Jan. 3, 1939. A. MARCHEV 2,142,449

METHOD OF AND MEANS FOR DUPLICATING

Filed Dec. 13, 1935 4 Sheets-Sheet 1

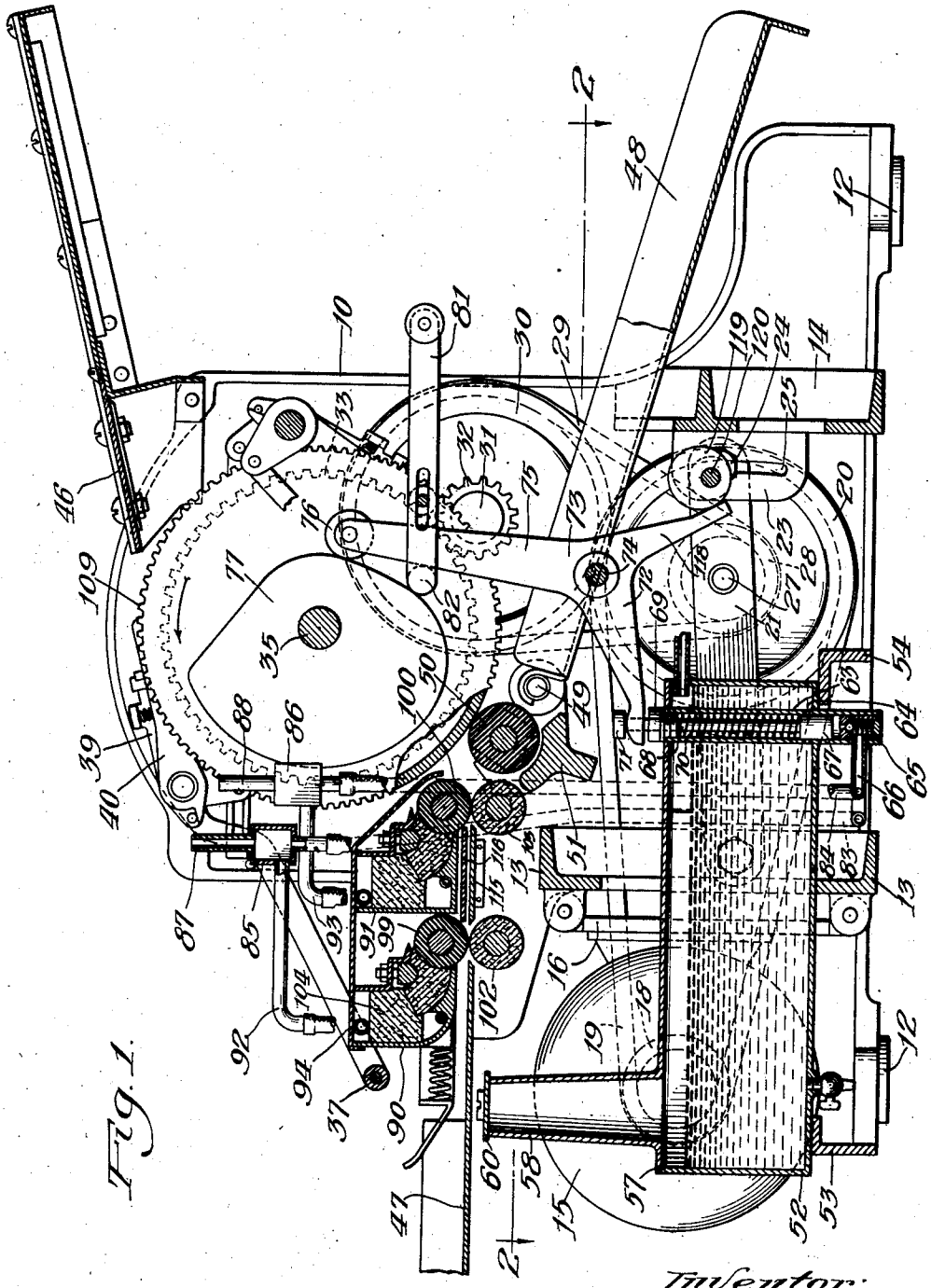


Fig. 1.

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Filed Dec. 13, 1935 4 Sheets-Sheet 2

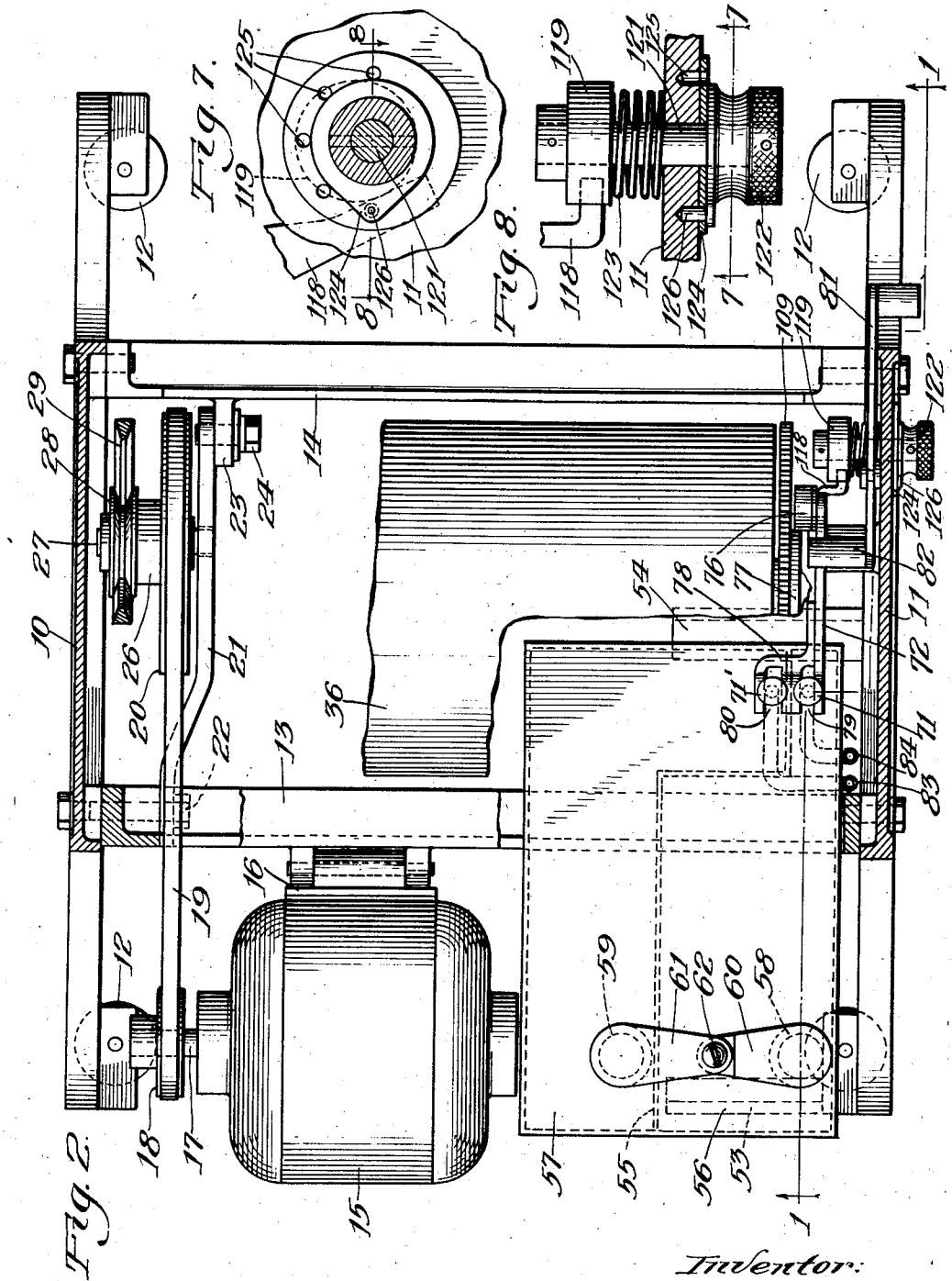


Fig. 2.

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METHOD OF AND MEANS FOR DUPLICATING

Filed Dec. 13, 1935 4 Sheets-Sheet 3

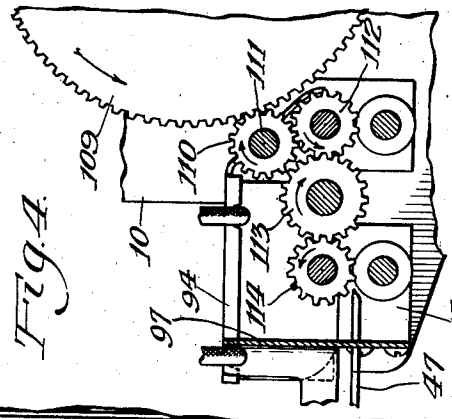


Fig. 4.

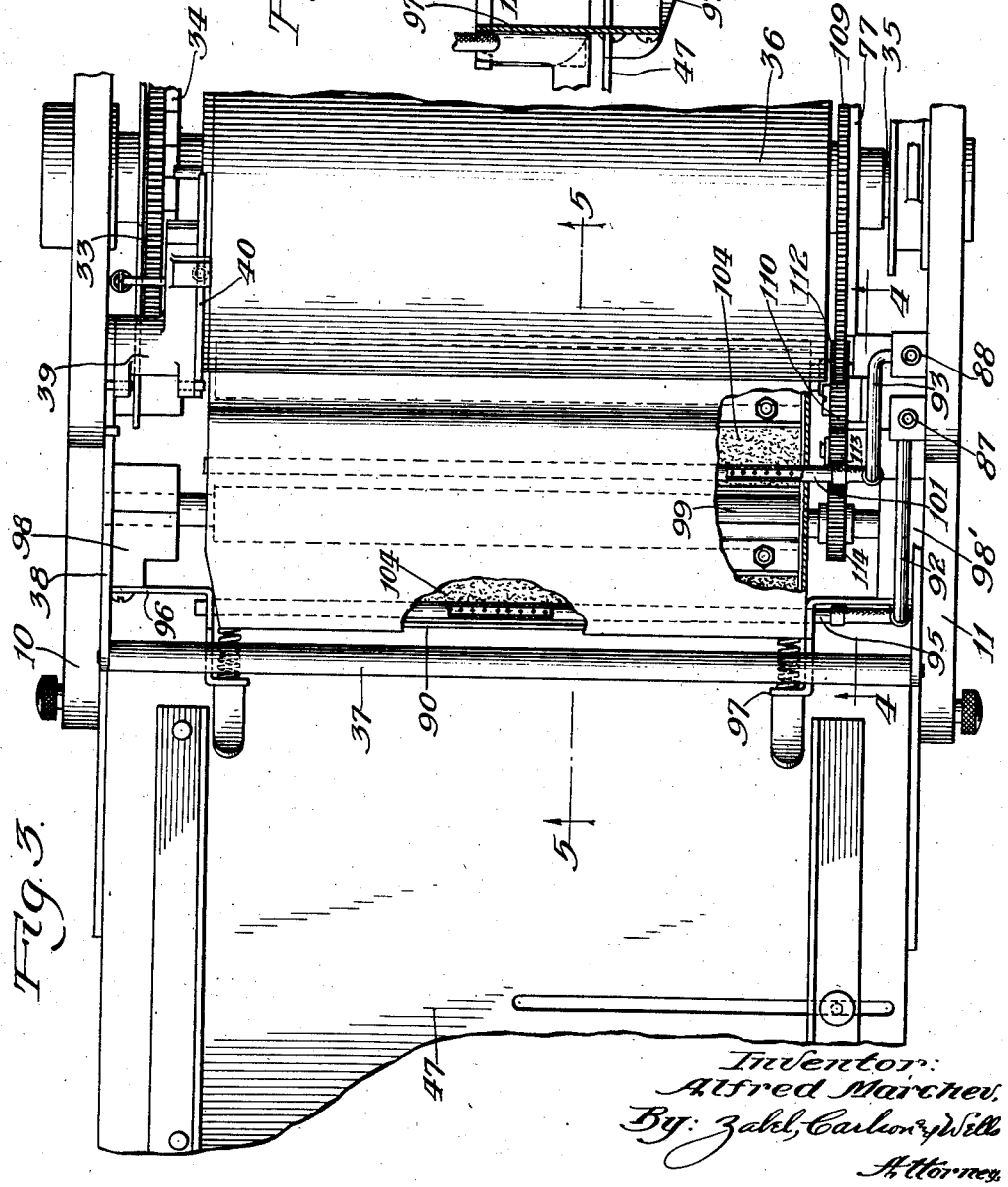


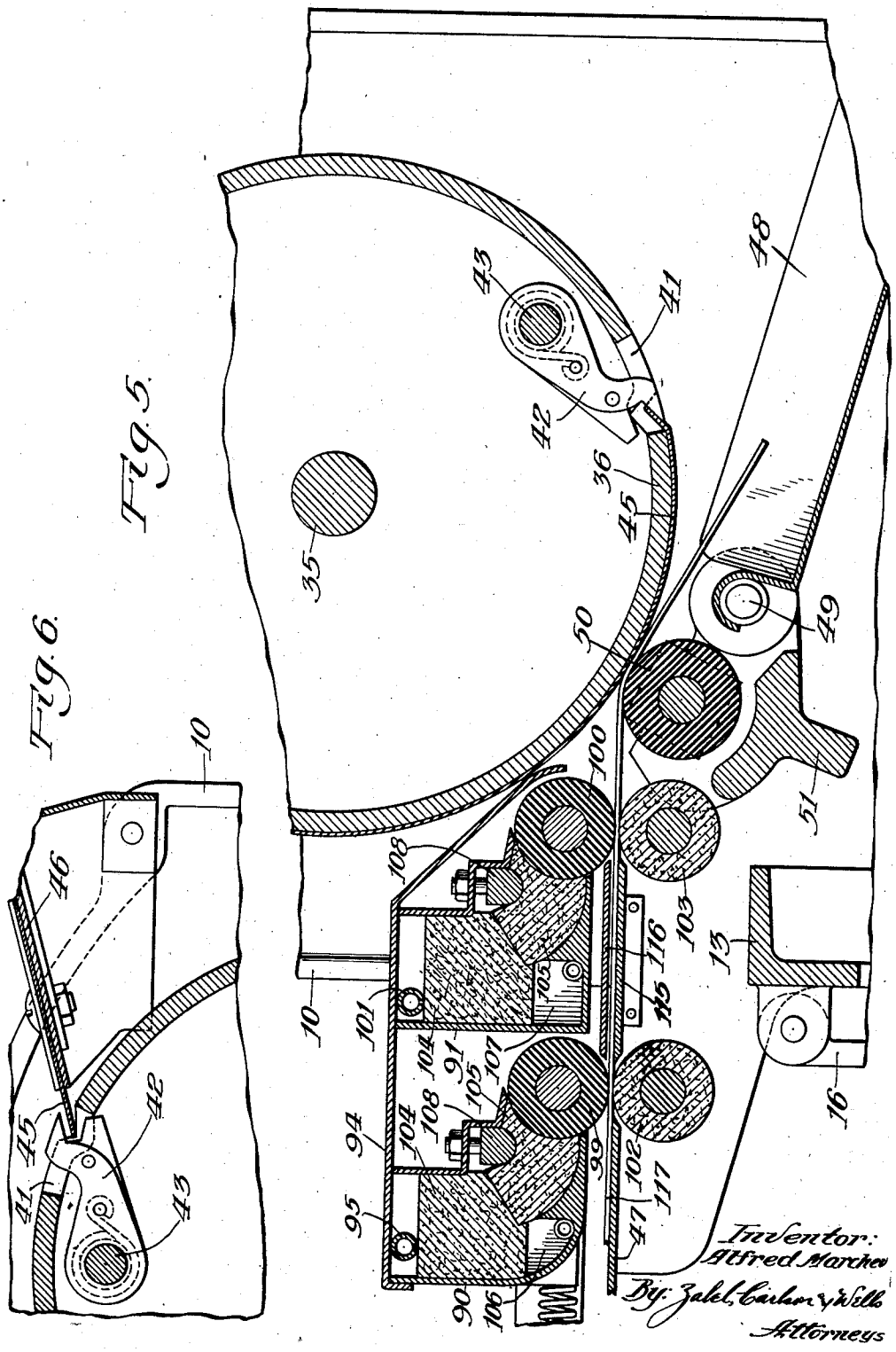
Fig. 3.

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Jan. 3, 1939. A. MARCHEV 2,142,449

METHOD OF AND MEANS FOR DUPLICATING

Filed Dec. 13, 1935 4 Sheets-Sheet 4



Patented Jan. 3, 1939 2,142,449

UNITED STATES PATENT OFFICE

2,142,449

METHOD OF AND MEANS FOR DUPLICATING

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Application December 13, 1935, Serial No. 54,269

8 Claims. (Cl. 101—132)

This invention relates to the art of duplicating and is particularly applicable to that process of duplicating in which a master copy has the data to be transferred formed thereon in reverse of a suitable ink or carbon and where a copy sheet is pressed against the master sheet after being moistened with a suitable solvent for the ink or carbon on the master sheet so as to transfer the data on the master sheet to the moistened surface of the copy sheet.

One form of machine to which this invention is particularly applicable is the form in which the master sheet is fixed on a cylindrical drum and in which copy sheets are fed to the drum by any suitable means such as feed rollers, the copy sheets being moistened on one surface by a volatile solvent such as alcohol as they are advanced to the drum. A machine of this character is disclosed in the application of John W. Hernlund, Serial No. 44,911, filed October 14, 1935, for Duplicating machine. The present invention is illustrated in the drawings as applied to the machine shown in the aforesaid application.

The present invention comprises a method of treating the copy sheets as they are applied to the master sheet whereby a carrier liquid such as water which is not a solvent of the carbon on the master sheet is first applied to the surface of a copy sheet and thereafter the solvent fluid is applied to the previously moistened surface. It has been found that the moistening of the copy sheet with a suitable moistening liquid before applying the solvent liquid greatly improves the clearness and uniformity of the copies obtained from a master sheet.

The invention also comprises the provision of a machine wherein a copy sheet is first passed between a pair of rollers and moistened with a carrier liquid that is not a solvent of the carbon on the master and is thereafter in its advance to the drum passed between a pair of rollers one of which applies a volatile solvent for the carbon of the master sheet upon the same surface of the copy sheet that received the initial moistening.

The invention also comprises a machine in which supply reservoirs for the carrier liquid and the volatile solvent liquid are provided, and means driven from the drum which carries the master sheet operates to supply the fluid in the reservoirs to their respective moistening devices in measured amounts.

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

Fig. 1 is a vertical sectional view through a duplicating machine to which the invention is applied;

Fig. 2 is a sectional view taken on the line 2—2 of Fig. 1;

Fig. 3 is a fragmentary plan view partly broken away of the machine shown in Fig. 1;

Fig. 4 is a sectional view taken on the line 4—4 of Fig. 3;

Fig. 5 is an enlarged fragmentary sectional view taken on the line 5—5 of Fig. 3;

Fig. 6 is a fragmentary sectional view illustrating the manner of securing a master sheet upon the duplicating drum;

Fig. 7 is an enlarged fragmentary view of the control means for hurrying the liquid feed;

Fig. 8 is a view of the same mechanism shown in Fig. 7 taken substantially on the line 8—8 of Fig. 7.

Referring now to the drawings in which a preferred embodiment of the invention is shown, reference characters 10 and 11 designate a pair of side frames adapted to rest upon any suitable support, the side frames being provided with rubber feet 12. Interposed between the side frames 10 and 11 and rigidly secured thereto are brackets 13 and 14. The bracket 13 provides a support for a drive motor 15. A supporting plate 16, to which the motor 15 is bolted, is secured to the bracket 13. The motor 15 has a drive shaft 17 upon which a drive pulley 18 is secured. The drive pulley 18 drives a belt 19 which passes through the bracket 13 and over a pulley 20 which is carried by a cross bar 21. The cross bar 21 is pivotally secured to the bracket 13 by means of a bolt 22 and is connected to a lug 23 on the bracket 14 by means of a bolt 24 riding in an elongated slot 25 in the lug 23. The pulley 20 has a hub 26 which is rotatably mounted upon a shaft 27 that is fixed to the cross bar 21. The hub 26 also has thereon a second pulley 28. The pulley 28 is connected by means of a belt 29 to a pulley 30 which is rotatable upon a stub shaft 31 fixed to the side frame 10. This stub shaft also has a pinion 32 thereon which meshes with a gear 33.

The gear 33 is connected to a suitable clutch mechanism comprising a ratchet wheel 34 which is mounted to rotate with the gear 33 upon a drum shaft 35 which carries a cylindrical drum 36. A pawl (not shown) is provided upon the drum 36 and is controlled by the operator to engage the ratchet wheel 34 for causing rotation of the drum 36. The details of this driving con-

nection are shown fully in the application hereinbefore referred to and form no part of the present invention.

As illustrated in the aforesaid application, a cross bar 37 (see Fig. 3) is connected by means of an arm 38 to a pair of levers 39 and 40 which control the starting and stopping of the drum 36. The drum 36 has on its periphery a series of openings 41 through which master sheet gripping members 42 (see Figs. 5 and 6) project. These gripping members are operated as described in the aforesaid application by means of a shaft 43 mounted in the drum so that they may be opened to receive a master sheet 45 in the manner indicated in Fig. 6. The master sheets are guided to the gripping mechanism by a master sheet guide or table 46 which is fixed to the side frames 10 and 11. A copy sheet table 47 is mounted on the side frames 10 and 11, and a receiving tray 48 is mounted upon a stub shaft 49 to receive copy sheets after they have been applied to the drum 36. A pressure roller 50 is supported by a bracket 51 that is pivotally mounted on the stub shaft 49, it being understood, of course, that there are two of the shafts 49 at opposite sides of the machine.

The structure hereinbefore described is substantially that shown in the prior application hereinbefore referred to, and further description is believed to be superfluous since this structure merely cooperates with the structure to be hereinafter described and which contains the novel features for carrying out the purpose of this invention.

Referring now to Figs. 1 and 2, there is shown a reservoir 52 located adjacent the frame 11. This reservoir extends through an opening in the bracket 13 and is further supported for example by means of brackets 53 and 54 upon the side frame 11. As shown best in Fig. 2, the reservoir is divided into two compartments by means of a partition 55, one compartment 56 being used for a volatile solvent for the ink or carbon on the master sheet, and the other compartment 57 being used for a carrier liquid such as water. The compartments are provided with inlet tubes 58 and 59, respectively. A cap 60 is provided for inlet tubes 58, and a cap 61 is provided for inlet tube 59. The caps are pivoted upon a common standard projecting up from the reservoir by means of a screw 62.

Each reservoir has a pump therein. Since the pumps are identical, the structure of only one of them will be described. The pump in the chamber 56 comprises a cylinder 63 having inlet openings 64 adjacent the bottom of the reservoir 52 and extending down below the reservoir where it is provided with a check valve 65 and an outlet conduit 66. A piston 67 is mounted in the cylinder 63 and has a piston rod 68 projecting upward through a packing cap 69 at the top of the cylinder 63. A spring 70 tends to urge the piston 67 downwardly to force liquid in the cylinder 63 out through the outlet 66. The piston rod 68 has a head 71 thereon which head is adapted to be engaged by an arm 72 upon a cam lever 73 which is pivoted at 74 upon the side frame member 11. The lever 73 has an upwardly extending arm 75 which carries a roller 76 adapted to engage a cam 77 mounted on the drum shaft 35. Thus, the cam 77, when the drum 36 is rotating, rocks the arm 75 to alternately lift the piston rods 68 and allow the same to drop under the influence of the spring 70. For each rotation of the drum shaft 35, one actuation of the pump is accomplished. The arm 72 is divided as indicated at 78 in Fig. 2 to provide a pair of slots 79 and 80 which receive the heads 71 and 71' of the two pumps in the compartments 56 and 57 so that both pumps are operated conjointly.

For the purpose of controlling the stroke of the pumps and thus the amount of liquid they pump for each stroke, means has been provided for regulating the operation of the lever 73 so as to limit the downward movement of the pistons such as 67. This means consists of an arm 118 on the lever 73 and an eccentric cam 119 pivoted by means of a shaft 120 upon the side frame 11. The cam 119 is fixed upon a shaft 121 which projects through the side frame 11 and has thereon a knurled head 122. A spring 123 surrounds the shaft 121 between the cam 119 and the side frame 11. A plate 124 underlies the knurled head 122, and this plate and the side frame 11 are provided with a series of openings indicated at 125 adapted to receive a pin 126 on the head 122. Thus the cam 119 can be set in any one of several positions to limit the angular movement of the arm 118 about its pivot 74 and thus limit the counterclockwise movement of the lever 73. The movement of the lever 73 in a counterclockwise direction determines the extent to which the springs 70 can pull their pump pistons 67 downwardly.

For hand operation of the pumps, a hand lever 81 is mounted on the side frame 11 and carries a projection 82 at its inner end for engaging the arm 75 and actuating the lever 73 as will be readily understood. The liquids from the two pumps are conducted upwardly by means of a pair of conduits 83 and 84, conduit 83 being connected to the pump in the compartment 57, and the conduit 84 being connected to the pump in the compartment 56. Adjacent the top of the machine, each of the conduits 83 and 84 is provided with a surge chamber. The conduit 83 has a surge chamber 85, and the conduit 84 has a surge chamber 86. The surge chamber 85 has a vent pipe 87 opening to atmosphere, and the chamber 86 has a vent 88 opening to atmosphere.

A pair of moistening receptacles 90 and 91 are adapted to receive liquid from the chambers 85 and 86 through conduits 92 and 93. These moistening receptacles are substantially duplicates and have a common cover 94 which extends over both of them. The two receptacles 90 and 91 are connected together to move as a single unit and are hinged upon a perforated pipe 95 (see Fig. 3) which supplies the liquid to the receptacle 90. This pipe 95 is in turn carried by a pair of brackets 96 and 97 which are fixed to bearing blocks 98 and 98' mounted on the side frames 10 and 11. A moistening roller 99 is associated with the receptacle 90 to receive water therefrom, and a moistening roller 100 is associated with the receptacle 91 to receive a volatile solvent therefrom. The conduit 92 is connected to the perforated pipe 95 by a flexible tubing in a well known manner, and the conduit 93 is connected to a similar perforated pipe 101 extending into and through the receptacle 91. Cooperating with the moistening roller 99 is a felt roller 102, and cooperating with the moistening roller 100 is a felt roller 103. Suitable absorbent material, as indicated at 104, and suitable moistening felt indicated at 105 is provided in each of the receptacles 90 and 91. Also, each receptacle is provided with a drain trough as indicated at 106 in receptacle 90 and 107 in receptacle 91. For the

purpose of adjusting the flow through the moistening felt 105, the receptacles are provided with adjustable bars 107 and 108 which operate in the usual fashion as will be understood by those skilled in this art.

The moistening rollers 99 and 100 are geared to the drum 36 by suitable gearing shown most clearly in Fig. 4. A gear 109 is fixed to the drum 36 and drives an idler gear 110 which is mounted on the side frame 11 by means of a suitable stub shaft 111. The idler gear 110 drives a gear 112 which is fixed upon the shaft of roller 100. The cooperating felt covered roller 103 associated with roller 100 is driven by friction and not by direct drive. A gear 113 connects the gear 112 with a gear 114 on the shaft of the roller 99 so as to drive this roller in the proper direction and at the proper speed with respect to the drum 36. The gears 109, 110, 112, 113, and 114 and the rollers 99 and 100 are so matched that the copy sheets are fed to the drum at a progressively increasing speed, that is, roller 100 moves the sheet slightly faster than roller 99, and the drum also moves the sheet slightly faster than roller 100 to prevent wrinkling of the sheet.

Between the rollers 99 and 100, there is a guide chute, the purpose of which is to prevent copy sheets from any tendency they may have to curl after they are first moistened. This guide chute is best illustrated in Fig. 5 where it is shown as comprising a lower plate 115 which is in effect an extension of the copy sheet table 47 and which extends across the space between the felt rollers 102 and 103. Overlying the plate 115 and spaced therefrom is a second guide plate 116 which extends between the moistening rollers 99 and 100 and cooperates with the plate 115 to guide the copy sheets from the rollers 99 and 102 to the rollers 100 and 103.

In operation, a copy sheet 117 is fed into the machine until it is stopped by engagement with the rollers 99 and 102. However, when the machine is started by actuation of the cross bar 37 to connect the drum 36 to the gear 33 which is continuously driven from the motor, the rollers 99 and 102 will advance the copy sheet 117. The roller 99 also moistens the top surface of the copy sheet, and the sheet so moistened passes between the plates 115 and 116 to the rollers 100 and 103 which have been rotating since the machine started and hence are ready to receive the front edge of the copy sheet. The roller 100 spreads the volatile solvent liquid upon the already moistened top surface of the copy sheet, and the copy sheet is then advanced to the pressure roller 50 and the drum 36 which cooperate to press the moistened copy sheet against the master sheet 45.

The volatile solvent used may be of any suitable type. One solvent liquid which has been found to be successful is a liquid composed of seventy-five per cent ethyl alcohol which has been denatured and twenty-five per cent of a petroleum solvent having a narrow boiling range—for example, a boiling range varying from 170° F. to 240° F. This petroleum solvent may be purchased on the market under the trade name of Skelly-Solve. It acts as a diluent on the alcohol and slows up the action of the alcohol solvent so as to produce a somewhat better result.

For a first moistening liquid, it has been found that ordinary water is very successful in combination with the above described solvent. The copies produced with the double moistening are much improved over those where only a volatile solvent is used. The results indicate that the carrier liquid insures a more even distribution of the solvent liquid and a more effective dissolving action upon the carbon by the solvent. The principal ingredient of the solvent liquid, ethyl alcohol, mixes readily with water.

While the preferred embodiment of the invention has been shown and described, 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 the intention to claim all novelty inherent in the invention as broadly as possible in view of the prior art.

Having thus described the invention, what is claimed as new and desired to be secured by Letters Patent is:

1. A method of producing copies from a master sheet having the characters formed thereon of a material which can be transferred to a copy sheet when wetted by a suitable solvent which comprises first wetting the surface of a copy sheet to be applied to said master sheet with a carrier liquid, and thereafter moistening the said wetted surface with a volatile liquid solvent for the material of which said characters are formed, and pressing the moistened surface into intimate contact with the master sheet.

2. A method of producing copies from a master sheet having the characters formed thereon of a material which can be transferred to a copy sheet when wetted by a suitable solvent which comprises first wetting the surface of a copy sheet to be applied to said master sheet with a carrier liquid incapable of dissolving the material of which said characters are formed, and thereafter moistening the said wetted surface with a volatile liquid solvent for the material of which said characters are formed, and pressing the moistened surface into intimate contact with the master sheet.

3. A method of producing copies from a master sheet having the characters formed thereon of a material which can be transferred to a copy sheet when wetted by a suitable solvent which comprises first wetting the surface of a copy sheet to be applied to said master sheet with a carrier liquid, and thereafter moistening the said wetted surface with a volatile liquid solvent for the material of which said characters are formed, which solvent is readily miscible with the carrier liquid, and pressing the moistened surface into intimate contact with the master sheet.

4. A method of producing copies from a master sheet having the characters formed thereon of a material which can be transferred to a copy sheet when wetted by a suitable solvent which comprises first wetting the surface of a copy sheet to be applied to said master sheet with a carrier liquid, incapable of dissolving the material of which said characters are formed, and thereafter moistening the said wetted surface with a volatile liquid solvent for the material of which said characters are formed, which solvent is readily miscible with the carrier liquid, and pressing the moistened surface into intimate contact with the master sheet.

5. A method of producing copies from a master sheet having the characters formed thereon of a material which can be transferred to a copy sheet when wetted by a suitable solvent which comprises first wetting the surface of a copy sheet to be applied to said master sheet with

water, and thereafter moistening the said wetted surface with a volatile liquid solvent for the material of which said characters are formed, and pressing the moistened surface into intimate contact with the master sheet.

6. A method of producing copies from a master sheet having the characters formed thereon of a material which can be transferred to a copy sheet when wetted by a suitable solvent which comprises first wetting the surface of a copy sheet to be applied to said master sheet with water, and thereafter moistening the said wetted surface with a solvent fluid comprising alcohol, and pressing the moistened surface into intimate contact with the master sheet.

7. A duplicating machine comprising a rotatable drum having means to secure a master sheet thereon, a pressure roller cooperating therewith to press copy sheets against the master sheet, a pair of feeding and moistening rollers for feeding copy sheets to said drum and applying moisture thereto, a second pair of feeding and moistening rollers adapted to feed copy sheets to said first named rollers, and means interconnecting said rollers and said drum whereby to advance the copy sheets at a progressively increasing speed from the second pair of rollers through the first pair of rollers and between the drum and pressure roller.

8. A method of treating copy sheets in duplicating which comprises first wetting the sheets with a carrier liquid and then wetting them with an ink solvent.

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