

May 15, 1956

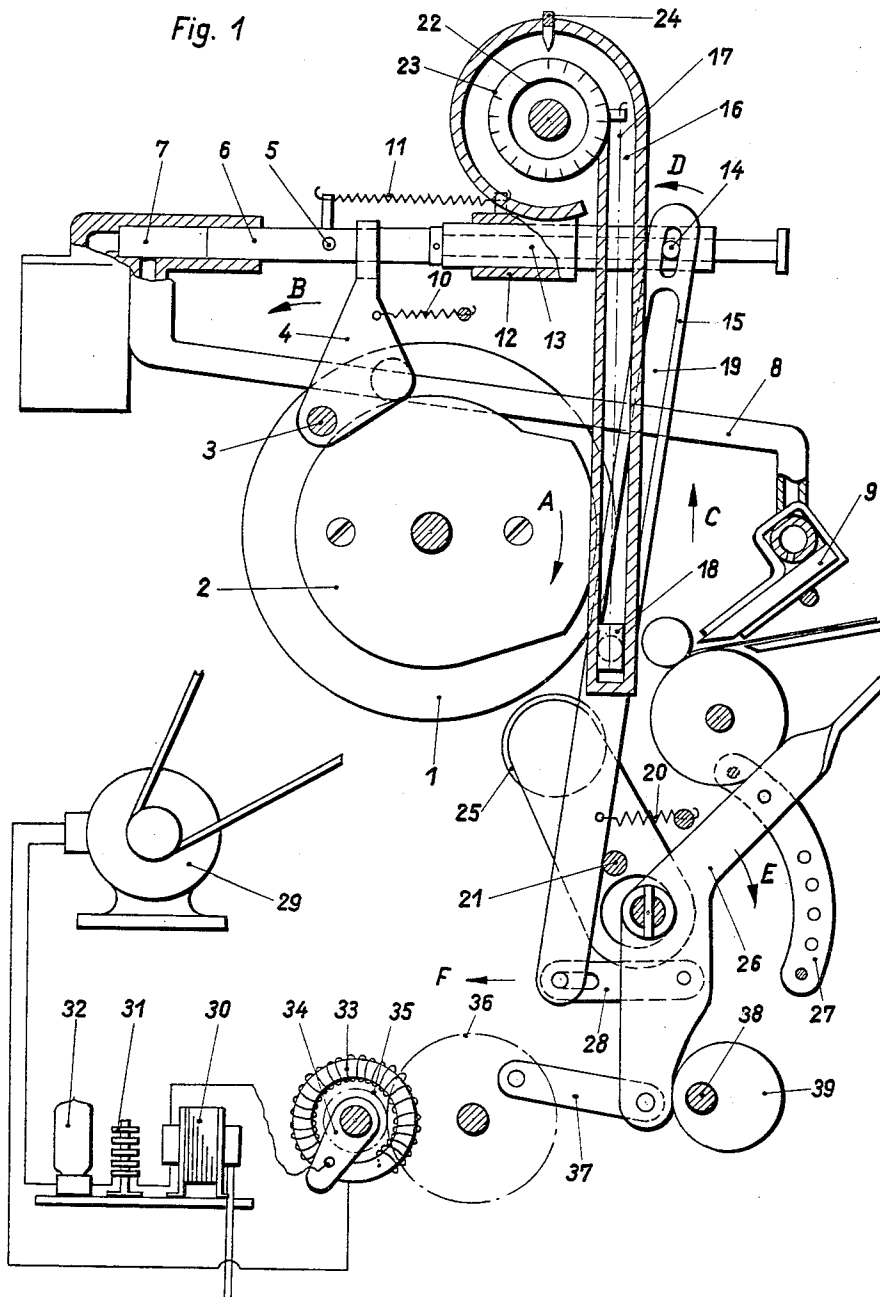
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2,745,340

MOISTURE CONTROL DEVICE FOR ROTARY DUPLICATING MACHINES

Filed Jan. 16, 1952

4 Sheets-Sheet 1



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4 Sheets-Sheet 2

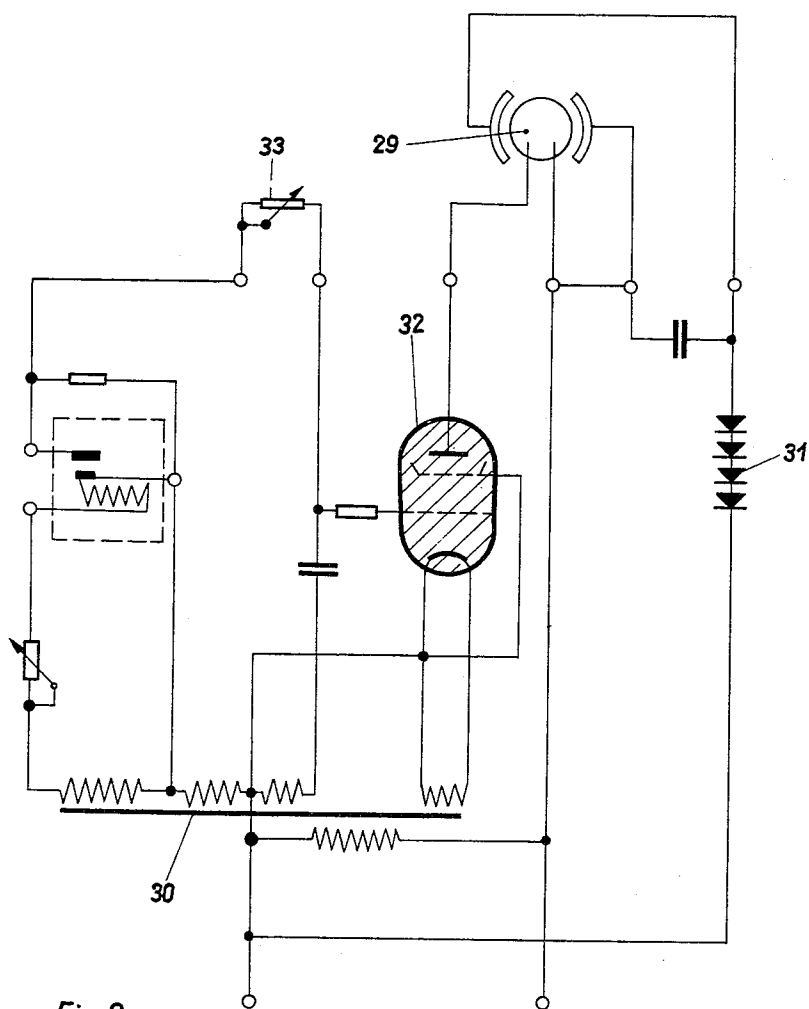


Fig. 2

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4 Sheets-Sheet 3

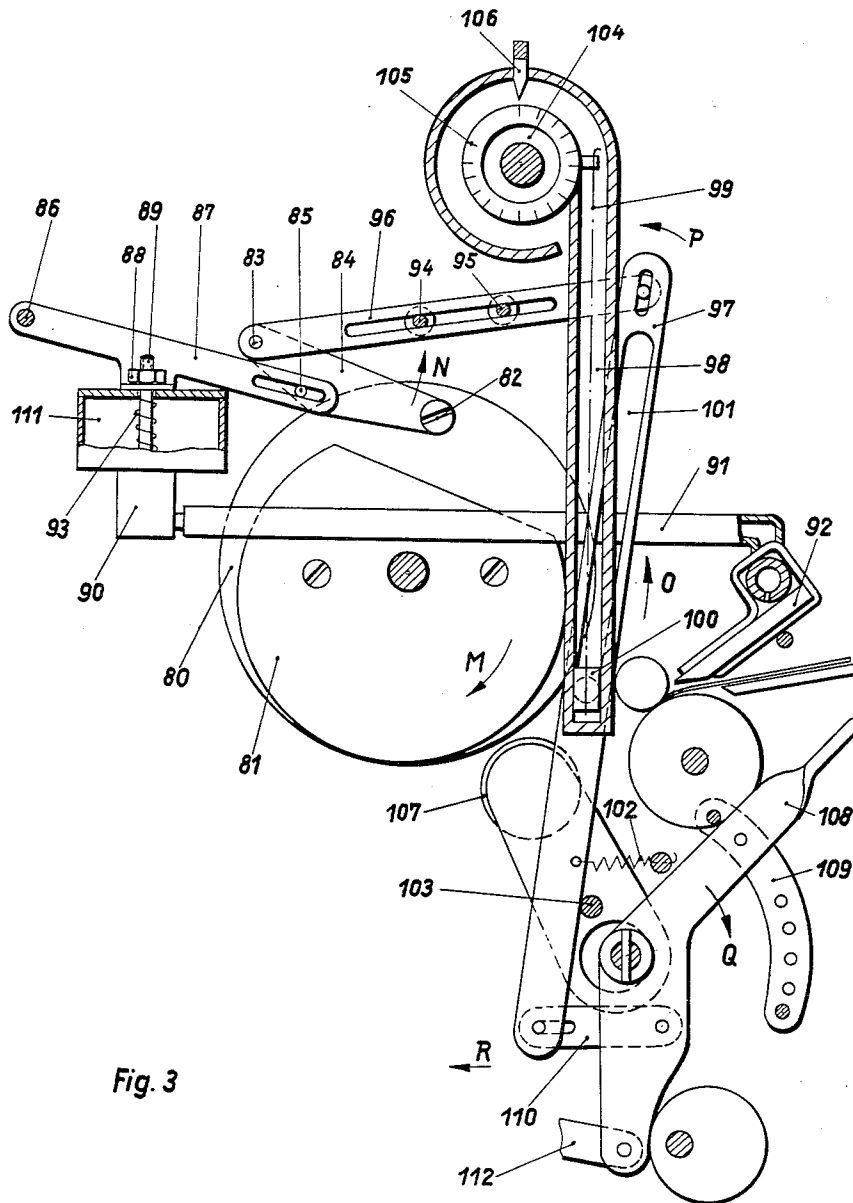


Fig. 3

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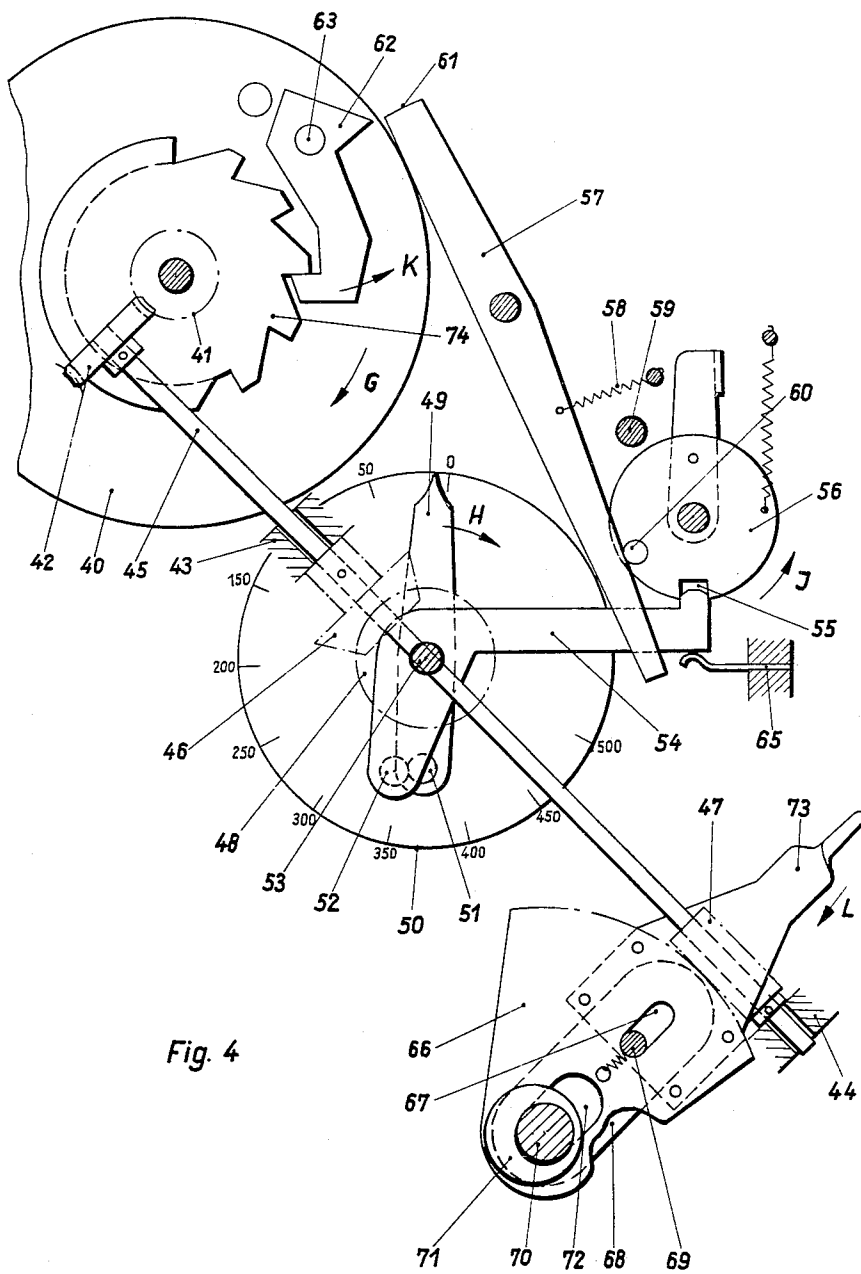
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MOISTURE CONTROL DEVICE FOR ROTARY DUPLICATING MACHINES

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4 Sheets-Sheet 4



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2,745,340

MOISTURE CONTROL DEVICE FOR ROTARY DUPLICATING MACHINES

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Claims priority, application Germany January 22, 1951

12 Claims. (Cl. 101—132.5)

The invention relates to rotary duplicating machines for printing from mirror-script originals capable of being reproduced on sheets (hereinafter called "copy sheets") which have to be moistened by a moistening device, and more especially to such rotary duplicating machines which afford an adjustable printing pressure for the printing elements and comprise a device for feeding a liquid to the moistening device from a storage container or the like. Known rotary duplicating machines of this kind require, with an increasing number of copies made, an increase of the printing pressure and an increase of the amount of liquid in order to enable obtaining a greater number of prints from the hectographic mirror-print original. With known machines of this kind, the control of the printing pressure was independent of the control of the feed of liquid to the moistening device. Both parts of the machine had separately to be adjusted at short intervals during the operation, whereby mistakes in the operation were caused, and bad or imperfect copies, or even considerable spoiling of the original, resulted. Since the operating conditions of the machines often change, this was a disadvantage in connection with duplicating machines employing a moistening liquid.

With a view to avoiding or at least mitigating these disadvantages, the invention consists in a rotary duplicating machine for printing from mirror-script originals capable of being reproduced on sheets which have to be moistened by a moistening device, characterized by an operative connection between a mechanism for adjusting the printing pressure and a mechanism for adjusting the feed of liquid to the moistening device. There may be provided an eccentric device for increasing the pressure exerted by a counter roller against the printing drum, an adjusting device for determining the stroke of the piston of a pump for the liquid, and a lever arrangement for jointly adjusting the efficiency of the counter roller and of the pump for the liquid. Alternatively, there may be provided an eccentric device for increasing the pressure exerted by a counter roller against the printing drum, an adjusting device for determining the opening of a valve or valves for the feed of the liquid, and a lever arrangement for jointly adjusting the efficiency of the counter roller and the valve or valves. Owing to the operative connection, it is possible, in a single operation, to increase the printing pressure as well as the amount of liquid by predetermined amounts after predetermined numbers of copies have been made. Thereby, the danger of damaging or spoiling of the mirror-script originals by moistening in excess due to errors is excluded or, at least, reduced.

According to a further refinement of the invention, a counting device actuatable by the printing drum of the machine, for example over a worm and worm wheel, is provided, the counting device being arranged for automatically effecting the adjustment of the printing pressure and of the feed of the liquid, for example by means of a further worm and worm wheel, in dependence on the number of rotations performed by the printing drum. The counting device may be a predetermined counter

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operatively connected to a blocking pawl of a single-stroke coupling, the arrangement being such that the counting device, after reaching a predetermined count arrests the printing drum by releasing the blocking pawl of the single-stroke coupling.

A further improvement of the rotary duplicating machine consists in the provision of a device, for example an electronic control device or a device comprising a control resistor, for controlling the speed of printing. Especially the provision of an electronic control device has the advantage that a control effect may be obtained within a wide range of control without any substantial loss of power of the motor. To this end, the control device may comprise a thyatron valve, a selenium rectifier, a transformer, and one or more variable resistors for controlling the armature current of a direct current motor for driving the printing drum. A lever connection may be provided between an adjusting mechanism for the printing pressure and the device for controlling the speed. A control of the number of rotations of the direct current motor is effected on converting an alternating current of a main supply into a direct current while differentially clipping the peaks of the alternating current. For performing the control, the armature current of the direct current motor is controlled. The electronic control in connection with a duplicating machine using a moistening liquid has many advantages over hitherto known mechanical control devices and control devices comprising resistors. The electronic control device may operate without noise, without substantial loss of power, and is highly effective; moreover, by the possibility of controlling the speed with increasing number of copies obtained from the original, the possibility of utilizing the original is essentially increased since the printing speed is reduced by the alternation of the number of revolutions per unit of time and the moistened areas of the copy sheets to be printed remain in contact with the original for a longer time and thereby exhaust the original to a greater extent even after it has already extensively been used.

Preferably, the electronic control device, if provided, is also coupled with the printing mechanism or with the counting mechanism respectively. The rotary duplicating machine in its preferred construction may operate completely automatically it being only necessary to set the machine to the number of copies required after which the machine is started. The entire subsequent operation is taken over by the mechanism of the machine, if the machine is provided with means for automatically feeding the copy sheets to the machine.

The invention also consists in a rotary duplicating machine using a liquid for moistening copy sheets, comprising an electronic control device.

To make the invention clearly understood reference will now be made to the accompanying drawings, which are given by way of example and in which:

Fig. 1 is a side view of a rotary duplicating machine comprising a pump for the control of the feed of the liquid, and means for controlling the printing speed;

Fig. 2 is a circuit diagram of an arrangement for controlling the number of revolutions per unit of time of a motor for driving the printing drum;

Fig. 3 is a side view of a rotary duplicating machine comprising a valve for controlling the feed of the liquid; and

Fig. 4 is a side view of a device for automatically controlling the printing process, and of a switching-off device for arresting the printing drum.

In Fig. 1, a printing drum 1 is rigidly connected to cam 2 for operating a moistening device and rotated, in operation, in the direction of the arrow A. A forked lever 4 tiltable around a shaft 3 is rotated by the cam 2 in the direction of the arrow B, and presses, by means of a pin

5, a piston 6 of a pump into a cylinder 7, whereby a moistening liquid contained therein flows through a feed pipe 8 onto a moistening felt 9 of a moistening device. A spring 10 returns the forked lever 4 after it has left the region of greatest radius of the cam 2 into its initial position. Thereby, the piston 6 of the pump is brought by a spring 11 into abutment against an adjusting tube 13 displaceable in a sleeve 12 fixed relatively to the frame of the machine. By means of a pin 14, the adjusting tube 13 is retained by a lever 15 in a position set for each case. Thereby, the stroke of the piston 6 and the amount of the liquid fed is set. The adjustment of the lever 15 may be effected manually as well as simultaneously with the adjustment of the printing pressure. On manual adjustment, a slidable member 18 is displaced in a slot 19 of the lever 15 by means of a chain 17 guided in a fixed groove 16. The groove 16 is inclined relative to the slot 19 and thereby causes the lever 15, which is pulled by a spring 20 against an abutment stud 21, to rotate around the latter in the direction of the arrow D when the slidable member 18 is displaced in the direction of the arrow C. The adjusting tube 13 is forced to participate in such rotation and presses the piston 6 of the pump more deeply into the cylinder 7 of the pump whereby the distance between the pin 5 and the forked lever 4 is increased. The forked lever 4 is tilted through a total tilting angle that remains constant, but engages pin 5 only during movement through a smaller part of said angle. Correspondingly, the fed amount of liquid is smaller. On a hand wheel 22, on which the chain 17 is wound, a scale 23 is provided which, in conjunction with a fixed index mark 24, enables the amount of the liquid which is fed to be read off. The increase of the printing pressure by means of a counter roller 25 is effected over a manually operable lever 26 and requires an increased feed of the liquid. The manually operable lever 26 is tiltable in the direction of the arrow E and is fixed in a selected position by a notched segment 27 fixed in position. With the displacement of the lever 26, a lug 28 is displaced in the direction of the arrow F and now replaces the abutment 21. The displacement of the lug 28 in the direction of the arrow F, however, enables the lever 15 to tilt against the direction of the arrow D around its slideable member 18. Thereby the adjusting tube 13 is displaced against the direction of the arrow D. The spring 11 pulls the piston 6 of the pump, whereby the distance between the pin 5 and the forked lever 4 is also decreased in a step-by-step manner according to the adjusted printing pressure. The piston 6 of the pump, thus, is in the maximal extreme case displaced during the entire tilting movement of the forked lever 4 and correspondingly the amount of the liquid fed has also a maximal value.

Furthermore, an increase of the printing pressure requires a reduction of the number of rotations per unit of time of the printing drum 1. This is achieved by the varying of the number of rotations per unit of time of a motor 29 driving the printing drum 1. The number of rotations per unit of time of the motor 29 is dependent on its armature current and field current, which currents are controlled by an arrangement, the main elements of which are a transformer 30 (see also Fig. 2), a rectifier 31, and a thyatron valve 32. A variable resistor 33, whose tapping arm 34 is coupled to toothed wheels 35, 36 and over a lug 37 to the lever 26 determines the current flowing through the arrangement, the circuit diagram of which is shown in Fig. 2.

An eccentric 39 rotatable around a shaft 38 can, in connection with the printing drum 1, automatically tilt the lever 26 in the direction of the arrow E and thereby increase the printing pressure in dependence on the rotations of the printing drum.

In Fig. 3, a printing drum 80 rigidly connected to a cam 81 for operating a moistening device rotates in direction of the arrow M, whereby the cam 81 rotates a roller 82 of an angular lever 84 tiltable around a shaft 83 in the direction of the arrow N. With a pin 85, a valve

lifter 87 mounted on a shaft 86 is also tilted in the direction of the arrow N and, by means of a nut 88, a valve rod 89 is lifted. Thereby, the outlet orifice in a valve chamber 90 is opened, and the liquid flows through a feed pipe 91 onto a moistening felt 92 of the moistening device. When the roller 82 has left the cam 81, a tension spring 93 returns the elements into their initial position.

In order to alter the flow times, and thereby to feed differently great amounts of liquid to the felt 92, the path of the roller 82 on the cam 81 is increased or shortened. To this end, the shaft 83 is displaced in such a manner that the pin 85 becomes the centre of rotation of the angular lever 84, whereby the roller 82 is tilted in the direction of the arrow N away from the cam 82 or against the direction of the arrow N towards the cam 82. The first movement is used for reducing the amount of liquid fed, the latter for increasing it. The position of the shaft 83 is determined by the lever 97 over a lug 96 rectilinearly guided by upstanding studs 94 and 95. The adjustment of the lever 97 can be effected manually as well as simultaneously with the adjustment of the printing pressure. On manual adjustment, a slidable member 100 is displaced in a slot 101 of the lever 97 by means of a chain 99 guided in a groove 98 fixed in position. The inclined position of the groove 98 relative to the slot 101 causes the lever 97, which is drawn by a spring 102 against an abutment stud 103 to tilt around the latter in the direction of the arrow P on displacement of the slidable member 100 in the direction of the arrow O, while the displacement referred to above of the lug 96 takes place. On a hand wheel 104, on which the chain 99 is wound, a scale 105 is fixed which, in conjunction with a fixed index mark 106 affords a possibility of reading off the fed amount of liquid. The increase of the printing pressure of a counter roller 107 is effected over a manually operable lever 108 and requires the feed of a greater amount of liquid. The lever 108 is tilted in a direction of the arrow Q and is kept in a set position by a notched segment 109 fixed in position. With this displacement, a lug 110 is displaced in the direction of the arrow R and replaces the abutment stud 103. However, the displacement of the lug 110 in the direction of the arrow R causes the lever 97 to tilt against the direction of the arrow P around its slidable member 100, whereby also the lug 96 is pulled against the direction of the arrow P. Thereby, the angular lever 84 rotates around its pin 85 and penetrates more deeply into the curved path of the cam 81, the roller 82 being lifted by the cam 81 during a greater distance, the flow time and therewith the amount of liquid flowing out of a storage container 111 becomes greater.

The reduction of the number of rotations per unit of time of the printing drum 80 on increasing printing pressure of the counter roller 107 is achieved over the lug 112 by displacing the lever 108 as has already been described with reference to Fig. 1.

In Fig. 4, a printing drum 40 rotates in the direction of the arrow G together with a worm 41 rigidly connected thereto, and thereby drives a toothed worm wheel 42 and a shaft 45 mounted in bearings 43 and 44 together with its conical wheel 46 and its worm 47. By means of a conical wheel 48, driven by the conical wheel 46, a pointer 49 is rotated in the direction of the arrow H, the pointer having been preset on a scale 50 to a desired number of copy sheets. Before reaching a zero position, a pin 51 of the pointer 49 engages an abutment 52 on a pawl 54 tiltable around a shaft 53 of the conical wheel 48, the pawl being lifted out of recess 55 of a blocking disc 56 when the pointer 49 reaches its zero position. A release member 57 is pulley by a spring 58 in the direction of the arrow J towards an abutment 59 and abuts against the pin 60 of the blocking disc 56. Release member 57 enters with its own abutment edge 61 into the path of a pawl 62 when blocking disc 56 is released by member 54 and rotates due to spring 56' to a position

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in which pin 60 releases member 57. When pawl 62 reaches the abutment edge 61, it is tilted around a shaft 63 fixed on the printing drum 40 in the direction of the arrow K and is thus drawn out of engagement with a permanently rotating ratchet wheel 74. A spring 65 always urges the pawl 54 against the blocking disc 56.

During the rotation of the shaft 45, the worm 47 drives a toothed segment 66, which by means of its elongated hole 67 carries with it a pin 69 fixed on a lever 68. The lever 68 is fixed on a rotatable shaft 70 to which also an eccentric 71 is keyed which corresponds to member 39 in Fig. 1. The eccentric 71 serves for controlling the printing pressure of a counter roller, which may be a rubber roller, against the printing drum 40. An elongated hole 72 and the elongated hole 67 of the toothed segment 66 enable a manual displacement of the eccentric 71 by displacing a handle 73 in the direction of the arrow L, whereby the toothed segment 66 is disengaged.

What we claim is:

1. In a rotary duplicating machine, in combination, a rotary printing drum member; a pressure member for pressing sheets against said printing drum member; adjusting means connected to one of said last mentioned members for adjusting the printing pressure; a counting device connected to said printing drum member and counting turning movements of the same for counting the number of sheets printed; and motion transmitting means connecting said counting device with said adjusting means in such manner that the printing pressure is increased in accordance with the number of turning movements of said drum member counted by said counting device, and thereby in accordance with the number of printed sheets.

2. In a rotary duplicating machine, in combination, moistening means for moistening sheets to be printed; supply means for supplying a liquid to said moistening means; control means for controlling the amount of liquid supplied by said supply means to said moistening means; a rotary printing drum member; a pressure member for pressing sheets against said printing drum member; adjusting means connected to one of said last mentioned members for adjusting the printing pressure; a counting device connected to said printing drum member and counting turning movements of the same for counting the number of sheets printed; first motion transmitting means connecting said counting device with said adjusting means in such manner that the printing pressure is increased in accordance with the number of turning movements of said drum member counted by said counting device; and second motion transmitting means connecting said adjusting means with said control means in such manner that the amount of liquid supplied to said moistening means is increased in accordance with an increase of the printing pressure, and thereby in accordance with the number of printed sheets.

3. In a rotary duplicating machine, in combination, a rotary printing drum member; a pressure member for pressing sheets against said printing drum member; adjusting means connected to one of said last mentioned members for adjusting the printing pressure; drive means for rotating said printing drum member; regulating means for regulating the rotary speed of said drive means and thereby the rotary speed of said drum member; motion transmitting means connecting said adjusting means with said regulating means in such manner that the rotary speeds of said drive means and of said drum member are decreased in accordance with an increase of the printing pressure; and operating means for operation of said motion transmitting means for simultaneous regulation of the rotary speed of said drum member and of the printing pressure.

4. In a rotary duplicating machine, in combination, moistening means for moistening sheets to be printed; supply means for supplying a liquid to said moistening means; control means for controlling the amount of liq-

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uid supplied by said supply means to said moistening means; a rotary printing drum member; a pressure member for pressing sheets against said printing drum member; adjusting means connected to one of said last mentioned members for adjusting the printing pressure; drive means for rotating said printing drum member; regulating means for regulating the rotary speed of said drive means and thereby the rotary speed of said drum member; first motion transmitting means connecting said adjusting means with said regulating means in such manner that the rotary speed of said drum member is decreased in accordance with an increase of the printing pressure; second motion transmitting means connecting said adjusting means with said control means in such manner that the amount of liquid supplied to said moistening means is increased in accordance with an increase of the printing pressure; and operating means connected to said first and second motion transmitting means to actuate the same for simultaneous regulation of the rotary speed of said drum member, of the printing pressure, and of the amount of liquid supplied to the moistening means.

5. In a rotary duplication machine, in combination, moistening means for moistening sheets to be printed; pump means including cylinder means and piston means for supplying a liquid to said moistening means; control means for adjusting the stroke of said piston means for varying between different amounts the amount of liquid supplied by said pump means to said moistening means for a printing operation; a rotary printing drum member; a pressure member for pressing sheets against said printing drum member; an operating lever; a link connecting said operating lever with said pressure member; and a lever system connecting said operating lever with said control means for operating the same depending on the printing pressure of said pressure member in such manner that the amount of supplied liquid is increased to correspond to increased printing pressure.

6. An arrangement as claimed in claim 5 including a cam rotating with said drum member; a pivoted actuating member actuated by said cam to perform a rocking movement; a pin secured to said piston means and located in the path of said rocking member so that said piston means is moved when said rocking member engages said pin; and wherein said control means include means for adjusting the position of said piston means and of said pin with respect to said actuating member so that said pin may be engaged by said actuating member only during part of the rocking movement of the same for reducing the stroke of said piston means.

7. In a rotary duplicating machine, in combination, moistening means for moistening sheets to be printed; pump means including a cylinder means and piston means for supplying a liquid to said moistening means; a piston rod fixed to said piston means; a stop fixed on said piston rod; an adjustable stop means cooperating with said abutment; a lever means pivotally connected to said abutment means for adjusting the position of the same; an operating lever; a link means connecting said operating lever with said lever means so that the position of said abutment means is adjusted when said operating lever is operated; a rotary printing drum member; a pressure member for pressing sheets against said printing drum member; a link connecting said pressure member with said operating lever; a pin fixed on said piston rod; a rocking actuating member engaging during movement thereof said pin for moving said piston means whereby the amount of supplied liquid is adjusted in accordance with the printing pressure by the shifting of the position of said abutment means so that said pin is engaged by said rocking actuating member only during part of said rocking movement of the same, whereby the piston stroke is adjusted.

8. In a rotary duplicating machine, in combination, a rotary printing drum member; a pressure member for pressing sheets against said printing drum member; an operating lever; link means connecting said operating lever

with said pressure member; a rotary cam means engaging said operating lever for actuating the same; a reducing transmission connecting said rotary drum member with said rotary cam means in such manner that said cam means makes one revolution for a predetermined number of revolutions of said rotary printing drum member whereby the printing pressure is adjusted due to the operation of said operating lever by said cam means in accordance with the number of sheets printed by said drum member.

9. In a rotary duplicating machine, in combination, a rotary printing drum member; a pressure member for pressing sheets against said printing drum member; adjusting means connected to one of said last mentioned members for adjusting the printing pressure; electric motor means for rotating said printing drum member; regulating means for regulating the rotary speed of said electric motor means and thereby the rotary speed of said drum member, said regulating means including variable resistor means associated with said electric motor means; motion transmitting means connecting said adjusting means with said regulating means in such manner that the rotary speeds of said motor means and of said drum member are decreased in accordance with an increase of the printing pressure; and operating means for operation of said motion transmitting means for simultaneous regulation of the rotary speed of said drum member and of the printing pressure.

10. An arrangement as claimed in claim 3 wherein said drive means is a direct current motor means, and wherein said regulating means include a thyatron tube; a selenium rectifier; a transformer; and at least one variable resistor for controlling the field current of said motor means.

11. In a rotary duplicating machine, in combination, moistening means for moistening sheets to be printed; variable feed pump means for supplying a liquid to said moistening means, said pump means including a movable element movable between a plurality of positions for varying the output of said pump means for varying between different amounts the amount of liquid supplied by said pump means to said moistening means for a printing operation; a rotary printing drum member; a pressure member for pressing sheets against said printing drum mem-

ber; adjusting means connected to one of said last-mentioned members and being movable between a plurality of operative positions for adjusting the printing pressure for a printing operation; operating means connected to said adjusting means and being movable between a plurality of positions for moving said adjusting means between said operative positions of the same; and motion-transmitting means connecting said operating means with said movable element of said pump means for moving said element between said positions of the same for simultaneous adjustment of the amount of liquid supplied to said moistening means and of the printing pressure in such a manner that the amount of supplied liquid is increased to correspond to increased printing pressure.

12. In a rotary duplicating machine, in combination, moistening means for moistening sheets to be printed; supply means for supplying a liquid to said moistening means; valve means including a valve opening member movable through a stroke including a plurality of positions of said valve opening member for varying between different amounts the amount of liquid supplied by said supply means to said moistening means for a printing operation; a rotary printing drum member; a pressure member for pressing sheets against said printing drum member; an operating member; a link connecting said operating member with said pressure member; and a lever system connecting said operating member with said movable valve opening member for operating the same between said positions depending upon the printing pressure of said pressure member in such a manner that the amount of supplied liquid is increased to correspond to increased printing pressure.

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