June 6, 1939. E. M. BENELLO 2,161,554

MOISTENING DEVICE FOR DUPLICATING MACHINES

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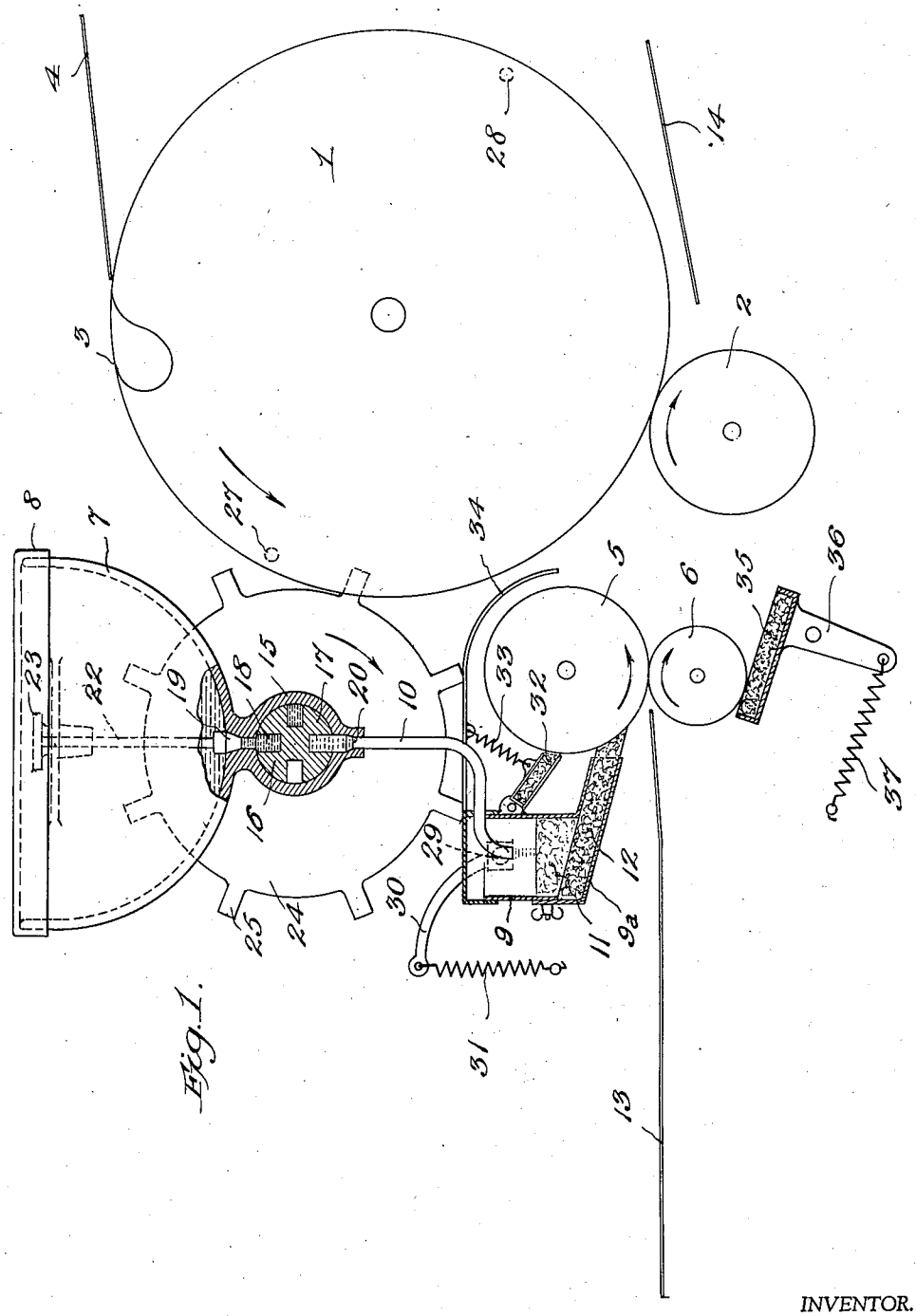


Fig. 1.

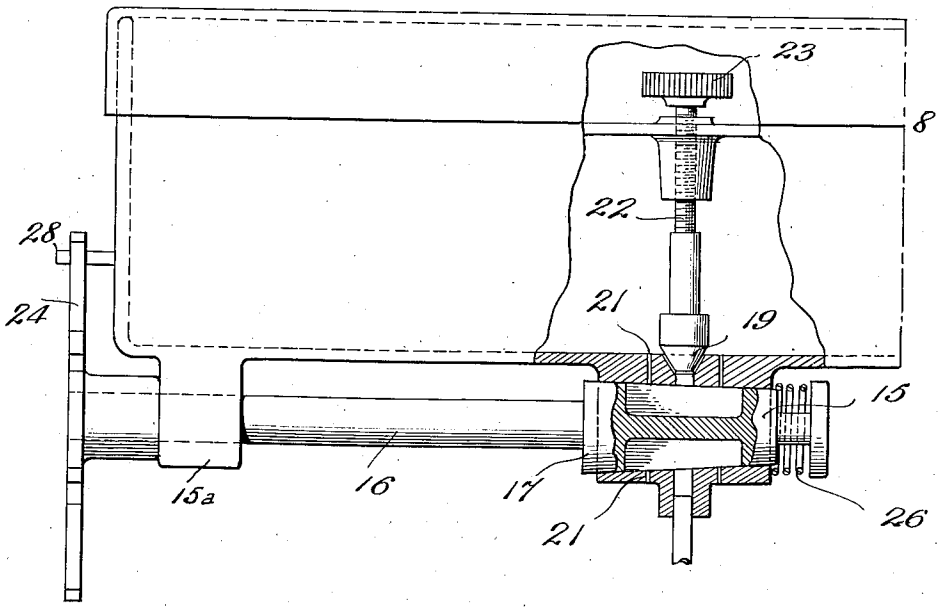
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Fig. 2.



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MOISTENING DEVICE FOR DUPLICATING MACHINES

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11 Claims. (Cl. 101—132)

The present invention relates to duplicating machines, and, more particularly, to duplicating machines of the type in which a copyable mirror-script original is employed and the copies are produced on clear sheets previously moistened with a readily volatilizing solvent.

As those skilled in the art know, the principal difficulty in duplicating machines of the described character resides in the uniform and adequate moistening of the clear copy sheets with the readily volatilizing ink solvent. First of all, the quantity of solvent on the clear sheet had to be carefully controlled since insufficient solvent caused weak and indistinct copies to be produced, while an excess of solvent caused the original to rapidly dissolve and to smear so that only a very small number of imperfect copies could be obtained from a single original. Irregular distribution of the solvent on the surface of the copy sheets provided imperfect copies having weaker and stronger portions so that not only the copies have been unattractive and of little practical value but the ink of the original was inequally consumed so that after a few copies have been printed with an inequal distribution of the solvent, the original itself became of inequal strength so that the following copies have been practically useless even though the distribution of the solvent on the copies has been subsequently readjusted. Although various other suggestions and proposals have been made to solve the outstanding problem and to provide the art with a satisfactory moistening device, none, as far as I am aware, of these various suggestions and proposals was completely satisfactory and successful when carried into practice on a practical and commercial scale.

I have discovered that the problem may be solved in a remarkably simple manner.

It is an object of the present invention to provide a moistening device for duplicating machines which is free from the disadvantages and inconveniences of conventional moistening devices.

It is another object of the present invention to provide an improved moistening device for duplicating machines which is adapted to dispense a rapidly volatilizing solvent and to provide a completely regular, uniform, predetermined and readily controlled film of moisture on the surface of clear sheets to be subsequently imprinted.

It is a further object of the invention to provide a novel and improved moistening device for mirror-script duplicating machines, which combines a moistening roller and a moistening felt and an automatically controlled solvent supply thereto.

The invention also contemplates an improved moistening device which is simple in construction, easy and inexpensive to manufacture, and which may be readily added to conventional duplicating machines without requiring substantial structural changes.

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

Fig. 1 is a diagrammatic view, somewhat fragmentary, of a duplicating machine embodying the principles of the present invention;

Fig. 2 is a fragmentary detail view, having parts in section, of the reservoir and valves shown in Fig. 1.

Broadly stated, according to the principles of the present invention, I provide a printing roller having clamping means for fastening at least the leading edge of a copyable mirror-script original thereto. The printing roller is adapted to cooperate with a conventional counter pressure roller for pressing copy sheets against the surface of the original. In front of the bight of said rollers I provide a pair of rollers, at least one of which has the object of moistening the copy sheets, the other of which cooperates with the former to propel the copy sheet into the bight of said printing and counter pressure rollers when all of the said rollers are rotated. In the following, I will refer to the latter two rollers as the moistening roller and the counter moistening roller. These two rollers have a double purpose in the operation of the machine. First of all, I provide driving means for these rollers so that they are adapted to be rotated in proportion to the rotary displacement of the printing roller so as to feed a clear sheet in between the bight of the printing roller and of the counter pressure roller. At the same time, I also feed a controlled quantity of ink solvent to the surface of the moistening roller so that during the feeding process the surface of the clear copy sheet is provided and coated with a thin and highly uniform film of a readily volatilizing solvent.

As those skilled in the art will readily appreciate, the success of the moistening process largely depends on the provision of a regular, thin and uniform film of moisture on the surface of the moistening roller which has been heretofore impossible. In accordance with my discovery, this critically important uniform moistening may be accomplished by providing a strip of moistening

felt or the like absorbent material which bears against the surface of the moistening roller and which is continuously supplied with a carefully controlled amount of solvent from a reservoir. I have found that capillary action is entirely inadequate for providing that uniform and controlled supply of solvent and that excellent results may be obtained by supplying the solvent to the moistening felt by means of gravity. This is accomplished by locating the reservoir at a higher level than the moistening felt which is in part surrounded with cotton, felt or the like absorbent materials. I also provide rotary valve means for controlling the flow of the solvent through the solvent distribution pipe. These rotary valve means are intermittently actuated in accordance with the rotation of the printing roller or of the moistening roller and release an accurately determined and positively controlled amount of solvent for each revolution of the printing roller. Thus, a limited and positively controlled amount of solvent is released for each copy sheet to be printed, and the accumulation of excessive quantities of solvent in the moistening felt during interruption of the printing operation is prevented.

The moistening roller and the counter moistening roller may be made of any suitable material. I prefer, however, to employ a moistening roller which is at least slightly absorbent or porous and elastic to a certain extent, such as, for example, rubber or rubber compositions, preferably having a microporous structure. Especially good results are obtained with moistening rollers constituted of synthetic rubber, which have an increased resistance against the detrimental effects of most solvents. I have found that on the surface of such roller a much more even distribution of the solvent may be obtained than on moistening rollers having a non-porous surface. The counter moistening roller is made of a non-porous, non-absorbent and highly polished material, such as, for example, steel, glass, synthetic resin, or a nickel alloy sold under the trade-mark "Monel" metal.

Referring now more particularly to Fig. 1 of the drawings, an exemplary embodiment of the invention is illustrated. A printing roller 1 and a counter pressure roller 2 cooperate with each other in the conventional manner to press copy sheets against a copyable mirror script original tensioned around the circumference of the printing roller. Printing roller 1 is provided with clamping means 3 for fastening the leading edge of the original which may be inserted by means of a master insertion table or tray 4. In front of the bight of the printing and the counter pressure rollers, I arrange a pair of feed rollers 5 and 6 which are adapted to be rotated in conformity with the rotation of the printing roller to feed a clear sheet into the bight of the printing roller and of the counter pressure roller. In view of the fact that these driving means are of conventional character and well known to those skilled in the art, description and illustration thereof has been omitted for the sake of simplicity. Feed roller 5 is constituted of slightly absorbent rubber composition and acts as a moistening roller as it will be described more fully hereinafter, feed roller 6, on the other hand has the purpose of pressing the sheet to be moistened against the moistening roller 5 and is preferably constituted of a highly polished, non-yielding material, such as steel, glass, or a synthetic resin sold under the trade-mark "Pontilite". Roller 6 may have a smooth or a finely grooved surface.

The solvent supply means are arranged in front of the bight of feed rollers 5 and 6. The supply means comprise a reservoir or fluid tank 7 having a cover 8, and a moistening chamber 9 provided with a readily removable extension piece 9a. The moistening chamber is arranged at a level lower than reservoir 7 and contains a layer of absorbent cotton 11 and a strip of felt 12 having substantially the same width as the moistening roller 5. The strip or pad of felt 12 is adjusted to bear against the surface of the moistening roller and to provide the same by means of gravity flow with a uniform and constant film of the readily volatilizing solvent. A feed table or tray 13 is provided at the left side of the machine for introducing clear sheets to be moistened and to be printed onto, into the bight of the feed rollers, the printed sheets being discharged into a receiving tray 14. The conduit means between the solvent reservoir 7 and the moistening chamber 9, however, do not provide any direct communication but various controlling organs are arranged therebetween to obtain the desired regularity and positive control of the solvent flow. Thus, first of all, reservoir 7 having an outlet opening or port 19 is provided with a control valve 22. The tapering end of the control valve may be raised or lowered in the outlet opening of corresponding form by means of turning adjustment screw 23 whereby an accurate adjustment of the outflow of solvent from the reservoir may be readily obtained. The solvent released from the reservoir, however, is not introduced directly into the moistening container 9, but is subjected to a further positive control by means of rotary valve 17, which is intermittently actuated by means of a suitable part of the duplicating apparatus, as it will be more fully described hereinafter.

The rotary valve essentially comprises a valve body 15 which may be integrally formed with reservoir 7. Valve body 15 is provided with a tapering and horizontal bore adapted to take up the rotatable part 17 of the valve and forming a liquid-tight joint therewith. Rotatable part or member 17 is provided with four small and radially arranged chambers 18 which are independent from each other. Chambers 18 are constructed and arranged to successively register with inlet duct 19 communicating with the reservoir 7 and with outlet duct 20 in communication with at least in part flexible conduit 10 connected to the moistening container. Clearly, rotation of valve 17 continuously or intermittently will cause chambers 18 to be filled up one after the other with the readily volatilizing solvent discharged through adjustable valve 22 from the reservoir and to discharge this limited amount of solvent into conduit 10 after one half of a revolution of the valve.

To provide positive control of the rotary valve in accordance with the speed of operation of the duplicating machine, the rotary valve is provided with a spindle or rod 16 which is rotatably supported in an extension or bearing 15a, preferably integrally formed with the reservoir. A pin wheel 24 having 8 pins 25 uniformly distributed around the circumference thereof, is connected to the end of spindle 16, helical spring 26 provided at the other end of the spindle provides some pressure between the tapering walls of the valve body and valve member in order to ensure liquid-tight closure under all operating conditions. Pin wheel 24, and thus the rotary valve,

are actuated by means of a pair of pins 27, 28 arranged at diametrically opposite points on the side of the printing roller 1. In practice it has been found advisable to provide a plurality of fine air ducts 21 in the valve body to facilitate the escape of air trapped in chambers 18 because otherwise the quick filling and discharge of said chambers could not be satisfactorily accomplished.

The moistening container proper consisting of parts 9 and 9a is pivotally mounted in a pin or shaft 29 and a lever 30 connected thereto. A helical spring 31 having one of its ends connected to lever 30 and its other end connected to a stationary part of the machine provides a directional effect and presses the moistening container and the moistening felt 12 against moistening roller 5. A pivoted wiper 32 held by spring 33 bears against the surface of the moistening roller to collect lint, dust and dirt and to maintain the surface of the moistening roller clean. A similar wiper or drier comprising a felt pad 35, pivoted lever 36 and a spring 37 is provided for the counter moistening roller to completely absorb any excess moisture accumulating on the surface of the counter moistening roller due to its contact with the moistening roller at times when there is no copy sheet inserted therebetween, and to prevent the accidental and detrimental moistening of the back side of the copy sheet. With the same object in view it is preferred to provide the surface of the counter moistening roller with fine circular or spiral grooves (not shown). A shield 34 mounted on the top of the moistening container has the object of protecting the surface of the moistening roller from dust and from interference from the copyable mirror script original of which generally only the leading edge is secured to the circumference of the printing roller by means of clamp 3, while the other edge is left free.

From the preceding description, the operation of my improved duplicating machine will be readily understood by those skilled in the art. A clear copy sheet to be printed onto is introduced in between the bight of feed rollers 5 and 6 and the printing, counter pressure and feed rollers are set into rotation. Due to the rotary displacement of the rollers, the copy sheet will be successively passed through the bight of the feed rollers and through the bight of the printing and counter pressure rollers. During each rotation of printing roller 1, pins 27, 28 will engage two successive teeth or pins around the circumference of pin wheel 24 and will cause a rotation of the rotary valve by one quarter of a revolution. Thus, during each full revolution of the printing roller the rotary valve will be displaced by one quarter turn so that one of the chambers 18 will be brought into alignment with the discharge duct 20 and will discharge its contents, a predetermined and positively controlled amount of the readily volatilizing solvent. At the same time the opposite chamber 18 will be brought into alignment with the inlet or filling duct 19 communicating with the solvent reservoir 7 and will be filled with the solvent. Therefore, at any time during the operation of the machine, one of the chambers 18 is being filled, the next one is filled and ready for discharge, the third one is being discharged and the fourth one is completely empty. Of course, the amount of the solvent within each chamber is a completely definite and predetermined quantity which permits a positive control of the solvent fed to the moistening felt and roller with ar accuracy and precision heretofore unobtainable. For each revolution of the printing roller and thus for the printing of each single copy sheet an entirely fixed and limited amount of solvent is released from the container. A further controlling possibility is provided by means of adjustable control valve 22 which permits adjustment of the filling rate at which the individual chamber 18 are filled up from the reservoir. In the event the control valve is open to any substantial extent, all chambers are successively and completely filled up during the step by step rotation of the rotary valve. By means of the screw adjustment 23, of course, it is readily accomplished that the time during which each of the chambers is in alignment with the duct 19 is insufficient for completely filling the chambers so that only ¾ or ½ or even less of the volume of the chambers will be filled with the solvent and thus the amount of solvent discharged for each copy sheet will be diminished. This in turn provides further and increased accuracy of the solvent feed control and permits obtaining optimum and preferred operating conditions. Each rotation of the printing roller and of the moistening roller will release exactly the same amount of moisture into the moistening container. This uniform and positively controlled amount of moisture will be uniformly distributed around the circumference of the moistening roller 5 by means of moistening felt 12, so that both insufficient moistening and excessive moistening of the copy sheets with their obvious disadvantages are practically completely eliminated. The operation of wipers 32 and 36 and the advantages obtained thereby are obvious and will be readily understood by those skilled in the art without any further explanation.

It will be noted that the duplicating machine embodying the invention provides a number of important advantages. First of all, complete uniformity of the solvent distribution along the surface of the copy sheet is assured. Whether the duplicating machine is operated at a slow or at a high speed, for each copy sheet exactly the same positively controlled amount of solvent will be released. But not only the amount of solvent released per copy sheet may be easily maintained constant, it is also possible to adjust this elementary amount with the greatest facility and precision. The surprisingly excellent results and uniform moistening of the sheets are explained by the circumstance that the distribution of the solvent is already rather uniform in the moistening pad. Instead of directly transferring this moisture to the clear sheet, as this has been done heretofore in the conventional duplicating machines, the pad transfers the solvent to the surface of the moistening roller where the forces of adhesion between the solvent and the slightly porous surface of the moistening roller provide a further equalizing and adjusting or controlling effect. The completely uniform and regularly distributed moisture film of the moistening roller is now transferred by the combined effect of contact and pressure to the clear sheet, so that an extremely thin and uniform and delicately balanced layer or film of moisture will be provided on the clear sheet. From the above considerations it will be readily appreciated that the results obtained by means of my improved duplicating machine and novel moistening device are vastly superior to the results obtained by any of the conventional moistening devices embody-

ing moistening pads or moistening rollers alone, with or without the combination of capillary supply means.

It is also to be observed that my improved moistening device is of such character that it may be readily added to conventional duplicating machines of the copyable mirrorscript original type without requiring any substantial structural changes, so that the imperfect and inconvenient old machines may be easily converted into my novel and improved duplicating machine.

Moreover, my moistening device does not leave any unmoistened margin on the leading edge of the copy sheet. The solvent is completely enclosed in the reservoir and the moistening chamber so that excessive evaporation, unpleasant odors and fire hazards are completely eliminated.

Furthermore, my novel moistening device is extremely simple in construction, easy and foolproof in operation and may be manufactured on a practical and commercial scale at a low price.

Although I have described my invention 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. I consider all of these variations and modifications as within the true spirit and scope of the present invention as disclosed in the present description and defined by the appended claims.

I claim:

1. In a spirit duplicating machine having cooperating printing and counter pressure rollers, a pair of combination feed and moistening rollers located in front of the bight of said rollers, and a moistening felt bearing against the surface of said moistening roller, solvent supplying means for said machine; said solvent supplying means comprising in combination a reservoir for a readily volatilizing solvent, conduit means for feeding said solvent to said moistening felt, rotary valve means in said conduit means adapted to release a positively controlled unitary amount of solvent for each copy sheet to be printed, and means for actuating said rotary valve means in accordance with the rate of operation of the duplicating machine.

2. In a spirit duplicating machine having cooperating printing and counter pressure rollers, a pair of combination feed and moistening rollers, and a moistening felt bearing against the surface of said moistening roller; solvent supplying means for said machine, said solvent supplying means comprising in combination a reservoir for a readily volatilizing solvent, conduit means for feeding said solvent to said moistening felt, a rotary valve associated with said reservoir and adapted to be rotated to release positively controlled quantities of solvent for each rotation thereof, and means for rotating said valve in accordance with the rotation of said printing roller.

3. In a spirit duplicating machine having cooperating printing and counter pressure rollers, a pair of combination feed and moistening rollers and a moistening felt bearing against the surface of said moistening roller; solvent supplying means for said machine, said solvent supplying means comprising in combination a reservoir for a readily volatilizing solvent, conduit means for feeding said solvent to said moistening felt, a rotary valve operatively associated with said reservoir adapted to release a unitary amount of solvent for each copy sheet to be printed, means for controlling the quantity of said unitary amount, and means for periodically actuating said rotary valve in accordance with the rate of operation of said duplicating machine.

4. In a spirit duplicating machine having cooperating printing and counter pressure rollers, a slightly absorbent and elastic moistening roller, a non-porous and highly polished counter moistening roller, and a moistening felt bearing against the surface of said moistening roller; solvent supplying means for said machine, said solvent supplying means comprising in combination a reservoir for a readily volatilizing solvent, conduit means for feeding said solvent to said moistening felt, a rotary valve operatively associated with said reservoir adapted to release a unitary amount of solvent for each copy sheet to be printed, an adjustable pin valve for adjusting said unitary amount, and means for actuating said rotary valve in accordance with the rotation of said printing roller.

5. In a spirit duplicating machine having cooperating printing and counter pressure rollers, a slightly absorbent and elastic moistening roller, a non-porous and highly polished counter moistening roller, and a moistening felt bearing against the surface of said moistening roller; solvent supplying means for said machine, said solvent supplying means comprising in combination a reservoir for a readily volatilizing solvent, a rotary valve having a stationary portion communicating with said reservoir, a rotary portion for said valve, a plurality of chambers in said rotary portion adapted to be successively filled with solvent and to be discharged when said valve is rotated, conduit means between said valve and said moistening felt, and means actuated by rotation of said printing roller for rotating said valve chambers and to cause periodical discharge of solvent into said conduit means.

6. In a spirit duplicating machine having cooperating printing and counter pressure rollers, a pair of combination feed and moistening rollers, and a moistening felt bearing against the surface of said moistening roller; solvent supplying means for said machine, said solvent supplying means comprising in combination a reservoir for a readily volatilizing solvent, a rotary valve having a stationary body portion, a charging duct in said reservoir in communication with said body portion, a rotary portion for said valve, a plurality of radially arranged chambers in said rotary portion, a discharge duct in said valve body portion, a conduit connected between said discharge duct and said moistening felt, said rotary valve portion being adapted to be displaced step by step to successively bring said chambers in registering position with said charging and discharge ducts to cause the periodical discharge of unitary amounts of solvent into said conduit, and means actuated by rotation of said printing roller for causing step by step rotation of said rotary valve.

7. In a spirit duplicating machine having cooperating printing and counter pressure rollers, a pair of combination feed and moistening rollers, and a moistening felt bearing against the surface of said moistening rollers; solvent supplying means for said machine, said solvent supplying means comprising in combination a reservoir for a readily volatilizing solvent, a rotary valve having a stationary portion communicating with said reservoir, a rotary portion for said valve, a plurality of chambers in said rotary portion adapted

to be successively filled with the solvent and to be discharged when said valve is rotated, conduit means between said valve and said moistening felt, a pin wheel connected to said rotary valve, and pins located on the side of said printing roller capable of engaging said pin wheel and of actuating said valve when said printing roller is rotated.

8. In a spirit duplicating machine having co-operating printing and counter pressure rollers, a pair of combination feed and moistening rollers, and a moistening felt bearing against the surface of said moistening roller; solvent supplying means for said machine, said solvent supplying means comprising in combination a reservoir for a readily volatilizing solvent, a rotary valve having a stationary body portion, a charging duct in said reservoir in communication with said body portion, valve means for controlling the passage of solvent through said charging duct, a rotary portion for said valve, a plurality of radially arranged chambers in said rotary portion adapted to be successively filled with solvent and to be discharged when said valve is rotated, conduit means between said valve and said moistening felt, and means actuated by rotation of said prining roller for rotating said valve chambers and to cause periodical discharge of solvent into said conduit means.

9. In a spirit duplicating machine having co-operating printing and counter pressure rollers, a pair of combination feed and moistening rollers, and a wiper for said moistening roller; solvent supplying means for said machine, said solvent supplying means comprising in combination a moistening felt bearing against the surface of one of said feed and moistening rollers, a reservoir for a readily volatilizing solvent, conduit means for feeding said solvent to said moistening felt by means of gravitational action, rotary valve means in said conduit means adapted to release a positively controlled unitary amount of solvent for each copy sheet to be printed, and means for actuating said valve means in accordance with the rate of operation of the duplicating machine.

10. In a spirit duplicating machine having co-operating printing and counter pressure rollers; sheet moistening means dispensing a readily volatilizing solvent; solvent supplying means for said sheet moistening means, said solvent supplying means comprising in combination a reservoir for said solvent located at a level higher than said moistening means, conduit means in between said reservoir and said moistening means, a rotary valve in said conduit adapted to release a unitary amount of solvent for each copy sheet to be printed, and means for periodically actuating said valve in accordance with the rate of operation of said duplicating machine.

11. In a spirit duplicating machine having co-operating printing and counter pressure rollers and a pair of combination feed and moistening rollers; a solvent feed device for said moistening roller, said feed device comprising in combination a reservoir located at a level higher than said rollers, a downwardly inclined moistening felt located at a level lower than said reservoir and bearing against the surface of said moistening roller to supply solvent thereto exclusively by means of gravitational action, conduit means between said reservoir and said moistening felt, valve means for controlling the flow of solvent through said conduit means, and means for actuating said valve means in accordance with the rate of operation of the duplicating machine.

EGIDIO MARIA BENELLO.