Jan. 3, 1961 R. R. LAUPMAN 2,966,844

AUTOMATIC PRINTING PASTE FEED CONTROLLING DEVICE

Filed May 28, 1956

Fig. 1

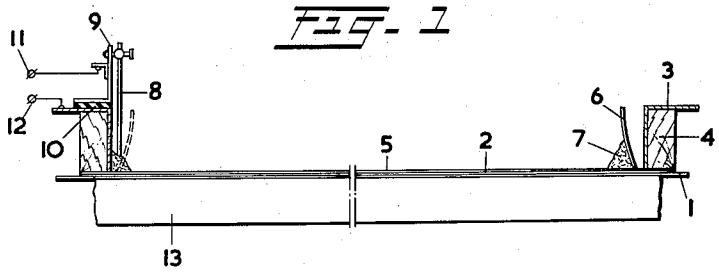


Fig. 2

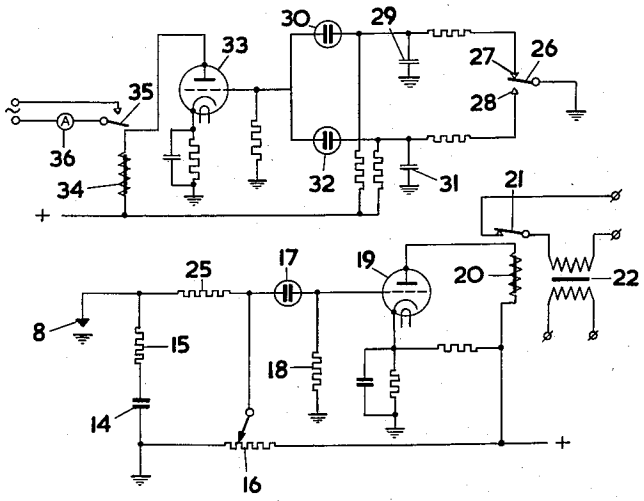
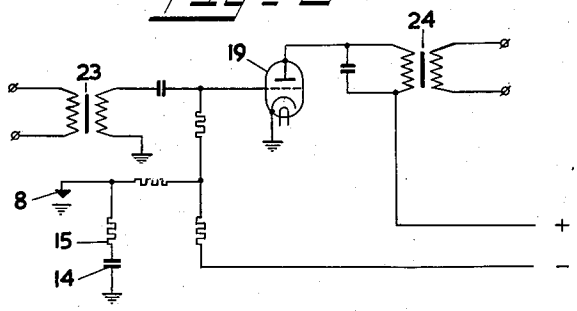


Fig. 3



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AUTOMATIC PRINTING PASTE FEED CONTROLLING DEVICE

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This invention relates to an apparatus for screen printing webs of cloth, which apparatus comprises a plurality of stencil frames each having a reciprocatory squeegee in superposed relationship therewith and more particularly to an automatic printing paste feed controlling device for use in an apparatus of this type.

Though in printing apparatuses of the above type the majority of the manipulations to be performed has been automatized, the feeding of the printing paste is still effected manually. The drawback attaching thereto is that owing to a slight inattention of the person controlling the printing paste feed, fluctuations in said feed may occur, so that e.g. too little printing paste is supplied to the stencil frames, which has for its result that the cloth is not correctly printed, or too much printing paste is supplied which may result in an overflow of said paste. In either case an incorrect control of the feed will lead to a large waste of the webs of cloth to be printed.

Now the object of the invention is to eliminate this drawback.

In order to accomplish this object of the invention a feeler is provided at the end of each stencil frame, which end corresponds with the end of the forward stroke of the squeegee, which feeler when cooperating with the printing paste dammed up by the squeegee at said end will close a circuit energizing a servo-mechanism that controls the feed of the printing paste to the relative stencil frame. In such a construction the printing paste feed is a function of the level to which the printing paste is dammed up and the time.

According to the invention the feeler may comprise a pin which if desired may be adjustable and which is insulated from the earthed frame of the apparatus and is connected with the one plate of a condenser belonging to the servo mechanism, the other plate of which condenser is earthed, said first plate being also connected via a glow discharge tube with a grid of an electron discharge tube in whose anode circuit the winding of a relay is included, which relay controls the operation of a printing paste feeding device.

It is also possible to construct the controlling device without any mechanical parts, such as a relay. In said case the feeler may comprise a pin which, if desired, may be adjustable and which is insulated from the earthed frame of the apparatus and is connected with the one plate of a condenser belonging to the servo mechanism, the other plate of which condenser is earthed, said first plate being also directly connected with a grid of an electron discharge tube, which grid is furthermore connected with the negative terminal of a D.C. source and with an A.C. source, a winding of a transformer being included in the anode circuit of the tube, which transformer is directly coupled with a printing paste feeding device.

Experience has shown that in such an automatic feed controlling device some undesirable conditions may present themselves; in the first place it is possible, namely, that at a given moment the printing paste reservoir is

empty, so that printing paste is no longer fed to the stencil frames and a printing of the webs of cloth takes place no longer, while in the second place it is possible that the control valve in the printing paste feed line does not function properly, so that either too much printing paste is fed to the stencils or the feed is entirely interrupted. Notwithstanding the correct operation of the feed controlling device these conditions may present themselves.

In the third place it may happen that for some or other reason the feed controlling device does not trip.

The invention therefore furthermore provides a device for checking and indicating such an undesirable condition.

To this end the apparatus according to the invention is furthermore provided with a relay coupled with the controlling device to be checked which relay comprises a change-over contact system, the movable contact of which is earthed, while each stationary contact is connected respectively with the one plate of a condenser whose other plate is earthed, said first plate being connected both with the non-earthed terminal of a voltage source and with an electrode of a glow discharge tube, the other electrodes of two glow discharge tubes being connected with each other and with the grid of an electron discharge tube in whose anode circuit a relay is included, the contact of which relay in the non-energized condition of the relay closes a circuit of an alarm device, which circuit extends through a voltage source.

The invention will be illustrated hereinafter with reference to the accompanying drawing in which:

Figure 1 is a section of a stencil frame and of an associated squeegee, which frame is provided with a feeler according to the invention;

Figure 2 is a circuit diagram of the controlling device according to the invention, which comprises a relay and in which in addition the checking and alarm device according to the invention is indicated and

Figure 3 is a circuit diagram of a truly electronically operating controlling device according to the invention.

In Figure 1 a conveyor belt **1** on which the web of cloth **2** to be printed is provided, is located above the frame **13** of the printing apparatus. Over said web of cloth **2** there is a stencil frame **3** comprising a frame **4** on which the stencil screen **5** is secured.

A squeegee **6** is movable over said stencil screen **5**, which squeegee by moving to the left as seen in the drawing pushes the printing paste **7** in front of it.

At the end of the stencil frame **3**, which end corresponds with the end of the forward stroke of said squeegee **6** there is a feeler according to the invention, which in the embodiment shown consists of a metal pin **8** which is so secured to a support **9** as to be adjustable either in vertical or in angular direction, which support **9** is fastened to, but insulated from the stencil frame **3** at **10**. A terminal **11** is connected with the support **9**, while with the stencil frame **3** which just as the frame **13** of the apparatus is earthed, a terminal **12** is connected. Said terminals are directly connected with a controlling device, two embodiments of which are shown in Figs. 2 and 3.

In Figure 2 the feeler **8** is diagrammatically shown and said feeler is connected via a resistor **15** with the one plate of a condenser **14**, the other plate of which is earthed. The end of the resistor **15** connected with the feeler **8** is connected via a resistor **25** with a glow discharge tube **17**, the other side of which is earthed via a resistor **18** and is connected with the grid of an electron discharge tube, in this case a triode **19**. In the anode circuit of this triode **19** the winding of a relay **20** is included, a contact of which is shown at **21**. This contact **21** is included in a circuit, in which the secondary winding of a transformer **22** is included and the output termi-

nals of which are directly connected with a feeding device for the printing paste.

The relay 20 is furthermore provided according to the invention with a change-over contact system comprising a movable contact 26 and two stationary contacts 27, 28. The movable contact 26 is earthed. The stationary contact 27 is connected via a resistor with a plate of a condenser 29, the other plate of which is earthed. The first-named plate of the condenser 29 is furthermore connected via a resistor with the positive terminal of a current source (designated by +) and the one electrode of a glow discharge tube 30.

In a similar manner the other stationary contact 28 is connected via a resistor with a condenser 31, the one plate of which is earthed and the other plate of which is connected via a resistor with the above terminal of the voltage source and with the one electrode of a glow discharge tube 32. The other electrodes of the two glow discharge tubes 30, 32 are interconnected and are connected with the grid of an electron discharge tube 33. The anode circuit of said electron discharge tube 33 contains a relay coil 34, the associated movable contact 35 of which is connected via an alarm device 36 with the one terminal of a voltage source (designated by ~) and the stationary contact cooperating therewith is connected with the other terminal of said voltage source.

Also in Figure 3 the feeler 8 is connected via a resistor with the one plate of a condenser 14, the other plate of which is earthed. In this case the end of the resistor 15 connected with the feeler 8 is connected via two resistors with the grid of an electron discharge tube, which is a triode 19 again here. This grid is likewise connected via one of the last-named resistors with the negative terminal of a D.C. source and via a transformer 23 with an A.C. source. In the anode circuit of the triode 19 the primary winding of a transformer 24 is included, the secondary winding of which is directly connected with the feeding device for the printing paste. Neither in Figure 2 nor in Figure 3 is this printing paste feeding device shown.

The operation of the controlling device according to the invention is as follows:

At the end of the forward stroke of the squeegee 6 the mass of printing paste moved by said squeegee, which mass is designated in Figure 1 by 7, is dammed up between the upstanding wall of the stencil frame 3 and the leading edge of the squeegee. In case the amount of printing paste on the stencil frame 3 is sufficient, said dammed up mass of printing paste which is electrically conductive, will effect a connection between the terminals 11 and 12 via the pin 8, the mass of printing paste and the stencil frame 3.

In that case, therefore, a connection between the pin 8 in Figure 2 and the earth is established. As a result the condenser 14 is discharged via the resistor 15 and as a result the potential of the point intermediate the resistor 25 and the glow discharge tube 17 will have a value which is no longer sufficient to keep the glow discharge tube conductive. As a result the potential of the grid of the triode 19 will have such a value that said tube is blocked. Owing to the fact that the anode current no longer flows in the anode circuit of this tube the relay 20 is de-energized, so that the contact 21 is closed. Owing thereto the circuit in which this contact is included, is closed and the printing paste feeding device connected with this circuit is so influenced that no fresh amount of printing paste is fed to the relative stencil frame.

If owing to some or other cause the reservoir is empty or the control valve in the printing paste supply line is blocked in the closed positon, the relay coil 20 is energized for a time longer than normal and also the movable contact 26 will remain in contact with one of the stationary contacts, e.g. the contact 27, for the same abnormally long period.

If said period is longer than the period in which the condenser 29 is discharged to a voltage at which the glow discharge tube 30 will extinguish, said tube 30 is extinguished, so that the potential of the grid of the electron discharge tube 33 assumes such a value that said tube is blocked. Inasmuch as in the anode circuit of this tube no current flows any longer, the relay coil 34 is no longer energized, so that the movable contact 35 is moved against the associated stationary contact and the alarm device 36 is put into operation.

In case the relay coil 20 is not energized during a similar abnormally long period because e.g. in the feeding device which is automatically controlled by the above controlling device, the control valve in the supply line is blocked in the open position, the movable contact 26 is held against the stationary contact 28 for so long a period of time that the charge of the condenser 31 decreases at a value at which the glow discharge tube 32 will extinguish with the result that the electron discharge tube 33 is again blocked, the relay coil 34 is no longer energized and the movable contact 35 again puts the alarm device 36 into operation.

From the above it appears therefore that the alarm device 36 becomes operative, if both the period during which the relay coil 20 is energized and the period during which the relay coil 20 is not energized, exceeds a predetermined value which is required for the proper operation of the apparatus to be checked.

It will be clear that said maximum permissible duration may be adjusted in a simple manner by a suitable selection of the parameters of the relative parts in the checking and alarm device.

Furthermore it will be clear that, although in the foregoing only the case has been considered in which the control is dependent on the time of discharge of the condensers, the time of charge of the relative condensers may just as well be employed for this control.

In the circuit arrangement according to Figure 3 the potential of the connecting point of the condenser connected with the secondary winding of the transformer 23 and the grid of the triode 19 will assume such a value owing to the discharge of the condenser 14 via the resistor 15 that said tube will become conductive in the case under consideration, in which there is a sufficient amount of printing paste on the stencil frame. The alternating voltage supplied via the transformer 23 is directly supplied then via the transformer 24 to the printing paste feeding device connected with the latter transformer, so that said feeding device is so influenced that no further supply of the printing paste to the relative stencil frame takes place.

It will be clear that if the reverse is the case, e.g. when the mass of printing paste moved by the squeegee 6 is not dammed up to such a level at the end of the stroke of said squeegee that it comes into contact with the pin 8, the printing paste feeding device is so influenced that a fresh amount of printing paste is fed to the relative stencil frame.

Furthermore it will be clear that the circuit arrangement according to Figure 3 offers the advantage over the circuit arrangement according to Figure 2 that it contains no mechanical parts, so that the reliable operation of the servo mechanism is improved.

Although the feeler is constructed as a conductive pin in the embodiment described hereinbefore, the feeler may obviously also be constructed in an entirely different manner and even an optical method may be used for influencing the servo mechanism for actuating the printing paste feed. It is also possible to construct said servo mechanism in various manners other than the one described above.

A great advantage of the controlling device according to the invention is that it can be applied without more to printing apparatuses operating at widely varying speeds, while furthermore the operation of the apparatus is in-

dependent of the consumption of the printing paste and the viscosity of the printing paste.

I claim:

1. An automatic electrically conducting liquid feed controlling device having at least one feeler adapted to close, in conjunction with the liquid, an electric circuit so as to influence the grid voltage of an electron tube characterized in that the feeler is connected with one plate of a condenser, the other plate of which is earthed, said first plate being also connected to the grid of the electron tube, said grid being further connected to the negative terminal of a direct voltage source and to an alternating voltage source, while in the anode circuit of the electron tube a winding of a transformer is included, said transformer being directly coupled to a feeding device for the liquid.

2. An automatic feed controlling device to be used with an apparatus as set forth in claim 1 for screen printing webs of cloth which apparatus comprises a stencil frame having a reciprocatory squeegee in superposed relationship therewith characterized in that the feeler is mounted at the end of the stencil frame corresponding with the end of the forward stroke of the squeegee and is adapted to cooperate with the printing paste dammed up by the squeegee at said end.

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