

Feb. 13, 1940.

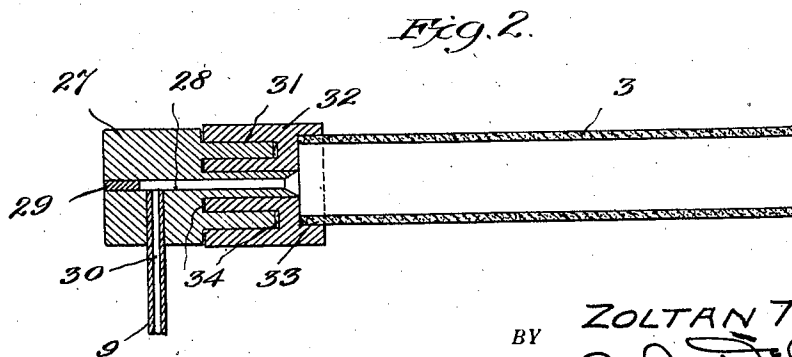
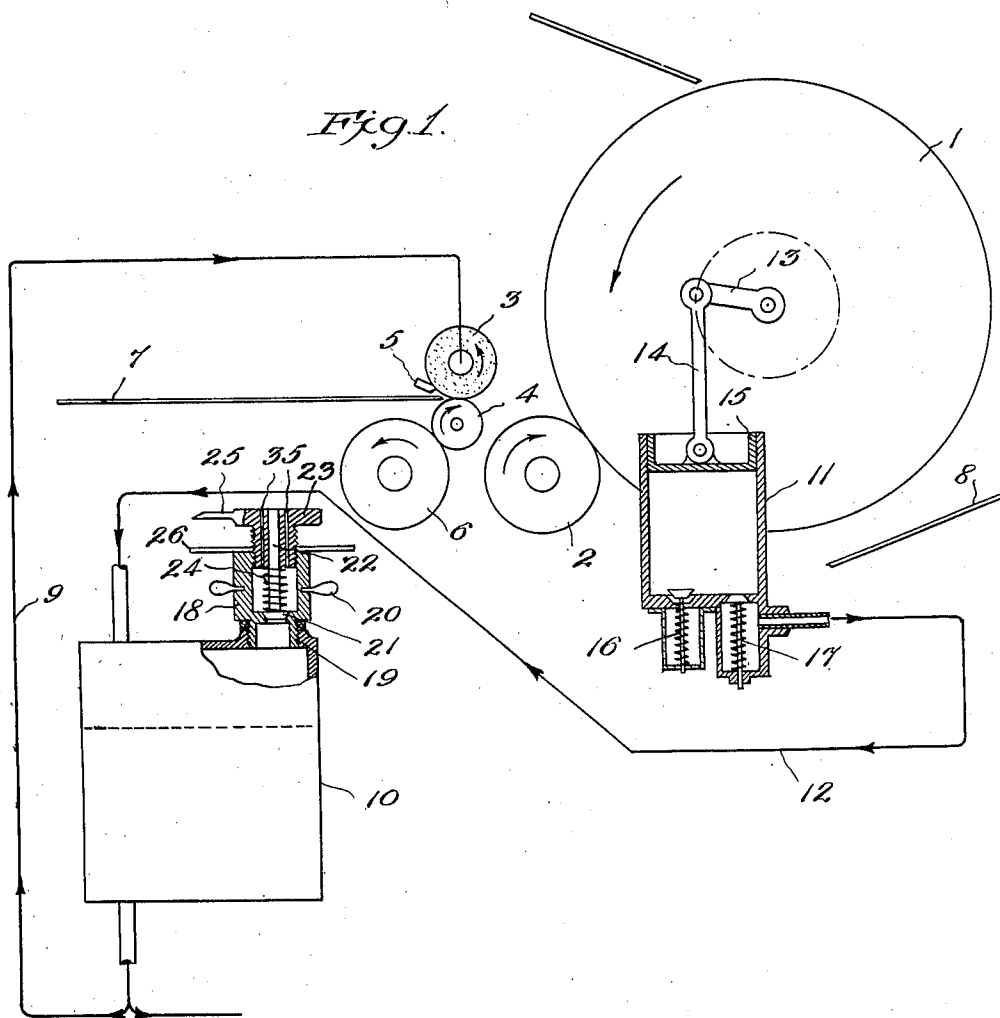
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MOISTENING DEVICE FOR DUPLICATING MACHINES

Filed Nov. 29, 1938

2 Sheets-Sheet 1



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2 Sheets--Sheet 2

Fig. 3.

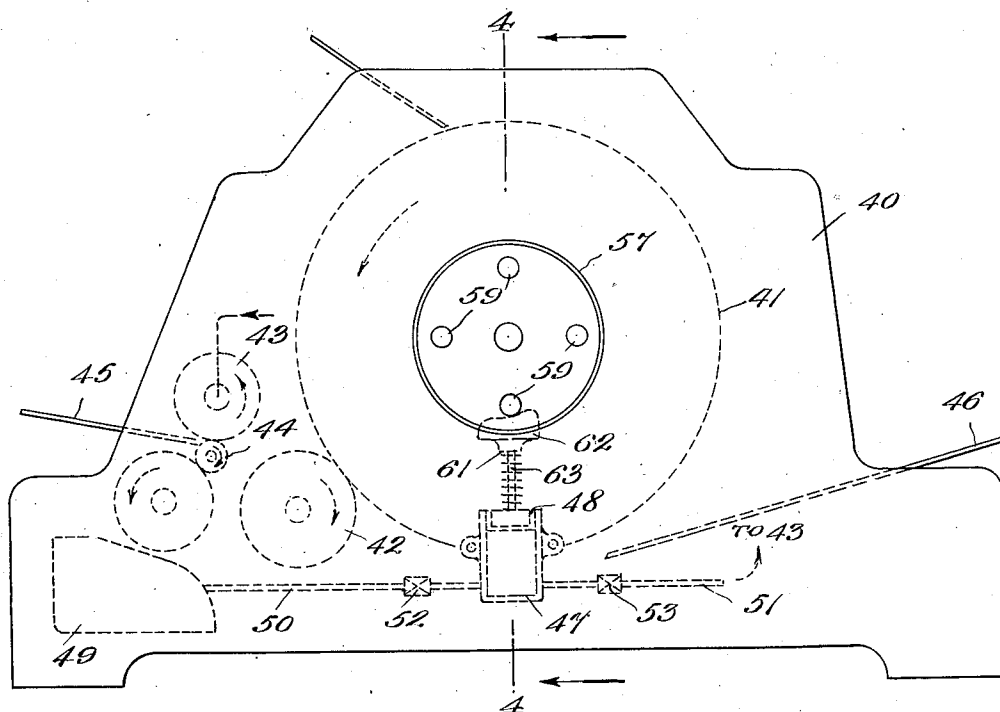
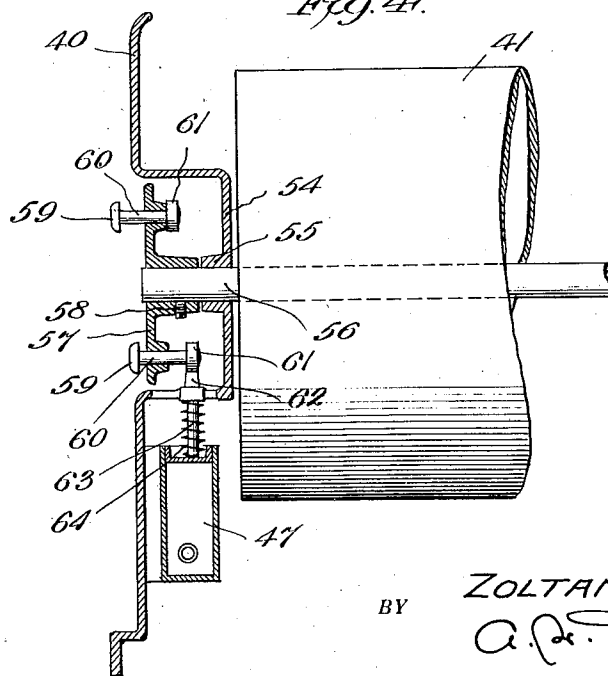


Fig. 4.



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MOISTENING DEVICE FOR DUPLICATING MACHINES

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14 Claims. (Cl. 101—132.5)

The present invention relates to duplicating machines, and, more particularly, to duplicating machines of the type in which a copyable mirror script original is copied onto clear sheets previously moistened with a readily volatilizing solvent, and to an improved moistening device for duplicating machines of the described character.

Heretofore, in duplicating machines printing onto clear sheets which are previously moistened with a readily volatilizing solvent, generally referred to in the art as spirit duplicating machines, various moistening devices were used to moisten the copy sheet to be printed onto. Thus, moistening pads constituted of felt or some other absorbent material were extensively used. Likewise, moistening rollers were employed to a great extent, particularly in combination with a counter moistening roller. A film or layer of the suitable readily volatilizing solvent was applied to the surface of the moistening roller by means of a pad, a wick or by partial submersion of the roller in a trough containing a quantity of the solvent. The sheet to be printed onto was subsequently passed between the two cooperating rolls whereby the moisture film on the surface of the moistening roller was transferred to the surface of the copy sheet. As those skilled in the art know, great difficulties were experienced in providing a uniform layer or film of moisture on the surface of the copy sheet by any of the foregoing devices. Any structure involving pads, wicks and other absorbent materials quickly deteriorated and required frequent replacement. Moreover, the distribution of the moisture by means of such absorbent materials on the surface of the moistening rollers was far from being satisfactory and uniform. Uneven distribution of the moisture on the moistening roller caused the production of uneven and unattractive prints and reduced the number of prints obtainable from a single original. Although various suggestions and proposals were made from time to time to solve the outstanding problem and to provide a completely satisfactory and foolproof moistening device for spirit duplicating machines, none, as far as I am aware, of these suggestions and proposals was completely satisfactory and successful when carried into practice on a practical and commercial scale.

I have discovered a simple and satisfactory solution of the outstanding problem.

It is an object of the present invention to provide a moistening device for duplicating machines, particularly for duplicating machines of the spirit type which is free from the disad-

vantages and inconveniences of conventional moistening devices.

It is another object of the present invention to provide a novel and improved moistening device for spirit duplicating machines involving a moistening roller of microporous character.

It is a further object of the invention to provide a novel moistening device for spirit duplicating machines in which a moistening member of microporous character is provided and the moistening liquid is fed through the body of said moistening member under pressure and is caused to be deposited as an extremely fine film or dew of liquid on the outer surface of said member.

The invention also contemplates a moistening device for spirit duplicating machines for applying a perfectly uniform and fine film of readily volatilizing solvent to the surfaces to be printed onto, which is simple in construction, satisfactory and fool-proof in operation, and which may be manufactured on a practical and industrial scale at a low price.

Other and further objects and advantages will become apparent from the following description taken in conjunction with the accompanying drawings in which:—

Fig. 1 illustrates a diagrammatic side elevational view of a duplicating machine equipped with a moistening device embodying the principles of the present invention;

Fig. 2 depicts a longitudinal sectional view, somewhat fragmentary, of a microporous moistening roller embodying the invention;

Fig. 3 shows a side elevational view, somewhat fragmentary and with parts broken away for reasons of clarity, of a modified embodiment of the present invention;

Fig. 4 is a vertical sectional detail view taken on line 4—4 of Fig. 3, also fragmentary, showing the liquid pump and its actuating mechanism illustrated in Fig. 3.

Broadly stated, according to the principles of the present invention, I provide a moistening member for the purpose of transferring the liquid, such as spirit, alcohol, ether, etc., to the face side of the copy sheet to be printed onto. In contrast to conventional practice according to which either completely solid moistening members such as solid rolls and the like were employed, or moistening members of highly porous and absorbent character such as felt and the like, I employ a moistening member constituted of a material having finely and uniformly distributed voids or pores therein through which the volatile solvent may be pressed or squeezed

in the desired fine and uniform distribution. Although various materials of a finely distributed porous character can be employed such as for example, chamois and various other microporous sheet-like materials of a flexible character, I prefer to employ microporous metals, microporous porcelain, earthenware, or rubber for my moistening members. Thus, good results are obtainable by means of moistening members constituted of porous bronze having fine and intercommunicating voids through which the moistening solvent may be passed under pressure. Such porous bronze articles are made by first briquetting metal powders under high pressure and then sintering in a non-oxidizing atmosphere until the lower melting ingredient powder, such as tin, fuses and alloys with the copper ingredient to form a rigid porous structure. Porous metals of this type are employed in bearings, such as a bearing sold under the trade name "Compo bearing" in which the intercommunicating voids are filled with oil or grease under pressure. Likewise, I have found that other microporous materials such as unglazed earthenware burnt to a porous consistency or certain rubber compounds, particularly chlorinated rubber having finely and uniformly distributed pores therein may be used with satisfactory results. In the following description, I will refer to these materials as "microporous" materials, this term being interpreted to include all materials having finely and uniformly distributed pores or voids therein which are in communication with each other so that a relatively thin liquid may be caused to pass through the material under sufficient pressure, to appear as a fine coating, film or dew on the outer surface thereof. Of course, it is not generally necessary that these pores or voids should be of a microscopic size, but it is sufficient if the pores are small enough to prevent the free leakage or squirting of the liquid from the material. Preferably, the moistening member constituted of such microporous material is provided in the form of a hollow, cylindrical roller, the readily volatilizing solvent being fed to the hollow center of the roller and is pressed through the wall thickness thereof to the outer surface where it may be applied to the surface of a copy sheet to be printed onto. The supply of liquid to the roller may be accomplished in various ways, for example, by means of a suitable pump actuated by the duplicating machine which either directly pumps the liquid, in predetermined unitary amounts to the microporous and hollow moistening roller or establishes superatmospheric pressure in a reservoir containing the volatile liquid which is conducted under this pressure to the hollow, cylindrical moistening roller of microporous character by means of a suitable conduit.

The invention will now be more fully described to those skilled in the art, reference being had to the accompanying drawings.

Referring now more particularly to Fig. 1 of the drawings, a preferred embodiment of the present invention is illustrated. A printing roller 1 cooperates with a counter pressure roller 2 in conventional manner to print onto premoistened clear sheets with an original (not shown) tensioned around the circumference of the printing roller. In front of the bight of said cooperating rollers is another pair of cooperating rollers 3 and 4 rotatably mounted. Of these rollers, the upper one, 3, is constituted of a microporous material having a smooth and cylindrical outer surface

and an inner cylindrical cavity through which the volatile moistening liquid may be introduced, as it will be more fully explained hereinafter. Moistening roller 3 cooperates with counter moistening roller 4 having a smooth or grooved surface and having the object to press the sheet to be moistened against the moistened circumferential surface of the moistening roller. A felt pad 5 bears against the surface of the moistening roller to cause distribution of the moisture pressed through the walls of the moistening roller in a completely uniform manner. In some cases it is advantageous to have a roller 6 constituted of an absorbent material, such as felt, and the like, bearing against the surface of the counter moistening roller, in order to remove surplus moisture therefrom and to maintain the surface of counter moistening roller 4 in a dry condition at all times. Before the bight of cooperating rollers 3 and 4 is arranged a feed table 7, for the introduction of clear sheets to be printed onto into the machine, the printed sheets being deposited on a receiving tray 8 located at the outer side of the machine.

The solvent feeding means essentially comprise a conduit 9 connecting the hollow space within the moistening roller 3 with a solvent reservoir 10. The upper portion of the reservoir is connected with a pump 11 by means of another conduit 12. Pump 11 is actuated by the rotation of printing roller 1 by means of a crank 13, and of a connecting rod 14 which causes reciprocation of piston 15 within the cylinder of the pump during rotation of the printing roller. The cylinder of the pump is provided with an air intake valve 16 permitting air to enter the cylinder during the upward displacement of the piston and with an exhaust valve 17 operative during the downward motion of the piston and connected with conduit 12. The upper portion of reservoir 10 is also provided with a combination filling opening and pressure regulating valve comprising a sleeve member 18 having a lower threaded portion 19 cooperating with a corresponding threaded portion of reservoir 10 and having a tightening handle 20 associated therewith to facilitate the insertion and the removal of the complete valve structure. Within sleeve member 18 is provided a valve 21 seated in a corresponding seat of the sleeve member. Valve 21 is integrally formed with a valve rod 22 which is slidably mounted in a centrally arranged hole in a threaded regulator member 23. Regulator member 23 is held in a corresponding threaded portion of sleeve member 18 and may be inserted therein to a lesser or greater extent by means of rotation whereby the tension of a helical spring 24 surrounding valve rod 22 may be adjusted. An indicator needle 25 on the regulator member 23 and cooperating with a dial 26 rigidly mounted on sleeve member 18 indicates the amount of pressure maintained within solvent reservoir 10.

The construction of the moistening roller will best be understood from Fig. 2. As it will be noted from Fig. 2, a stationary male bearing 27 is provided having an axial bore 28 therein, the end of which is closed by means of a plug 29. A radial bore 30 branches into axial bore 28 and provides a connection thereof with conduit 9 connecting the moistening roller with the solvent reservoir. Stationary male bearing 27 is provided with a labyrinth-shaped profile 31 cooperating with a similarly shaped rotatable annular bearing member 32 which is holding hollow and microporous moistening roller 3 in a recess 33

thereof. It will be noted that packing rings 34 are inserted in suitable position between the co-operating surfaces of stationary male bearing 27 and rotatable female bearing member 32 to provide liquid-tight joint between these members and at the same time to permit relative and rotative displacement thereof with respect to each other.

From the foregoing description, operation of the moistening device embodying the invention will be readily understood by those skilled in the art. During the rotation of printing roller 1, pump 11 will introduce air under pressure into the upper space of solvent reservoir 10 and through conduit 12. This pressure will gradually increase until it is sufficient to open valve 21 against the pressure of helical spring 24 whereby some of the pressure will be released through the valve and through small air holes 35 provided in the regulator member 23. Thus, during the continuous operation of the machine and of pump 11, the pressure prevailing within reservoir 10 will be maintained substantially constant and is determined by the pressure of spring 24 and indicated by the position of needle 25 on dial 26. The constant air pressure above the level of the solvent in the reservoir will cause solvent to flow through conduit 9 and to fill out the inner space of the moistening roller 3 from which it will be slowly and uniformly squeezed through the microporous walls thereof and will appear on the outer circumferential surface of the roller in the form of a fine film or dew.

When it is desired to print copies of the original tensioned around the printing roller; printing roller, counter pressure roller, moistening roller and counter moistening roller are caused to rotate in the direction indicated by the arrows and at substantially equal circumferential speeds. In view of the fact that the driving mechanism is conventional and does not form the object of the present invention, its illustration has been omitted from the drawings for the sake of simplicity. Hereafter, a clear sheet is introduced into the bight of moistening and counter moistening rollers 3 and 4 which act as combination feed and moistening rollers. Moistening roller 3 will provide a thin film of readily volatilizing solvent on the upper face of the clear sheet which immediately is introduced into the bight of the printing roller and counter pressure roller whereby a clear and uniform copy of the copyable original will be imprinted upon the surface of the clear sheet. The printed sheet will be deposited on receiving tray 8. This operation is repeated in accordance with the number of copies desired and the air pressure prevailing in the reservoir and the amount of solvent fed to the moistening roller is adjusted by means of regulator member 23 to an optimum.

The modified embodiment of the invention illustrated in Figs. 3 and 4 is much similar to the one shown in Figs. 1 and 2, the only difference being in the construction and in the actuation of the pump mechanism. In a frame 40 are rotatably mounted a printing roller 41, a counter pressure roller 42, a microporous moistening roller 43, and a counter moistening roller 44 in cooperating position. Conventional driving means (not shown) are provided for the actuation of these elements, as those skilled in the art will readily understand. A feed table 45 and a receiving table or tray 46 are provided at opposite sides of the machine for the insertion of clear sheets into the machine and for receiving the printed sheets,

respectively. A pump 47 having a piston 48 is mounted on the frame of the machine and is connected with a solvent reservoir 49 by means of a conduit 50 and with microporous moistening roller 43 by means of a conduit 51. A check valve of conventional design is interposed in each of the conduits, check valve 52 permitting solvent to be sucked from the reservoir during the upward stroke of the piston and being closed during the downward stroke, whereas check valve 53 is closed during the upward stroke of the piston and being automatically opened during the downward stroke whereby a predetermined amount of liquid is supplied under pressure to the moistening roller for each stroke of the piston.

The construction and operation of the pump actuating mechanism will be best understood by referring to Fig. 4. As will be observed from Fig. 4, side frame 40 of the machine is provided with an indented portion 54 having a boss 55 therein in which a bearing for shaft 56 of printing roller 41 is provided. The outer end of shaft 56 has an actuating disk 57 rigidly mounted thereon by means of a set screw 58, so that the actuating disk will rotate with the printing roller during the rotation thereof. Actuating disk 57 is provided with four actuating buttons 59, each button having a shank 60 connected thereto which is slidably mounted in a corresponding opening of the actuating disk. The inner end of each shank 60 is provided with a small roller 61 rotatably mounted thereon which is adapted to cooperate with a corresponding cam 62 at the end of piston rod 63 to depress the piston against the pressure of spring 64.

The described arrangement of the actuating disk with the plurality of axially displaceable buttons provides a simple and convenient expedient for the adjustment of the amount of solvent fed for each rotation of the printing roller. Clearly, the quantity of solvent sucked from the reservoir and supplied under pressure to moistening roller 43 will be directly proportional to the number of actuating buttons pushed in and having its associated roller cooperating with the pump. Thus, when none of the buttons is pushed in, the pump remains inoperative during the rotation of the printing roller. By pushing in 1, 2, 3 or 4 buttons, the pump is caused to deliver 1, 2, 3 or 4 unitary amounts of solvent for each rotation of the roller whereby a simple, fool-proof and positive adjustment of the solvent feed is accomplished.

Although the present invention has been described in connection with a few preferred embodiments thereof, variations and modifications may be resorted to by those skilled in the art without departing from the principles of the present invention. Thus, instead of a moistening roller constituted of a microporous material it is also possible to employ a polygonal or curved microporous member or a microporous sheet such as, for example, chamois, stretched over a suitable slotted or foraminous member and to supply the solvent under pressure through the small intercommunicating voids or pores of such member to the article to be provided with a thin film of moisture.

It is also to be observed that the application of the principles of my invention is not restricted to spirit duplicating machines and to readily volatilizing solvents but my microporous moistening members may be employed with equal or similar results for feeding printing inks, textile dyes and other similar liquid or semi-liquid substances in

duplicating machines, printing machines, in the art of wall paper making, textile printing, gluing, sizing, paper making, and the like. I consider all of these variations and modifications as within the true spirit and scope of the present invention as disclosed in the foregoing description and defined by the appended claims.

I claim:

1. In a duplicating machine printing onto clear sheets previously moistened with a readily volatilizing solvent including a printing roller bearing copyable mirror-script original and a counter pressure roller cooperating with said printing roller, a moistening mechanism comprising in combination a microporous moistening roller constituted of a material having finely and uniformly distributed microscopic pores therein, and means for feeding a readily volatilizing solvent under superatmospheric pressure through said pores to the outer surface of said roller.

2. In a duplicating machine printing onto clear sheets previously moistened with a readily volatilizing solvent including a printing roller bearing copyable mirror-script original and a counter pressure roller cooperating with said printing roller for pressing clear sheets against said original, a moistening mechanism comprising in combination a moistening roller constituted of a microporous material for moistening said sheets, a counter moistening roller bearing against said moistening roller, and means for feeding a readily volatilizing solvent under superatmospheric pressure through the pores of said moistening roller to the outer surface thereof.

3. In a duplicating machine printing onto clear sheets previously moistened with a readily volatilizing solvent including a printing roller bearing copyable mirror-script original and a counter pressure roller cooperating with said printing roller, a moistening mechanism comprising in combination a microporous moistening roller having an axial cavity, a counter moistening roller bearing against said moistening roller, and means for feeding a readily volatilizing solvent under superatmospheric pressure through the axial cavity of said moistening roller to the outer surface thereof.

4. In a duplicating machine printing onto clear sheets previously moistened with a readily volatilizing solvent including a printing roller bearing a copyable mirror-script original and a counter pressure roller cooperating with said printing roller, a moistening mechanism comprising in combination a microporous moistening roller having an inner cylindrical cavity, a counter moistening roller bearing against said moistening roller, and means actuated by said printing roller for feeding a readily volatilizing solvent under superatmospheric pressure through the inner cavity of said moistening roller to the outer surface thereof.

5. In a duplicating machine printing onto clear sheets previously moistened with a readily volatilizing solvent including a printing roller bearing copyable mirror-script original and a counter pressure roller cooperating with said printing roller, a moistening mechanism comprising in combination a microporous moistening roller having an inner cylindrical cavity, a counter moistening roller bearing against said moistening roller, and means actuated by said printing roller for feeding a predetermined amount of a readily volatilizing solvent under superatmospheric pressure through the inner cavity of said moistening roller to the outer surface thereof.

6. In a duplicating machine printing onto clear sheets previously moistened with a readily volatilizing solvent including a printing roller bearing copyable mirror-script original and a counter pressure roller cooperating with said printing roller, a moistening mechanism comprising in combination a microporous moistening roller having an axial cavity, a counter moistening roller bearing against said moistening roller, a reservoir for a readily volatilizing solvent, and pumping means actuated by the operation of said printing roller for feeding said solvent under superatmospheric pressure from said reservoir to the cavity of said moistening roller and through the pores of said roller to the outer surface thereof.

7. In a duplicating machine printing onto clear sheets previously moistened with a readily volatilizing solvent including a printing roller bearing a copyable mirror-script original and a counter pressure roller cooperating with said printing roller, a moistening mechanism comprising in combination a microporous moistening roller having an axial cavity, a counter moistening roller bearing against said moistening roller, a reservoir for a readily volatilizing solvent connected to the axial cavity of said moistening roller, and a pump actuated by the operation of said printing roller for pumping air under superatmospheric pressure into said reservoir to feed said solvent to the axial cavity of said moistening roller.

8. In a duplicating machine printing onto clear sheets previously moistened with a readily volatilizing solvent including a printing roller bearing a copyable mirror-script original and a counter pressure roller cooperating with said printing roller, a moistening mechanism comprising in combination a microporous moistening roller having an axial cavity, a counter moistening roller bearing against said moistening roller, a reservoir for a readily volatilizing solvent connected to the axial cavity of said moistening roller, a pump actuated by the operation of said printing roller for pumping air into said reservoir and to feed solvent under superatmospheric pressure to the axial cavity of said moistening roller, and an adjustable pressure release valve associated with said reservoir for adjusting said pressure.

9. In a duplicating machine printing onto clear sheets previously moistened with a readily volatilizing solvent including a printing roller bearing a copyable mirror-script original and a counter pressure roller cooperating with said printing roller, a moistening mechanism comprising in combination a microporous moistening roller having an axial cavity, a counter moistening roller bearing against said moistening roller, a reservoir for a readily volatilizing solvent, conduit means connecting said reservoir to the cavity of said moistening roller, and a pump in said conduit means actuated by the operation of said printing roller for feeding predetermined amounts of solvent under superatmospheric pressure from said reservoir to said moistening roller for each rotation of said printing roller.

10. In a duplicating machine printing onto clear sheets previously moistened with a readily volatilizing solvent including a printing roller bearing a copyable mirror-script original and a counter pressure roller cooperating with said printing roller, a moistening mechanism comprising in combination a microporous moistening roller having an axial cavity, a counter moistening roller bearing against said moistening roller, a reservoir for a readily volatilizing solvent, con-

duit means connecting said reservoir to the cavity of said moistening roller, a pump in said conduit means actuated by the operation of said printing roller for feeding predetermined unitary amounts of solvent under superatmospheric pressure from said reservoir to said moistening roller for each rotation of said printing roller, and means for adjusting said unitary amounts.

11. In a duplicating machine printing onto clear sheets previously moistened with a readily volatilizing solvent including a printing roller bearing a copyable mirror-script original and a counter pressure roller cooperating with said printing roller for pressing clear copy sheets against said original, a moistening mechanism comprising in combination a hollow microporous moistening roller for moistening said copy sheets, a counter moistening roller bearing against said moistening roller located in front of the bight of said printing and counter pressure rollers, a reservoir for a readily volatilizing solvent, conduit means connecting said reservoir to the inner cavity of said moistening roller, a pump in said conduit means for feeding solvent under superatmospheric pressure from said reservoir to said moistening roller, and an actuating disk operatively associated with said printing roller for actuating said pump a predetermined number of times for each rotation of said printing roller.

12. In a duplicating machine printing onto clear sheets previously moistened with a readily volatilizing solvent including a printing roller bearing a copyable mirror-script original and a counter pressure roller cooperating with said printing roller for pressing clear copy sheets against said original, a moistening mechanism comprising in combination a hollow microporous moistening roller for moistening said copy sheets, a counter moistening roller bearing against said moistening roller located in front of the bight of said printing and counter pressure rollers, a reservoir for a readily volatilizing solvent, conduit means connecting said reservoir to the inner cavity of said moistening roller, a pump in said conduit means for feeding solvent under superatmos-

pheric pressure from said reservoir to said moistening roller, an actuating disk operatively associated with said printing roller for actuating said pump, and a plurality of actuating buttons on said disk, each of said buttons being adapted to be individually displaced from an inoperative into an operative position to cause actuation of said pump a predetermined number of times for each rotation of said printing roller.

13. In a spirit duplicating machine having a printing roller bearing a copyable mirror-script original and a counter pressure roller cooperating with said printing roller, moistening means for said machine, said moistening means comprising in combination a hollow moistening roller constituted of a material having microscopic pores uniformly distributed therein, a bearing member for each end of said moistening roller for rotatably supporting said roller and forming a liquid-tight joint therewith, a counter moistening roller bearing against the surface of said moistening roller, and means for feeding a readily volatilizing solvent under superatmospheric pressure through said bearing members to the inner space of said moistening roller.

14. In a spirit duplicating machine having a printing roller bearing a copyable mirror-script original and a counter pressure roller cooperating with said printing roller, moistening means for said machine, said moistening means comprising in combination a hollow moistening roller constituted of a material having microscopic pores uniformly distributed therein, a bearing member for each end of said moistening roller for rotatably supporting said roller and forming a liquid-tight joint therewith, an axial bore in at least one of said bearing members in communication with the inner space of said moistening roller, and means for feeding a readily volatilizing solvent under superatmospheric pressure through the axial bore of said bearing members and through the pores of said moistening roller to the outer surface thereof.

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