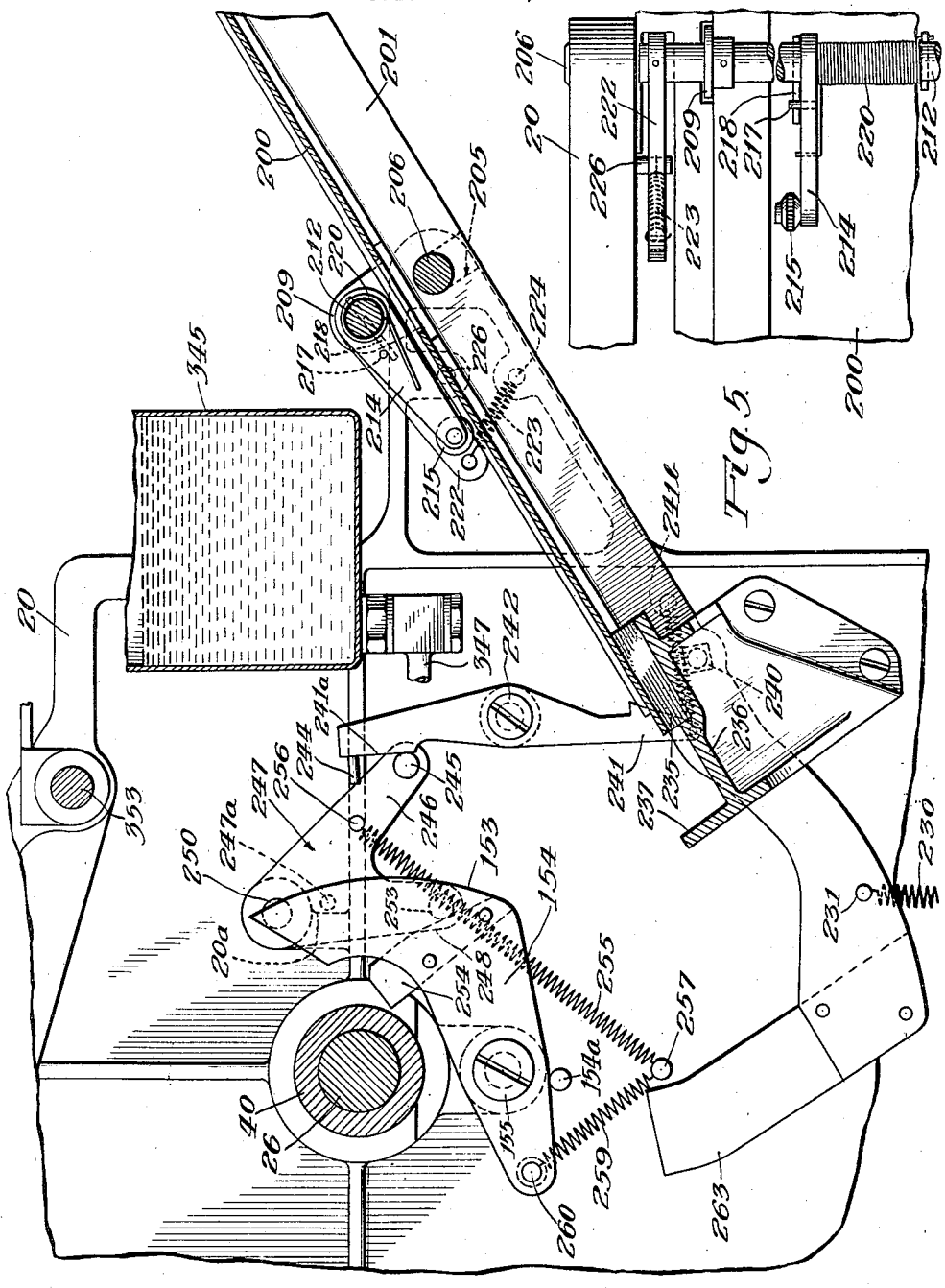


Fig. 4.

Fig. 5.

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Aug. 24, 1937. R. F. MORRISON ET AL 2,090,849

DUPLICATING MACHINE

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Fig. 7.

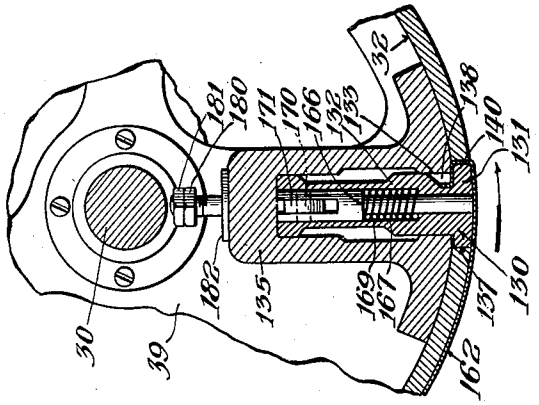
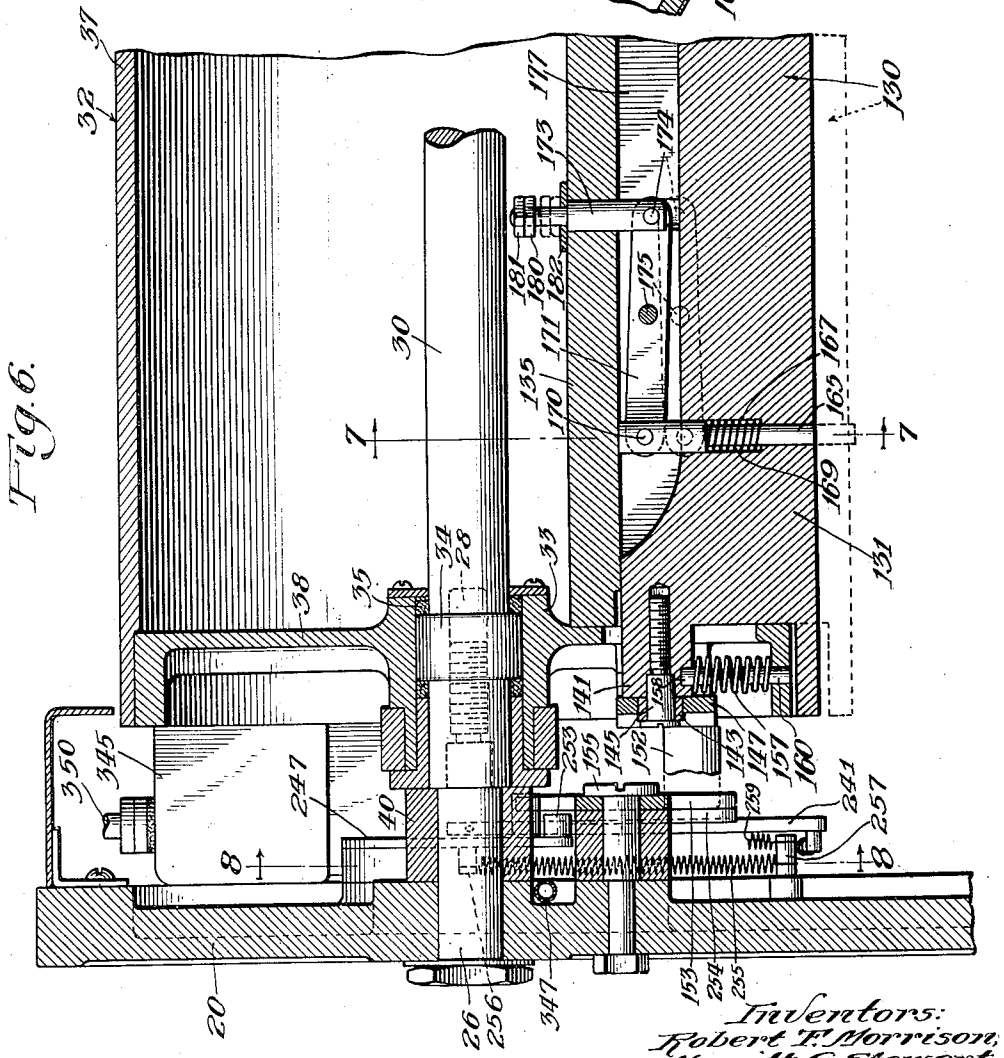


Fig. 6.



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DUPLICATING MACHINE

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Fig. 8.

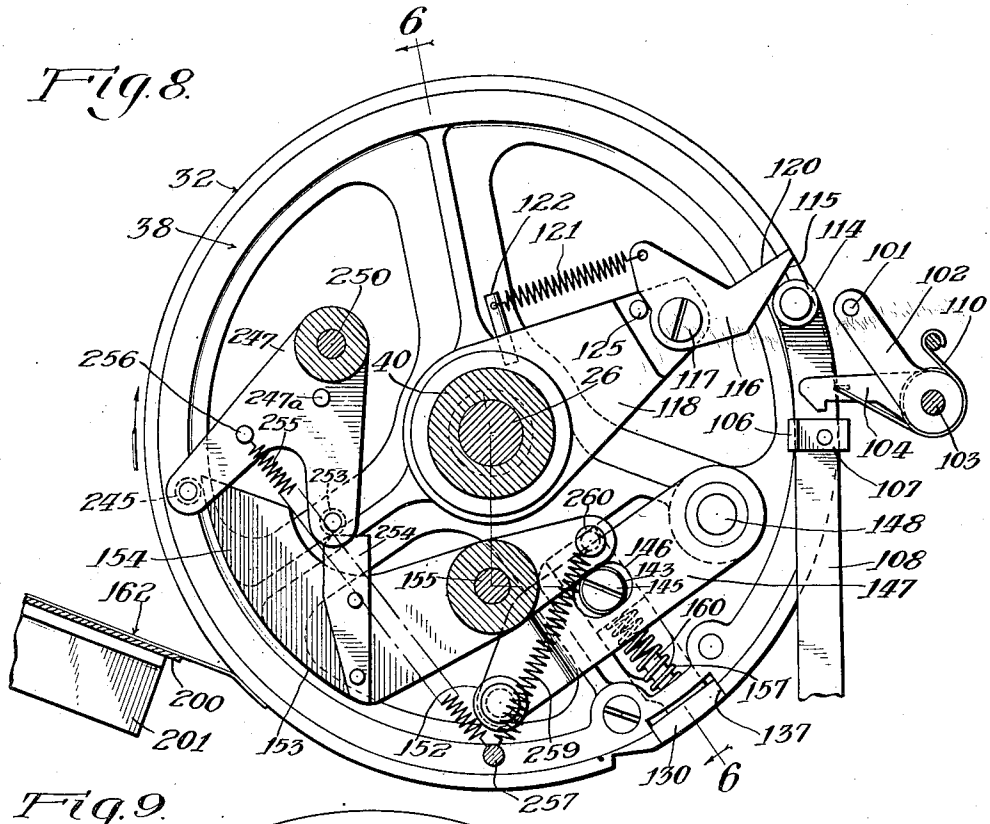
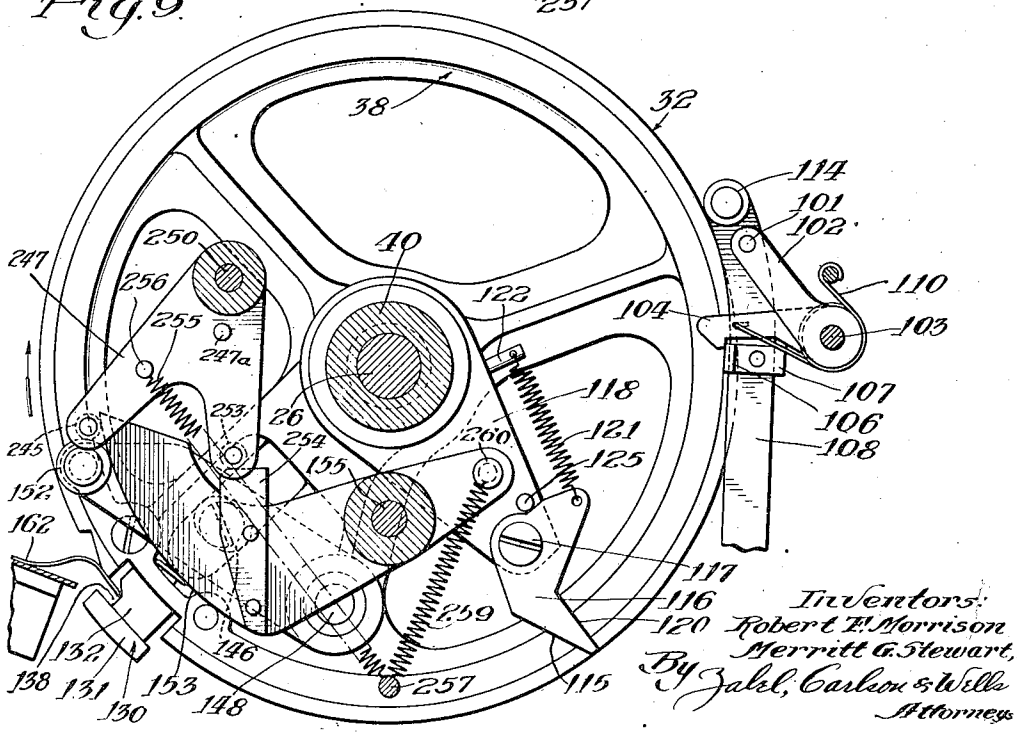


Fig. 9.



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Aug. 24, 1937. R. F. MORRISON ET AL 2,090,849

DUPLICATING MACHINE

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Fig. 12.

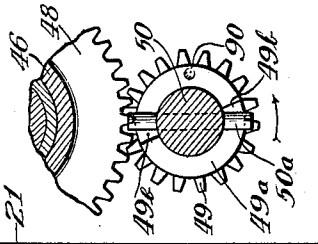
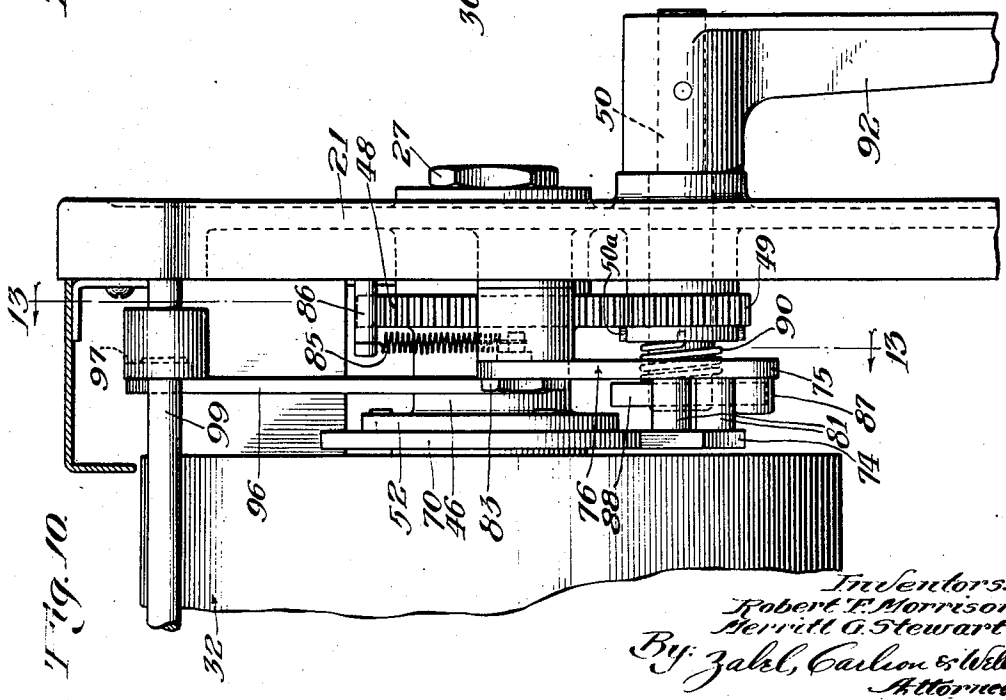


Fig. 11.

Fig. 10.



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Aug. 24, 1937. R. F. MORRISON ET AL 2,090,849

DUPLICATING MACHINE

Filed Nov. 16, 1934 8 Sheets-Sheet 8.

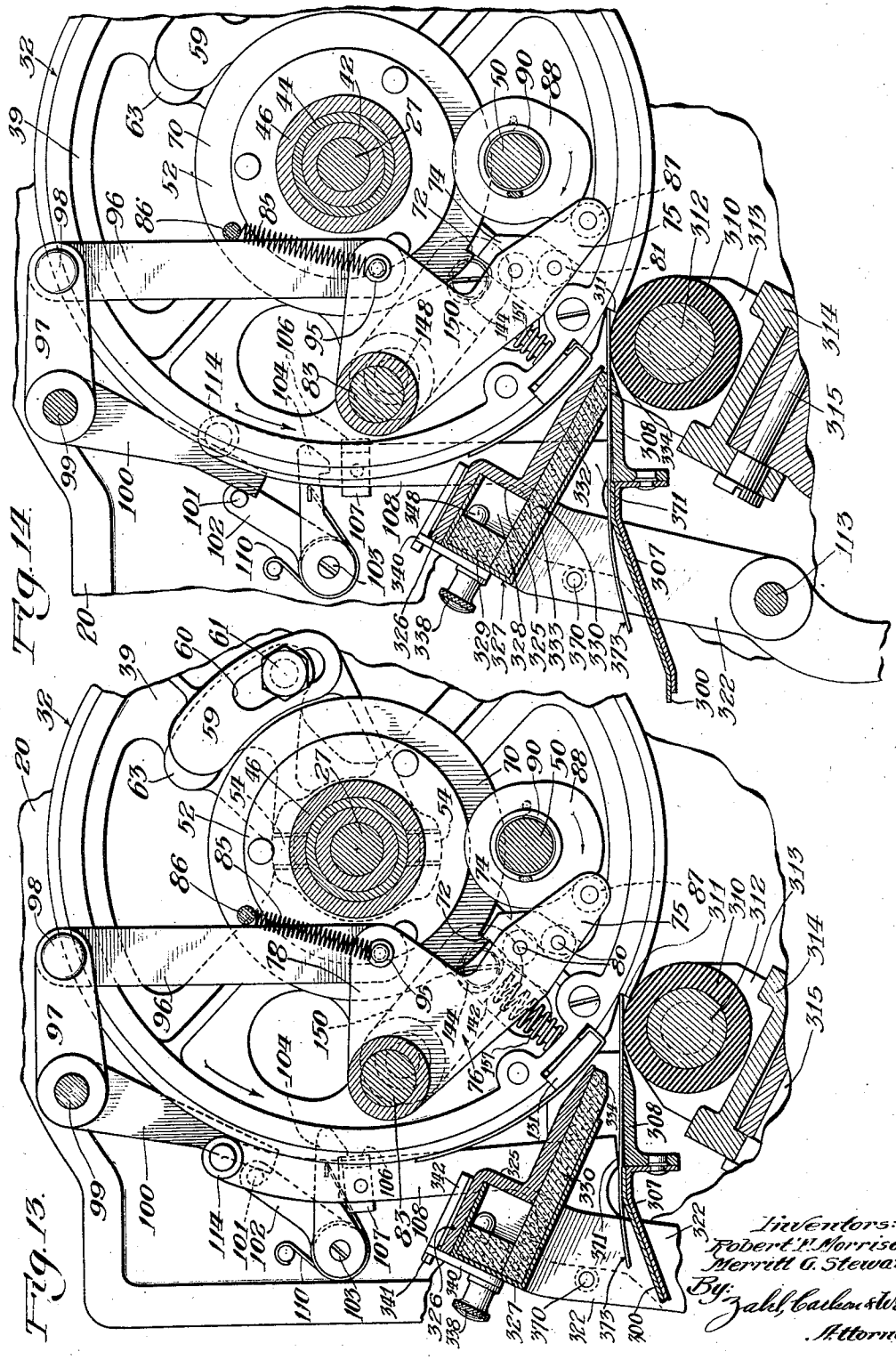


Fig. 14.

Fig. 13.

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Patented Aug. 24, 1937

2,090,849

UNITED STATES PATENT OFFICE

2,090,849

DUPLICATING MACHINE

Robert F. Morrison, Oak Park, and Merritt G. Stewart, Chicago, Ill., assignors to Ditto, Incorporated, Chicago, Ill., a corporation of West Virginia

Application November 16, 1934, Serial No. 753,336

12 Claims. (Cl. 101—132)

The invention relates to duplicating machines and is particularly adapted to be embodied in a duplicating machine of the type wherein master sheets of paper are employed and the copy sheets are moistened with a suitable solvent for the ink or carbon on the master sheet, each copy sheet being brought in turn into contact with the master sheet so that the data on the master sheet will be duplicated on the copy sheet.

The master sheets are generally made by placing a piece of carbon paper against the back surface of a sheet of paper and then the data to be duplicated is typed or written on the front surface of the master sheet so that it appears in reverse upon the back surface of the master sheet. Of course, it is not necessary to have the data appear on the front surface of the master sheet and therefore, it is not necessary to employ a ribbon in the typewriter during the typing operation.

In practice, volatile solvents, such as alcohol, are employed. The solvent may be applied to the copy sheets in any suitable manner such as, for instance, by a wick through which the solvent travels from a reservoir.

One form of the invention is embodied in a machine of the type described, which comprises a duplicating drum having automatic means for clamping master sheets thereto and for discharging them therefrom. The copy sheets are advanced manually to the duplicating drum and a platen roller is adapted to press the copy sheets against the master sheets during the duplicating operations. Means is provided for bringing the duplicating drum to a positive stop at the end of each cycle of operations. The operator may continue to operate mechanism for rotating the drum, but the drum remains in a fixed position during a predetermined portion of the cycle of operations and this facilitates the task of advancing the copy sheets to the duplicating drum and insures that accurate margins will be maintained at the forward ends of the copy sheets. The improved machine comprises moistening means which is brought into engagement with the copy sheets before they are drawn between the duplicating drum and the platen roller, the moistening means being adapted to apply a thin film of the solvent to that surface of each copy sheet which contacts the data on the master sheet.

Other features and advantages of the invention will become apparent as the following detailed description progresses, reference being had to the accompanying drawings, wherein—

Fig. 1 is a plan view of a duplicating machine which embodies the invention.

Fig. 2 is a section taken on line 2—2 of Fig. 1.

Fig. 3 is an enlarged section taken on line 3—3 of Fig. 1.

Fig. 4 is a section taken on the same line but showing some parts of the machine in changed positions.

Fig. 5 is a fragmentary plan view of a part of the mechanism shown in Fig. 4.

Fig. 6 is a section taken on line 6—6 of Fig. 8.

Fig. 7 is a fragmentary section taken on line 7—7 of Fig. 6.

Fig. 8 is a section taken on line 8—8 of Fig. 6.

Fig. 9 is a section taken on the same line as Fig. 8 but showing certain parts of the machine in changed positions.

Fig. 10 is a fragmentary front elevation, a portion of a guard member being broken away.

Fig. 11 is a fragmentary section taken on line 11—11 of Fig. 1.

Fig. 12 is a section taken on line 12—12 of Fig. 11.

Fig. 13 is a section taken on line 13—13 of Fig. 10, and

Fig. 14 is a section taken on the same line as Fig. 13 but showing certain parts of the machine in changed positions.

Referring to the drawings wherein a preferred embodiment of the invention is disclosed, the reference characters 20 and 21 designate two side frames adapted to rest upon any suitable support, the side frames 20 and 21 being provided with rubber feet 23 which rest upon the support. Interposed between the side frames 20 and 21 and rigidly secured thereto are brackets 24 and 25 (Fig. 2).

Projecting through the frames 20 and 21 are bolts 26 and 27, respectively, the inner ends of which are of reduced diameter as indicated at 28 and 29, respectively. The ends 28 and 29 of the bolts 26 and 27, respectively, are screw-threaded into the ends of a shaft 30 and support it between the frames 20 and 21. Rotatably journaled on the shaft 30 is a duplicating cylinder or drum 32 provided with hubs 33. Roller bearings 34 are interposed between the shaft 30 and the hubs 33. It will be noted that packing 35 is provided in the hubs 33 to prevent loss of lubricant from the roller bearings 34.

The drum 32 is fabricated from a cylindrical wall 37 and discs 38 and 39, the hubs 33 being preferably formed integral with the discs 38 and 39.

Referring to Fig. 6, it will be noted that the

largest end of the bolt **26** projects through the frame **20** and through a spacing collar **40** disposed adjacent the inner surface of the frame **20**. The larger portion of the bolt **26** terminates flush with the inner surface of the collar **40**. The adjacent end of the shaft **30** is also substantially flush with the inner end of the collar **40**. Referring now to Fig. 11, it will be noted that the larger portion of the bolt **27** extends through a sleeve **42** which has one end disposed within the frame **21**. The larger diameter of the bolt **27** terminates at the inner end of the sleeve **42**. The adjacent end of the shaft **30** also terminates substantially flush with the inner end of the sleeve **42**. The inner end of the sleeve **42** is provided with an outwardly extending annular flange **43**. Disposed around the sleeve **42** and interposed between the flange **43** and a collar **44** is a bushing **45** on which a sleeve **46** is rotatably journaled. A gear **48** formed integral with the sleeve **46** meshes with a pinion **49** mounted upon a shaft **50** which is rotatably journaled in the frame **21**. The inner end of the sleeve **46** is provided with an integral annular flange **52** and projecting from the inner surface of the flange **52** are two diametrically disposed lugs **54** (Figs. 11 and 13). The lugs **54** project into slots **55** formed in a hub **58** of a lever **59**. The hub **58** is pivotally mounted on one end of the adjacent hub **33**. The free end of the lever **59** is slotted as at **60** and the slot **60** accommodates a bolt **61** which is screw-threaded into a boss **63** formed integral with the disc **39** (Figs. 11 and 13). It will be readily understood that the sleeve **46** can drive the lever **59** through the medium of the lugs **54** and that the lever **59** will, in turn, rotate the drum **32** through the medium of the bolt **61**. It will also be readily understood that the drum **32** can be angularly adjusted with respect to the lever **59**. This adjustment may be made by loosening the bolt **61**, moving the drum relative to the lever and then tightening the bolt. The purpose of this construction will presently appear.

Riveted to the inner surface of the annular flange **52** is a disc **70** which is provided at its periphery with a shoulder or tooth **72** which is engageable by a dog **74** carried by an arm **75** of a bell crank lever **76** which also comprises an arm **78**. As best shown in Fig. 10, the dog **74** is spaced from the arm **75**, the dog **74** being secured to the arm **75** by rivets **80** and being spaced therefrom by sleeves **81**. The lever **76** is pivoted on a pin **83** which projects from the inner side of the frame **21**. A spring **85** tends to displace the lever **76** in a counter-clockwise direction (Fig. 13). One end of the spring **85** is secured to the lever **76** and the other end is secured to a pin **86** which projects from the frame **21**. It will be noted that the arm **75** is provided with a roller **87** at its free end, which roller **87** is engageable by a cam **88** pinned to the inner end of the shaft **50**.

Referring to Figs. 10 to 12, inclusive, it will be noted that the pinion **49** has a boss **49***a* with two diametrically disposed slots **49***b*. A pin **50***a* projecting through the shaft **50** has its ends disposed in the slots **49***b*. The slots **49***b* and the pin **50***a* are of such proportion that they permit relative angular displacement between the shaft **50** and the pinion **49**. In this instance, the shaft **50** may be displaced angularly a distance of 17½ degrees in a counter-clockwise direction (Fig. 12) before the pin **50***a* will drive the pinion **49**. The shaft **50** is provided with a crank or handle **92** whereby it may be rotated by the operator.

Disposed around the shaft **50** and having its ends secured to the cam **88** and to the boss **49***a* is a torsion spring **90** which tends to rotate the shaft **50** in a clockwise direction (Fig. 12) to bring the pin **50***a* and the slots **49***b* into the relative positions wherein they are illustrated in Fig. 12. The drum **32** is then in its idle or feeding position as illustrated in Fig. 13. Then when the operator rotates the shaft **50** in a clockwise direction (Fig. 2) by means of the handle **92**, the shaft will be rotated through an angle of 17½ degrees before the pin **50***a* drives the pinion **49**. During this lost motion of 17½ degrees, the dog **74** is disengaged from the shoulder **72** so that the drum **32** is free to rotate.

Upon the completion of one revolution of the drum or two revolutions of the handle, the drum stops as the dog **74** again engages the shoulder **72**. The handle automatically returns to an idle position through the release of tension on the torsion spring **90**, the pin **50***a* returning to the position wherein it is shown in Fig. 12.

The free end of the arm **78** in the bell crank lever **76** is connected by a pivoting pin **95** to one end of a link **96** which has its other end pivoted to the free end of a lever **97** by a pin **98**. The lever **97** is fixed to a shaft **99** which has its ends journaled in the frames **20** and **21**. Also fixed to the shaft **99** is a lever **100**, the free end of which is engageable with a pin **101** projecting from a lever **102** pivoted on a pin **103** projecting from the frame **20**. Operatively connected to the lever **102** and constrained to rotate therewith is a latch member or dog **104** adapted to engage a lug **106** projecting from a Z-shaped bar **107** which is riveted to a lever **108** (Figs. 8 and 14). A spring **110** tends to rotate the lever **102** and the latch member **104** in a clockwise direction (Fig. 13) to bring the latch member **104** into engagement with the lug **106**.

The lever **108** extends approximately vertically and has its lower end pivoted on a shaft **113** which has its ends fixed in the frames **20** and **21**. The upper or free end of the lever **108** is provided with an anti-friction roller **114** which is engageable by a cam surface **115** provided on a dog **116** which is pivoted by a pin **117** to a lever **118**. The roller **114** is also engageable under abnormal circumstances with a surface **120** provided on the dog **116**. The dog **116** is yieldingly urged in a counter-clockwise direction (Fig. 9) by a spring **121**. The spring has one end attached to the dog **116** and has its other end attached to a pin **122** projecting from the lever **118**. Angular displacement of the dog **116** around the pin **117** in a counter-clockwise direction (Fig. 9) is limited by a pin **125** which projects from the lever **118**.

It will be readily understood that when the drum **32** is rotated in a clockwise direction (Figs. 8 and 9), the cam surface **115** of the dog **116** will engage the roller **114** once during each revolution of the drum and displace it from the position wherein it is shown in Fig. 8 to the position wherein it is shown in Fig. 9 so that the latch member **104** may engage the lug **106** as illustrated in Fig. 9. In the event the drum should be rotated in the wrong direction, the surface **120** of the dog **116** will engage the roller **114** but will not displace it as the spring **121** will yield and permit the dog **116** to rotate in a clockwise direction (Fig. 9) around the pin **117** so that the dog will pass by the roller **114**.

It will be understood that the dog **74** co-

operates with the tooth 72 to bring the drum 32 to a complete stop each time the drum is rotated through 360 degrees. If it is assumed that the apparatus is in the condition wherein it is illustrated in Fig. 13 so that the dog 74 engages the tooth 72 and holds the drum against rotation in a counter-clockwise direction (Fig. 13), it will be readily understood that if the handle or crank 92 is rotated to rotate the shaft 50 in a clockwise direction (Fig. 13), the shaft 50 will rotate through 17½ degrees before the pin 50a will drive the pinion 49. During this initial movement of the shaft 50, the cam 88 will be displaced angularly from the position wherein it is shown in Fig. 13 to the position wherein it is shown in Fig. 14 so that the cam will displace the roller 87 and angularly displace the bell crank lever 76 to the position wherein it is shown in Fig. 14. This movement of the bell crank lever 76 will withdraw the dog 74 from engagement with the tooth 72 and as the operator continues to rotate the shaft 50 in a clockwise direction (Fig. 13) the drum 32 will rotate in a counter-clockwise direction (Fig. 14). It will be noted that when the bell crank lever 76 is displaced from the position wherein it is shown in Fig. 13 to the position wherein it is shown in Fig. 14 the link 96 acting through the lever 97 displaces the lever 100 in a clockwise direction (Figs. 13 and 14) so that the lever 100 acting through the pin 101 and the lever 102 disengages the pawl 104 from the lug 106 and permits the lever 108 to be displaced from the position wherein it is shown in Fig. 13 to the position wherein it is shown in Fig. 14. This movement of the lever 108 causes the moistening mechanism hereinafter described, to function.

As described above, the master sheets, from which the copies are made, are secured to the drum 32. The mechanism for securing the master sheets to the drum 32 preferably includes mechanism for automatically securing the master sheets to the drum and for discharging them from the drum.

The master sheet securing mechanism preferably comprises a bar or clamp which is designated generally by the reference character 130. The clamp 130 comprises a head portion 131 and a shank portion 132, the shank portion 132 being slidably journaled in a slot 133 formed in a bracket 135 secured to the inner surface of the drum 32. It will be noted that the wall 37 of the drum 32 has a slot 137 which receives the head 131 when the clamp 130 is in its functionally operative position (Fig. 7). The shank 132 is provided on one side with a longitudinally extending recess 138, one side of the recess being formed by an overhanging portion of the head 131. This overhanging portion is in the form of a flange 140 extending longitudinally of the head 130.

In Fig. 6, the construction of the ends of the clamp 130 is illustrated. Only one end is shown in this figure but it will be readily understood that the other end is identical in construction. The ends of the clamp 130 are provided with longitudinally extending lugs 141 and 142. Rollers 143 and 144 are disposed at the outer ends of the lugs 141 and 142, respectively, the rollers 143 and 144 being journaled upon pins 145 screw-threaded into the lugs 141 and 142. The roller 143 rides in a slot 146 formed in a lever 147 which is fixed to a shaft 148 extending longitudinally through the drum 32, the shaft being journaled in the discs 38 and 39 (Fig. 8). The roller 144 rides in a slot formed in a lever 150 which is fixed to the shaft 148.

Referring to Figs. 8, 13 and 14, it will be noted that the lever 147 is longer than the lever 150 and that the lever 147 carries a roller 152 at its free end. The roller 152 is engageable with a cam surface 153 formed on a cam member or lever 154 which is pivoted on a pin 155 projecting from the frame 20.

Returning again to the description of the clamp 130, it will be noted that compression springs 157 are interposed between the lugs 141 and 142 and flanges formed upon the periphery of the discs 38 and 39. The springs 157 are held in place by pins 158 projecting from the lugs 141 and 142 and by pins 160 projecting from the flanges of the discs 38 and 39. The springs 157 yieldingly urge the clamp 130 into the position wherein it is shown in Figs. 7 and 8 to secure a master sheet to the drum 32. In Fig. 7, a master sheet is shown at 162.

The drum 32 is provided with means for stripping or disengaging the master sheets from the clamp 130. This means comprises a plurality of pins 165. Only one of the pins 165 is shown in Fig. 6 but it will be readily understood that the right hand end (Fig. 6) of the drum 32 is provided with a similar pin and similar mechanism for actuating it. The pin 165 occupies the position wherein it is shown in full lines in Fig. 6 when the clamp is in the position wherein it is shown in the same figure. However, when the clamp 130 is displaced into the position wherein it is shown in dotted lines in Fig. 6, the pin 165 moves into the position wherein it is shown in dotted lines in the same figure. The inner end of the pin 165 is enlarged in diameter to provide a shoulder 166. The enlarged end of the pin 165 is slidably journaled in a bore 167 formed in the clamping member 130, the outer end of the bore 167 being of smaller diameter to journal the outer end of the pin 165. Disposed in the bore 167 is a spring 169 which yieldingly urges the pin 165 into the position wherein it is shown in full lines in Fig. 6 so that it does not project beyond the outermost surface of the clamping member 130. A pin 170 pivotally connects the inner end of the pin 165 to one end of a lever 171 which has its other end pivotally connected to a plunger or pin 173 by a pin 174. The lever 171 is pivoted intermediate its ends on a pin 175 fixed in the clamp 130. The clamp 130 is provided with a slot 177 which accommodates the inner end of the pin 165, the lever 171 and the outer end of the plunger or pin 173. It will be noted that the longitudinal axes of the pins 165 and 173 are disposed radially with respect to the axis of rotation of the drum 32.

The inner end of the plunger or pin 173 is of smaller diameter and is screw-threaded. Screw-threaded upon the inner end of the plunger or pin 173 is a nut 180 and a lock nut 181. The nut 180 is engageable with a hardened washer 182 which abuts against the bracket 135. The plunger or pin 173 is slidably journaled in the bracket 135.

The construction of the mechanism associated with the pin 165 is such that when the clamping member 130 moves from the position wherein it is shown in full lines in Fig. 6 to the position wherein it is shown in dotted lines in the same figure, the pin 175 is displaced the same distance and the latter distance is preferably longer than the distance between the opposite surfaces of the washer 182 and the nut 180. Therefore, the nut

180 abuts against the washer 182 before the pin 175 has reached the position wherein it is shown in dotted lines in Fig. 6 and, as a result thereof, the pin 165 travels a greater distance than the clamp member 130. Therefore, when the clamping member 130 moves into the position wherein it is shown in dotted lines in Fig. 6, the pin 165 projects from the clamping member as illustrated in Fig. 6. Obviously, if a master sheet is adhering to the outer surface of the clamping member 130, the pin 165 will push or strip it from that surface.

Means is provided for holding the master sheet and bringing it into a position wherein it may be grasped by the clamping member 130. This means preferably comprises an inclined table 200 formed of sheet metal. Secured to the bottom surface of the table 200 are bracket members 201 and 202, the bracket member 202 being shown only in Fig. 1 and being similar in construction to the bracket member 201 except for the fact that the bracket member 201 has an extension 203 (Fig. 3). The bracket members 201 and 202 have holes 205 which accommodate a shaft 206 mounted in the side frames 20 and 21.

Projecting upwardly from the bracket members 201 and 202 through slots in the table 200 are bearing members 209 and 210, respectively. A shaft 212 is rotatably journaled in the bearing members 209 and 210 and has a plurality of levers 214 journaled on it. Rotatably journaled on the free ends of the levers 214 are knurled rollers 215. Pins 217 projecting from the levers 214 are engageable with pins 218 projecting from the shaft 212. Springs 220 wound around the shaft 212 yieldingly urge the levers 214 in a counter-clockwise direction (Figs. 3 and 4), and tend to hold the pins 217 against the pins 218.

A lever 222 is pinned to one end of the shaft 212 and is yieldingly urged in a counter-clockwise direction (Figs. 3 and 4) by a spring 223 which has one of its ends secured to the free end of the lever 222 and has its other end secured to a pin 224 projecting from the frame 20. Displacement of the lever 222 in a counter-clockwise direction (Figs. 3 and 4) is limited by a pin 226 which projects from the frame 20. The construction is such that when the table 200 is in the position wherein it is illustrated in Fig. 4, the pin 226 holds the lever 222, the shaft 212 and the levers 214 in positions wherein they hold the knurled rollers 215 spaced from the upper surface of the table 200. However, when the table 200 is displaced from the position wherein it is shown in Fig. 4 to the position wherein it is shown in Fig. 3, the knurled rollers 214 will come into contact with a master sheet placed on the upper surface of the table 200. This engagement of the master sheet by the knurled rollers 215 takes place during the initial movement of the table. A master sheet is shown at 162 in Fig. 3.

Referring to Figs. 2, 3 and 4, it will be noted that a spring 230 has one of its ends secured to a pin 231 which projects from the extension 203 from the bracket 201. The other end of the spring 230 is secured to a pin 232 projecting from the side frame 20. The spring 230 tends to hold the table 200 in the position wherein it is shown in full lines in Figs. 2 and 4. Rubber bumpers 235 are secured to the top surface of the bracket 236 which extends between and is secured to the side frames 20 and 21. The bracket 236 is provided with an upwardly extending flange 237 against which the forward edge of the master sheet comes to rest when it is placed upon the table 200. The flange 237 may be called a paper stop or a margin bar.

When a master sheet has been placed upon the table 200 by sliding it onto the table 200 beneath the shaft 212 and the knurled rollers 215 until its forward edge abuts against the flange 237, the operator may tilt the table 200 at any desired time thereafter to bring it from the position wherein it is shown in Fig. 4 to the position wherein it is shown in Fig. 3. When the table 200 is brought into the position wherein it is shown in Fig. 3, a lug 240 projecting from the bracket member 201 is engaged by a pawl 241 and the table 201 is retained in the position wherein it is shown in Fig. 3 until the pawl 241 is displaced to release the lug 240. The pawl 241 is pivoted intermediate its ends on a pin 242 projecting from the side frame 20. At its upper end, the pawl 241 is provided with a pin 244 which is engageable by a pin 245 projecting from an arm 246 of a bell crank lever 247 which has a second arm 248. The bell crank lever 247 is secured to a pin 250 pivoted in the frame 20. A finger piece 251 is fixed on the outer end of the pin 250 for a purpose which will presently appear (Fig. 1).

Projecting from the arm 248 is a pin 253 which is engageable with a cam plate 254 riveted to the cam member 154. A spring 255 has one of its ends secured to a pin 256 projecting from the arm 246. The other end of the spring 255 is secured to a pin 257 projecting from the side frame 20. The spring 255 yieldingly urges the bell crank lever 247 in a clockwise direction (Fig. 3).

A spring 259 has one of its ends secured to a pin 260 projecting from the cam member 154, the other end of the spring 259 being secured to the pin 257. The spring 259 yieldingly urges the cam member 154 in a counter-clockwise direction (Fig. 3) around the pin 155.

The pin 260 is engageable with a plate 263 riveted to the inner end of the extension 203 on the bracket member 201.

It will be noted that the pin 244 projects from a flat surface 241*a* provided upon the upper end of the pawl 241. This surface 241*a* is engageable by the pin 245 as illustrated in Fig. 4 so that the pin 245 may displace the pawl 241 in a clockwise direction (Figs. 3 and 4) to disengage the pawl from the lug 240. A spring 241*b* yieldingly urges the pawl 241 in a counter-clockwise direction (Figs. 3 and 4).

When the cam member 154, which carries the cam plate 254, moves from the position wherein it is shown in Fig. 3 to the position wherein it is shown in Fig. 4, the pin 253 and the bell crank lever 247, as well as the pin 245, are displaced in a counter-clockwise direction (Fig. 4) because the pin 253 rides up on the cam plate 254 until it reaches the position wherein it is shown in Fig. 4. During the initial movement of the pin 253 in its movement over the cam plate 254 to reach the position wherein it is shown in Fig. 3, the pin 245 engages the surface 241*a* and displaces the pawl 241 so that it becomes disengaged from the lug 240, whereupon the spring 230 displaces the table 200 into the position wherein it is shown in Fig. 4.

When the operator tilts the table 200 from the position wherein it is shown in Fig. 4 to the position wherein it is shown in Fig. 3, the plate 263 displaces the cam member 154 from the position wherein it is shown in Fig. 4 to the position

wherein it is shown in Fig. 3 as the plate 263 engages and displaces the pin 260 during its final movement. The pin 253 then abuts the end of the cam member 254 as illustrated in Fig. 3 and a pin 247a projecting from the bell crank lever 247 engages a shoulder 20a formed on the frame member 20 so that the spring 255 can not displace the bell crank lever any farther in a clockwise direction (Fig. 3). It will be noted that the pawl 241 now holds the table 200 in the position wherein it is shown in Fig. 3.

The master sheet 162 is retained in the position wherein it is shown in Fig. 3 by the knurled rollers 215 and its forward end projects into the path of the clamping member 130 as illustrated in Figs. 3, 8 and 9. In Fig. 3, the drum 32 is not shown but the curvature imparted to the forward end of the master sheet by the drum is shown. This curvature is best illustrated in Fig. 8.

Referring now to Figs. 8 and 9 wherein the action of the clamping member 130 is illustrated, it will be noted that the cam member 154 is in the same position as it is shown in Fig. 3 and when it is in this position, it lies in the path of the roller 152. Then as the drum 32 is rotated in a clockwise direction (Figs. 8 and 9) the roller 152 rides up on the cam surface 153 and the lever 147, acting through the roller 143, displaces the clamping member 130 from the position wherein it is shown in Fig. 8 to the position wherein it is shown in Fig. 9. It may be said that the clamping member is then "open". As the drum 32 continues to rotate in a clockwise direction (Figs. 8 and 9) the forward edge of the master sheet 162 is received in the groove 138 of the clamping member 130. Referring to Fig. 9 it will be noted that the roller 152 is in engagement with the pin 245 and is displacing the bell crank lever 247 in a clockwise direction (Fig. 9) against the action of the spring 255 so that the pin 253 is being displaced to the left (Fig. 9). Before the clamp 130 can engage the lower end of the table 200 the pin 253 is disengaged from the upper end of the cam member 254 and the spring 259 displaces the cam 154 from the position wherein it is shown in Fig. 9 to the position wherein it is shown in Fig. 4. The spring displaces the cam member 154 until it abuts against a stop pin 154a projecting from the frame member 20. Simultaneously with the retraction of the cam lever or member 154, the springs 157 retract the clamping member 130 from its open position so that the forward edge of the master sheet is clamped to the drum 32 as illustrated in Fig. 7.

The master sheets and the copy sheets are discharged from the drum onto a table 275 having a plurality of bent bars 276 secured to its bottom surface. The bars 276 engage a rod 277 which extends between the frame members 20 and 21. Brackets 279 spot welded to the bottom surface of the table 275 are secured by screws 280 to a sheet metal housing member 281 which extends between the frame members 20 and 21.

Now if it is assumed that there is a master sheet 162 clamped to the drum 32 and that the table 200 has been brought into the position wherein it is shown in Fig. 3 with a new master sheet on it, the first master sheet will be discharged from the drum before the clamping member 130 reaches the position wherein it is shown in Fig. 9 and is engaging the new master sheet. Thus, it will be noted that in Fig. 8 the roller 152 is about to engage the cam surface 153. When the roller 152 engages the cam surface 153, the clamping member 130 opens and the first master sheet is delivered to the table 275. Then as the drum continues to rotate, the clamping member 130 clamps the second master sheet to the drum. As explained above, the pins 165 assist in discharging the first master sheet from the clamping member during the replacement of a master sheet. Now if it is assumed that there is a master sheet clamped to the drum 32 and that the operator has brought the table 200 into the position wherein it is shown in Fig. 3 with a second master sheet on it, it will be understood that if the operator for some reason does not desire to replace the first master sheet, it is not necessary to first discharge the first master sheet and then again place it on the table 200 to clamp it again to the drum as the operator may displace the finger piece 251 angularly to displace the bell crank lever 247 in a counterclockwise direction (Fig. 3) so that the pin 253 will permit the cam 154 to be retracted by the spring 259 and the pin 245 will travel along the surface 241a of the pawl 241 and displace the pawl in a clockwise direction (Fig. 3) against the action of the spring 241b so that the pawl will release the lug 240, whereupon the spring 230 will retract the table 200 into the position wherein it is shown in Fig. 4. The stop pin 244 co-operates with the pin 245 to limit the distance the operator can displace the bell crank lever 247 in a counter-clockwise direction (Fig. 3). When the table 200 is returned in this manner to the position wherein it is shown in Fig. 4, it is obvious that the first master sheet will remain clamped upon the drum during subsequent rotation thereof.

The copy sheets are fed manually to the drum 32 from a feed table 300 formed with downwardly extending flanges 301 at its sides. The inner ends of the flanges 301 rest in bracket members 302 which are secured to the frames 20 and 21 by screws 303, or the equivalent. The flanges 301 are secured detachably to the brackets 302 by set screws 304 which may be unscrewed to permit withdrawal of the table 300 from the machine. The inner end of the table 300 is inclined upwardly as best shown in Figs. 2, 13 and 14 and this upwardly extending end of the table 300 rests upon a sheet metal bracket 307 which is riveted to a bracket 308 extending between the side frames 20 and 21. It will be noted that the top surface of the bracket 308 forms a continuation of the top surface of the feed table 300 and these surfaces are adapted to guide the copy sheets over a platen roll 310 into engagement with a notch 311 formed in the cylindrical surface of the drum 32. The notch 311 provides a shoulder against which the forward ends of the copy sheets abut and this shoulder serves as a margin bar. The platen roller 310 is preferably formed from rubber and is mounted on a shaft 312 which has its ends journaled in bearings 313 formed on a bracket 314 which is secured by bolts 315 to a sleeve 316. Rotatably journaled within the sleeve 316 is an eccentric 318 fixed on a shaft 319 which is rotatably journaled in the side frames 20 and 21. At one end the shaft 319 is provided with a crank or handle 320 whereby the operator may rotate the shaft 319 to vary the pressure with which the platen roller 310 bears against the drum 32. The apparatus for adjusting the platen roller 310 is similar to apparatus shown and described in the co-pending application of Hernlund et al. Serial No. 695,920, filed October 30, 1933, and need not be described in further detail in this application.

Means is provided for moistening the copy sheets as they are advanced between the drum **32** and the platen roller **310**. The moistening means comprises two levers **322** pivoted upon the shaft **113**, the levers being pivoted between their ends. Springs **323** each have one end secured to one of the levers **322** and the other end secured to a bracket **324** fixed to one of the frames. The two levers **322** are formed integral with a bracket member **325**, the bracket member **325** being disposed at the upper ends of the levers. The bracket member **325** comprises an angular portion **326** which co-operates with a sheet metal housing member **327** to provide a chamber **328**. Disposed in the chamber **328** is a felt pad **329**, the bottom surface of which abuts against the inner end of a felt strip **330** which projects from the chamber **328**. The felt strip extends between a flange **332** extending from the angular portion **326** and an extension **333** on the housing member **327**. The outer end of the felt strip **330** is beveled as at **334** and is engageable with the copy sheets as they are advanced between the drum **32** and the platen roller **310**.

Pivoted on the housing member **327** are pins **338** to which levers **340** are fixed. The free ends of the levers **340** are engageable with slots **341** formed in bars **342** fixed to the angular member **326**. It will be readily understood that the pins **338** may be rotated to disengage the levers **340** from the slots **341** so that the operator may withdraw the housing member **327** and the felt members **329** and **330** as a unit from the bracket member **325**.

A reservoir or tank **345** extends between and is secured to the side frames **20** and **21**. Two conduits **347** extend from the tank **345** to the chamber **328**. The ends of the conduit entering the chamber **328** are preferably metallic tubes **348** which have their inner ends projecting into the felt pad **329**. Valve devices **350** control the flow of fluid from the tank **345** to the conduits **347**. The valves **350** are controlled by levers **352** and **352***a* fixed to a shaft **353** which is journaled in the side frames **20** and **21** (Figs. 1 and 2). A lever **355** has one end pivoted on the shaft **353** and carries a roller **356** at its free end. The roller **356** rides upon the cam **88** and is adapted to be oscillated thereby. Also pivoted on the shaft **353** is a plate **358** provided with a bifurcated lug **359** engageable by a lever **360** which is pivoted on the lever **352***a*. A pin **362** which projects from the lever **355** rides in a slot **363** formed in the plate **358**. A tension spring **365** has one of its ends secured to the plate **358** and has its other end secured to the lever **355**. A set screw **378***a* screw threaded through a lug on the plate **358** abuts against the upper end of the lever **355**. When the lever **360** engages the bifurcated lug **359** as best shown in Fig. 1, oscillation of the lever **355** by the cam **88** causes equal oscillation of the shaft **353** and it, in turn, oscillates the levers **352** and **352***a* to open and close the valve devices **350**. The construction is such that each time the drum is rotated through 360 degrees, the valves **350** are opened twice. If the lever **360** is withdrawn from the bifurcated lug **359**, the lever **355** will not oscillate the shaft **353**. Obviously, the operator has complete control of the flow of fluid to the moistening means.

Referring again to the levers **322** which are best shown in Figs. 1, 2, 13 and 14, it will be noted that one of them carries a pin **370** which is engageable by the lever **108**, the pin **370** abuts against the lever **108** at all times through the action of the springs **323**. The distance the lever **108** can be displaced in a clockwise direction (Fig. 14) around the shaft **113** is limited by a foot **371** formed on the lever **108** and adapted to abut against the top surface of the bracket **308**. This foot **371** also limits the distance the levers **322** can be displaced in a clockwise direction (Fig. 14) by the springs **323**.

The apparatus is constructed so that when a copy sheet is to be fed into the machine to occupy the position wherein a copy sheet **373** is shown in Figs. 13 and 14, the moistening felt strip **330** is in the position wherein it is shown in Fig. 13 so that the operator can bring the forward edge of the copy sheet into engagement with the notch **311**. After the copy sheet has been positioned in this manner and the operator rotates the crank or lever **92** in the manner described above, the drum **32** is not driven until the lever or crank **92** has been rotated through 17½ degrees. During this lost motion, the dog **74** is disengaged from the shoulder **72** and the lever **100** is displaced angularly in a clockwise direction (Fig. 14) to withdraw the pawl **104** from the lug **106** so that the springs **323** will displace the levers **322** and the lever **108** in a clockwise direction (Fig. 14) to bring the foot **171** into engagement with the top surface of the bracket **308**. The felt strip **330** then engages the top surface of the copy sheet **373** and is in engagement therewith when the drum **32** and the platen roller **310** start advancing the copy sheet between them. This is a feature of the invention.

Briefly, the operation of the machine is as follows: A master sheet is placed upon the table **200** and the operator tilts the table from the position wherein it is shown in Fig. 4 to the position wherein it is shown in Fig. 3. The knurled rollers **215** retain the master sheet in its correct position upon the table so that it will not gravitate down the inclined surface thereof. The operator then rotates the crank or lever **92** so that the master sheet will be clamped to the drum **32** by the clamping member **130**. It will be noted that it requires two revolutions of the crank or handle **92** for a complete revolution of the drum **32**. The operator then advances copy sheets one by one to the position wherein the copy sheet **373** is shown in Fig. 13. Each time a copy sheet is advanced to this position, the operator rotates the crank or lever **92**. During the initial movement of the crank or lever **92**, of each cycle of operation, the dog **74** is disengaged from the shoulder **72** and the moistening means is brought into contact with the upper surface of the copy sheet. As the operator continues to rotate the crank or lever **92**, the drum **32** starts to rotate and it co-operates with the platen roller **310** to advance the copy sheet and to bring the moistened surface thereof into contact with the master sheet. The volatile solvent on the copy sheet dissolves some of the ink on the master sheet so that the data on the master sheet is duplicated on the copy sheet. The copy sheet is then discharged onto the table **275**. After the desired number of copy sheets have been duplicated, the master sheet may be discharged automatically from the drum and replaced by another in the manner described above.

A feature of the invention is that the drum comes to a positive stop at the end of each cycle of operation. Thus, the dog **74** engages the shoulder **72** and positively holds the drum **32** against rotation until the crank or lever **92** has been rotated through 17½ degrees. Such con-

struction is advantageous as compared to detents, or the like, which permit continuous rotation of the drum 32.

As pointed out above, the construction of the moistening means is particularly advantageous as it is in contact with the copy sheets before they are drawn between the duplicating drum and the platen roller. This insures the same margin at the forward end of the paper in each instance and also enables the machine to be constructed so that relatively short margins are provided.

Another feature of the invention is the construction for the means for rotatably mounting the drum 32 between the side frames 20 and 21. The construction is such that the drum may be removed with little effort. Thus, it is only necessary to unscrew the bolts or pins 26 and 27 and to permit the spacing collar 40 to drop out of its place adjacent the frame 20, whereupon the drum 32 can be shifted longitudinally a short distance to the left (Figs. 6 and 11) and lifted bodily from its position between the side frames.

Referring again to the slot 60 in the lever 59 and the bolt 61 which secures the drum 32 adjustably to the lever 59, this construction is advantageous as it permits one to vary the angular position of the drum 32 with respect to the other mechanism of the machine. Thus, one may rotate the drum 32 relative to the lever 59 to bring the notch 311 into any desired position relative to the platen roller 310 and the mechanism which is actuated by the various cams, etc. In the preferred embodiment of the invention, it is preferable to have the radially extending surface of the slot or notch 311 disposed in a plane coincident with the longitudinal axes of the drum 32 and the platen roller 310. (Fig. 13.) Of course, the notch 311 is only in this position when the dog 74 engages the shoulder 72. However, it will be readily understood that with the dog 74 in engagement with the shoulder 72, the drum 32 may be displaced angularly in either direction to bring the notch 311 into any desired position relative to the shoulder 72. It may be also desirable at times to adjust the drum 32 angularly to have a master sheet thereon register with certain lines or other markings on the copy sheets.

As best shown in Figs. 6 and 11, the shaft 30 co-operates with the bolts 26 and 27 to function as a tie rod between the frames 20 and 21. The shaft also co-operates with the collar 40 to serve as a strut or spacing member between the frame 20 and 21.

While we have shown and described certain embodiments of our invention, it is to be understood that it is capable of many modifications. Changes, therefore, in the construction and arrangement may be made without departing from the spirit and scope of the invention as disclosed in the appended claims, in which it is our intention to claim all novelty inherent in our invention as broadly as possible, in view of the prior art.

We claim:

1. In a duplicating machine, a rotatable duplicating drum, a platen roller co-operating with said duplicating drum, a gear with which said duplicating drum is constrained to rotate, a shaft, a pinion journaled on said shaft and meshing with said gear, yielding means operatively connecting said shaft to said pinion, means for positively limiting angular displacement between said shaft and said pinion, means operatively connected to said shaft whereby it is rotated, means for holding said drum against rotation during a predetermined portion of each cycle of operations, and means operatively connected to said shaft for controlling said holding means.

2. In a duplicating machine, a rotatable duplicating drum, a platen roller co-operating with said duplicating drum, a gear with which said duplicating drum is constrained to rotate, a shaft, a pinion journaled on said shaft and meshing with said gear, yielding means operatively connecting said shaft to said pinion, means limiting angular displacement between said shaft and said pinion, a cam fixed on said shaft, and means controlled by said cam for locking said drum against rotation during a predetermined portion of each cycle of operations.

3. In a duplicating machine, a rotatable duplicating drum, means clamping a master sheet on said drum, a platen roller for pressing copy sheets against said master sheet, said platen roller co-operating with said duplicating drum to advance said copy sheets, means for locking said duplicating drum against rotation during a predetermined portion of each cycle of operations, means for moistening said copy sheets, and means for bringing said moistening means into contact with said copy sheets while said drum is locked against rotation.

4. In a duplicating machine, a rotatable duplicating drum, means clamping a master sheet on said drum, a platen roller for pressing copy sheets against said master sheet, said platen roller co-operating with said duplicating drum to advance said copy sheets, means including yielding means for driving said duplicating drum, means for locking said duplicating drum against rotation during the initial operation of said driving means during each cycle of operations, means for moistening said copy sheets, and means for bringing said moistening means into contact with said copy sheets while said drum is locked against rotation and said driving means is being operated.

5. In a duplicating machine, a rotatable duplicating drum having a cylindrical surface, said cylindrical surface having a groove extending longitudinally thereof, means clamping a master sheet on said drum, a platen roller for pressing copy sheets against said master sheet, said platen roller cooperating with said duplicating drum to advance said copy sheets, means for locking said duplicating drum against rotation during a predetermined portion of each cycle of operations, said groove being disposed in opposed relation to said platen roller when said duplicating drum is locked against rotation, means for moistening said copy sheets, and means for bringing said moistening means into contact with said copy sheets while said drum is locked against rotation.

6. In a duplicating machine, a rotatable duplicating drum, a platen roller co-operating with said duplicating drum, a gear with which said duplicating drum is constrained to rotate, a shaft, a pinion journaled on said shaft and meshing with said gear, yielding means operatively connecting said shaft to said pinion, means limiting angular displacement between said shaft and said pinion, a cam fixed on said shaft, means controlled by said cam for locking said drum against rotation during a predetermined portion of each cycle of operations, means for clamping a master sheet on said drum, means for moistening said copy sheets, means for bringing said

moistening means into contact with said copy sheets, a reservoir for holding the moistening medium, means including a valve operatively connecting said reservoir with said moistening means, and means whereby said cam controls said valve.

7. In a duplicating machine, a rotatable duplicating drum, means including yielding means for driving said duplicating drum, means for locking said drum against rotation during a predetermined portion of each cycle of operations, means including a cam for controlling said locking means, means for securing a master sheet on said drum, means for applying a solvent to copy sheets as they are brought into contact with said master sheet, a reservoir for holding said solvent, a conduit extending from said reservoir to said solvent applying means, and means controlled by said cam for controlling the flow of solvent through said conduit.

8. In a duplicating machine, a frame, a rotatable duplicating drum, a table from which copy sheets are advanced to said drum, a master sheet table pivoted in said frame, a pawl engageable with said master sheet table to hold one end thereof adjacent said drum, a spring for drawing said end of said master sheet table away from said drum, a cam movably mounted on said frame, means actuated by said table for bringing said cam into its functionally operative position, a spring pressed clamp on said drum for securing master sheets thereto, means actuated by said cam for controlling said clamp, and means actuated by said controlling means for disengaging said pawl from said master sheet table.

9. In a duplicating machine, a frame, a rotatable duplicating drum, a table from which copy sheets are advanced to said drum, a master sheet table pivoted in said frame, a pawl engageable with said master sheet table to hold one end thereof adjacent said drum, a spring for drawing said end of said master sheet table away from said drum, a cam movably mounted on said frame, means actuated by said table for bringing said cam into its functionally operative position, a spring pressed clamp on said drum for securing master sheets thereto, means actuated by said cam for controlling said clamp, a lever actuated by said controlling means for disengaging said pawl from said master sheet, and a finger piece whereby said lever is actuated manually.

10. In a duplicating machine, a frame, a rotatable duplicating drum, a table from which copy sheets are advanced to said drum, a master sheet table movably mounted in said frame, a pawl engageable with said master sheet table to hold one end thereof adjacent said drum, a spring for drawing said end of said master sheet table away from said drum, a cam movably mounted on said frame, means actuated by said table for bringing said cam into its functionally operative position, a spring pressed clamp on said drum for securing master sheets thereto, means actuated by said cam for controlling said clamp, a lever actuated by said controlling means for disengaging said pawl from said master sheet table, and a finger piece whereby said lever is actuated manually.

11. In a duplicating machine, a rotatable duplicating drum, a table from which copy sheets are advanced to said drum, means for moistening said copy sheets during their movement with said drum, yielding means for driving said drum, means for holding said drum against rotation during a predetermined portion of each cycle of operations, and means for bringing said moistening means into engagement with the copy sheets while the drum is held against rotation.

12. In a duplicating machine, a rotatable duplicating drum, means clamping a master sheet on said drum, a platen roller for pressing copy sheets against said master sheet, said platen roller cooperating with said duplicating drum to advance said copy sheets, means for locking said duplicating drum against rotation during a predetermined portion of each cycle of operations, means for moistening said copy sheets, and means actuated in synchronism with said drum to bring said moistening means into contact with said copy sheets while said drum is locked against rotation.

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