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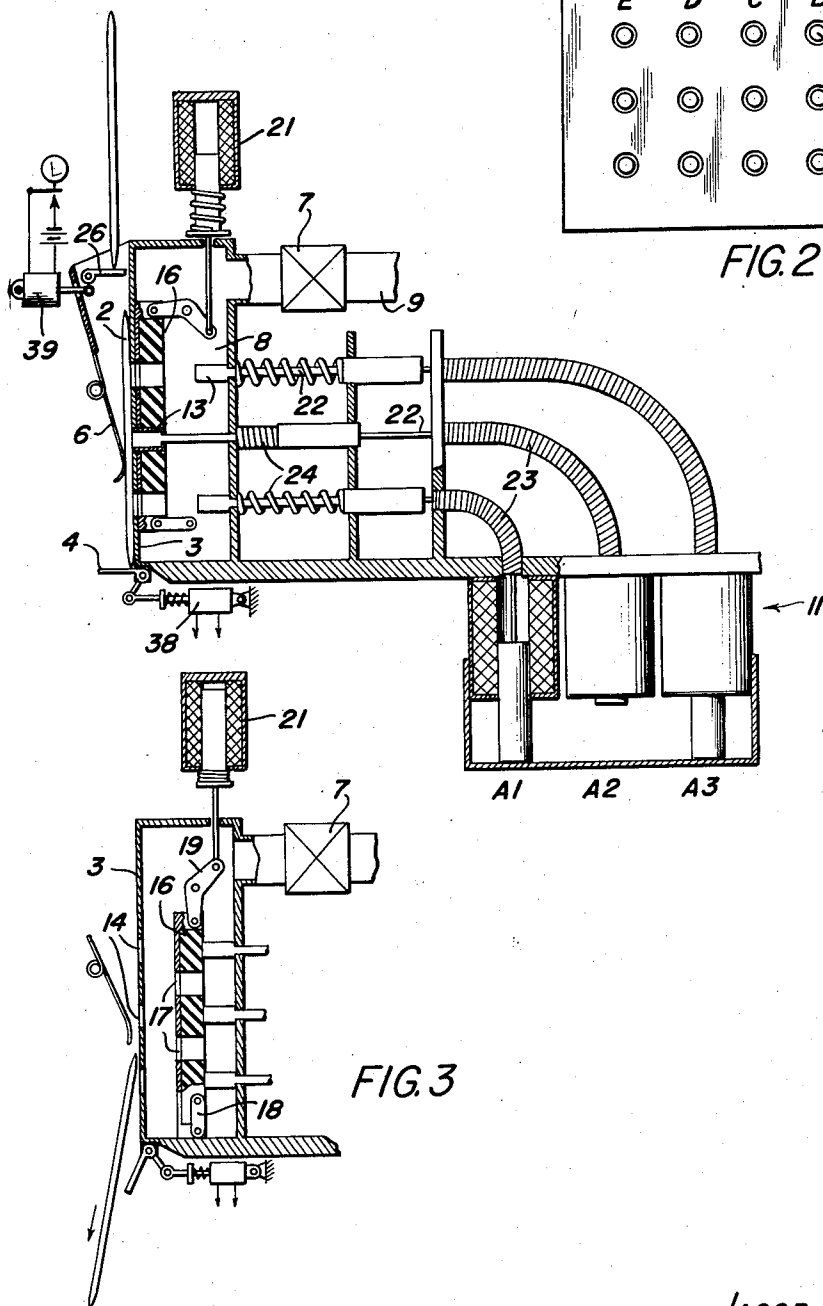
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2,901,969

DIFFERENTIAL PRESSURE ENVELOPE PRINTER

Filed March 4, 1958

2 Sheets-Sheet 1



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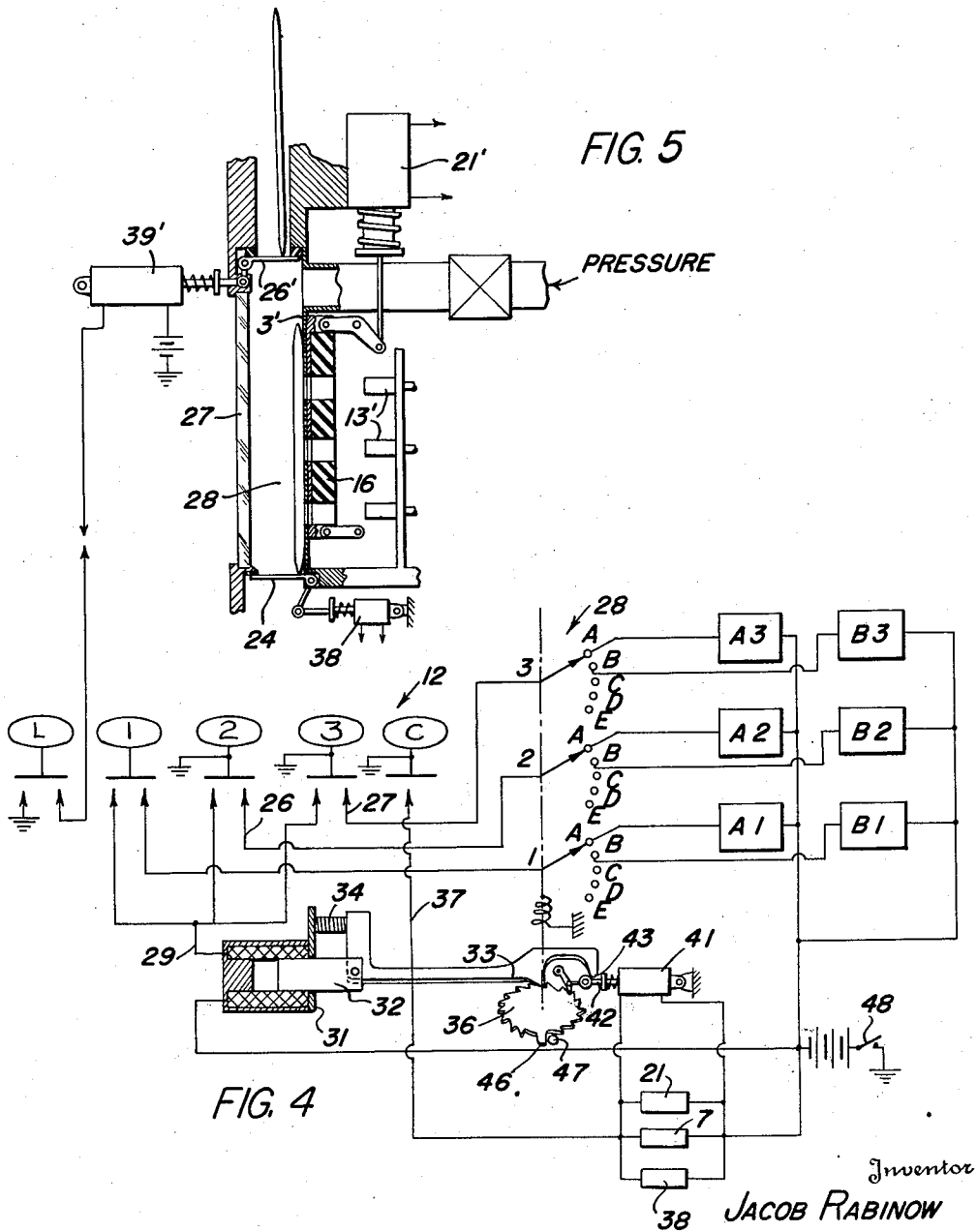
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DIFFERENTIAL PRESSURE ENVELOPE PRINTER

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4 Claims. (Cl. 101—93)

This invention relates to printing mechanisms and specifically printing mechanisms designed for printing on the outside wrappers of objects such as envelopes and the outside wrappers of packages; and has for its primary object the provision of means whereby the presence of irregularly-shaped contents in the package does not interfere with the ability of the device to print on the outside paper or other covering.

In modern schemes for sorting letter mail and mail of other types there arises a need for printing some types of indicia in the form of dots or other marks by means of which this mail can be sorted by automatic machinery. One of the great problems in connection with this is that the envelope may contain not flat objects, such as paper, but various irregular things like coins, keys, samples of rigid material, etc. In the case of packages, it is, of course, obvious that the content of the package may provide a very poor backing for the paper wrapper. The problem, then, is to make contact with the paper and print clear marks, including type, independently of the material behind the paper or plastic surface.

This problem is solved according to the invention by employing a vacuum platen which "sucks" the paper against an apertured grid, and the printing is done through the aperture of this grid. It should be understood that when "paper" is referred to in this patent specification, any other flexible sheeting is also included. Since the discussion will primarily be concerned with letter mail, the objects to be printed will be referred to hereinafter as letters and envelopes but, in practice, of course, many other forms of packaging are also comprehended. It should be further understood that the air pressure by which the paper is pressed against the grid can be obtained by outside pressure which is greater than atmospheric, or by pressure which is lower than atmospheric inside the chamber. In other words, either vacuum suction may be employed, or external pressure may be employed to press the paper against the grid. It is, however, essential that differential pressure be employed for the purposes described hereunder. The main object of the invention, then, is to provide a mechanism for printing on a surface of an envelope independently of the contents of the letter.

The prior art of printing on envelopes has employed techniques whereby the envelope is pressed against a platen and suitable fingers come forward against the platen and print marks on the envelope. The difficulty with this approach is that if the envelope contains irregular objects, the inking fingers or plungers do not contact the paper properly, and the markings become defective. If the fingers have enough pressure they can actually perforate or tear the paper where it is not fully supported. The device of the present invention effectively flattens the side being printed, and the filling of the envelope has no effect.

The specific nature of the invention as well as other objects and advantages thereof will clearly appear from

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a description of a preferred embodiment as shown in the accompanying drawings, in which:

Fig. 1 shows the general scheme of the invention;

Fig. 2 is a front view of the inking grid showing the arrangement of dot inkers;

Fig. 3 is a view of the vacuum chamber of Fig. 1, but in the inking and letter releasing position;

Fig. 4 is a schematic diagram of a control circuit arrangement for controlling the operation of the inker; and

Fig. 5 is a schematic view, partly in section, of an inking arrangement similar to Fig. 1, but utilizing an air pressure chamber instead of a vacuum chamber.

Referring to Fig. 1, the letter, 2, to be marked is dropped by a suitable mechanism, which is not part of this invention, in front of the grid 3 and rests upon hinged shelf 4 which is the reference surface which positions the envelope. Lateral positioning may be obtained by guiding the letter with suitable spring fingers 6 to the right as shown in Fig. 1, or any other suitable guide means may be used. Spring fingers 6 are tensioned to very lightly push the letter to the right and need not even touch the grid 3. After a suitable time has elapsed for the letter to come to rest on shelf 4, a solenoid operated valve 7 operated by control circuit means described below, is opened connecting the chamber 8 behind the envelope with the vacuum line 9. This vacuum line connects to a suitable exhaust pump, not shown, preferably of the type used in vacuum cleaners, which may be running continuously while the machine is in use. The air pressure ahead of the letter presses the envelope against the grid 3 and, since there is air inside the envelope, this pressure is transmitted to the back surface of letter 2, and this back surface is thus pressed firmly against the grid 3. It should be understood it does not make any difference whether the envelope is tightly sealed or not. The air pressure will be transmitted to the back surface either through the porosity of the material or, if it is not porous and the envelope is perfectly sealed (which is almost impossible in actual practice) the pressure on the outside envelope forces the inner air to have the same pressure and press the back surface against the grid. In any case, in practice, with the normal openings in the envelopes under the flaps and elsewhere, the front surface of the envelope shows no particular distortion and the back surface is sucked firmly against the grid.

In order to print on the envelope the necessary dots, or other markings, the individual solenoids of a group of solenoids 11 are actuated by a keyboard 12 (Fig. 5) or other suitable devices in any suitable manner. In the particular application for which this invention has been intended, an operator controls a keyboard 12 which controls the solenoids 11 so as to print the proper marking. This is shown schematically in Fig. 4. The throw of the tips of inking fingers 13 is adjusted so that they move forward just slightly beyond the front plane of the grid 3. This is so that there will be some finite pressure against the surface of the envelope which is held by vacuum against the grid. Since the paper is bowed or stretched slightly into the openings it would be enough for the printing fingers to merely reach the front surface of the grid to insure a good contact with the paper. In practice, since there is a slight springiness to fingers 13, and in the structure in general, it is safer to push the finger slightly forward which tends to lift the paper just slightly off the grid. By "slightly," I mean a few thousandths of an inch. The magnitude of the stretching and bowing of the paper depends on the size of the openings 14. In the models which have been built, these openings are of the order of one-quarter of an inch in diameter and the dots are of the order of one-eighth of an inch in diameter.

In order to ink the fingers, at least two expedients may be used. One is to provide an inking pad 16 behind the grid and inside the vacuum chamber located as shown in Figs. 1 and 3. The inking pad is provided with quarter-inch holes 17, through which the fingers can pass on their way to the envelope. When the fingers are retracted the inking pad can be moved diagonally and back on links 18 and 19 so as to ink the pads for the next print. All that is necessary is a small swinging motion as shown in Figs. 1 and 3, by means of which the fingers are inked when solenoid 21 is actuated. Another way of inking the fingers would be to open a door in the bottom of the vacuum chamber of Fig. 1 and bring an inking roller across all the inking fingers. The methods of inking this roller are well known to the printing art and need not be detailed here.

In order to insure fast operation, we prefer to keep the volume of the vacuum chamber to a minimum and in the embodiments shown in Figs. 1 and 5 only the fingers 13 or 13' are in the chamber. There are air leaks, of course, past the openings for the wires 22 and through the paper which fits against the front grid 3. These leaks are of no importance since the vacuum line can handle these leaks and still maintain adequate vacuum. A vacuum of a low level such as obtained in home vacuum cleaners is found to be sufficient for this purpose. More can be obtained from suitable pumps if the paper is of sufficient strength and if the openings in the grid are sufficiently small so as not to cause rupture of the paper.

Instead of using a vacuum chamber on the inside of the grid to suck the letter against the grid, one can also use a pressure chamber containing the letter as shown in Fig. 5, in which the same reference characters as in Fig. 1, with a prime (') added, are used for corresponding elements. Here no vacuum is necessary but air under pressure is introduced into this chamber after the letter has been dropped into it and the doors 24 and 26 closed. The advantage of this arrangement is that the printing mechanism can be left entirely open to the air. If the printing mechanism contains a large number of large parts, this arrangement may be preferred. Of course, a glass front 27 on the box will be necessary if the address on the letter is being read at the same time that the printing is done. If the printing is done after the letter is read, as is the case in some of the present-day machinery, then the pressure box 28 need not have a transparent window.

Fig. 2 is a front view of the apertured grid 3 in Fig. 1 or 3' in Fig. 5, showing the arrangement of inking fingers 13 in five vertical rows labelled A—E respectively, each vertical row representing a digit. It will be apparent that each of these digits may have any one of eight possible values, whereby the arrangement shown could be used to identify over 24,000 different addresses. It will be apparent that by increasing the number of markers, a greatly increased possible number of addresses may be obtained. Each individual inking finger 13 is controlled by a separate solenoid of the group of solenoids 11 (Fig. 1), there being therefore 15 such solenoids in the arrangement shown in Figs. 1 and 2. The plunger of each solenoid actuates an attached plunger wire 22 guided in a flexible spiral guide hose 23 of conventional construction. Energization of any individual solenoid causes its attached finger 13 to move forward into the inking position against the pressure of spring 24; when the solenoid is de-energized, the finger 13 moves back to its initial position under the pressure of spring 22.

Fig. 4 shows a control circuit which is equally applicable to the arrangement of Fig. 1 or Fig. 5. A single bank of control keys or buttons, 12, is pressed by the operator five times in succession to energize the successive digits A—E of the printing device. Assuming that the letter is in the position shown in Figs. 1 and 5, the operator will press the desired combination of keys 1, 2 and 3 to produce the desired digit in row A. For example, assuming that the desired digit is 023, that is, keys 2 and 3

are to be depressed. Rotary selector switch 28 is shown in position A; depression of keys 2 and 3 therefore closes a circuit through wires 26 and 27 respectively, through the A contacts of the selector switch to solenoids A2 and A3 respectively, thus causing the inking fingers 13 associated with these two solenoids to produce ink marks on the envelope. At the same time, depressing of either key 2 or 3 has closed a circuit through wire 29 to solenoid 31, causing its plunger 32 to be retracted. This withdraws pawl 33 against the action of spring 34, so that when the keys are subsequently released, pawl 33 acting on ratchet wheel 36 will advance the rotary switch contacts into position B. The next digit, B, can now be printed in the same way, by pressing the desired buttons 12, which not only prints the digit, but also again advances the rotary stepping 28 to position C, and so on. After all five digits have been printed, the "clear" button C is pressed, which closes a circuit through wire 37 to simultaneously energize the inking solenoid 21 (see Fig. 1), the valve solenoid 7 and the bottom door solenoid 38. This simultaneously releases the vacuum pressure and opens the bottom door 4 (or 24 in Fig. 5), thus permitting the letter to drop down to its next destination, usually a letter-stacking chute. At the same time, the inking solenoid 21 is energized to cause the ink pad 16 to assume the position shown in Fig. 3, thus reinking all of the fingers 13 for the subsequent operation. The device is now ready for reception of the next letter, which may be done automatically by the machine feeding the letters to the printer, but is shown in the disclosure as manually operated. For this purpose, a separate button L is provided, which operates solenoid 39 (or 39' in Fig. 5) to open door 36 and permit the next letter to drop into the machine. After the button L is released, the door 26 closes and the machine is now ready to repeat the operation of inking the letter as previously described. For this purpose, it is necessary that the rotary switch 28 be reset into its initial position as shown in Fig. 4. This is accomplished by solenoid 41, which is, like solenoids 21, 7 and 38, under the control of key C. When solenoid 41 is energized, its armature 42 is drawn to the right which causes cam 43 to be rotated counter-clockwise and raise pawl arm 33 to release ratchet 36. Ratchet 36 is biased by spring 37 toward its initial position, and thus turns counter-clockwise until lug 46 comes to rest against stop-pin 47. Thus the operation of control button C has also served to reset the rotary switch to its initial position and the device is now ready to begin inking again. A main switch 48 may be provided to render the entire system inoperative.

It will be apparent that the above control system is shown by way of example only and that both the inker actuating system and the control system may take many other forms within the scope of the invention. For example, the solenoid A, B, etc., could be dispensed with and the keys 1, 2, etc., arranged for manual operation of the respective inking fingers, as in a typewriter, in which case there would preferably be five rows of such keys, one for each bank A—E. Also, in the system of Fig. 4, five sets of keys could similarly be used, dispensing with the need for a rotary selector switch, in which case the arrangement of keys would be similar to that found in many ordinary adding machines, where there is one row of keys for each decimal order.

It will be apparent that the embodiments shown are only exemplary and that various modifications can be made in construction and arrangement within the scope of my invention as defined in the appended claims.

I claim:

1. In a printing device for printing on flexible material, a perforated plate against which a piece of flexible material can be pressed by gas pressure, means to position said flexible material in contact with one side of said perforated plate so that the material itself closes the individual perforations of the plate, pressure differential means to provide lower pressure on the side of said plate

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away from the said flexible material than on the other side, printing means movable through the perforations of said plate from said other side to contact said flexible material, and operating means to actuate said printing means selectively.

2. The invention according to claim 1, and a pressure box, said pressure differential means including means for producing a higher pressure in said box than outside said box, said perforated plate forming a wall of said box, whereby a piece of flexible material within said box is pressed against said perforated plate. 10

3. The invention according to claim 1 including individual flexible wires connected at one end to the respective movable printing means, said operating means com-

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prising actuators connected to the other ends of said wires respectively to move said flexible wires so as to push said printing means.

4. The invention according to claim 3, said actuators comprising individual magnetic reciprocating motors, keyboard means, and electrical circuit means individually and selectively connecting said keyboard means to said motors. 5

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