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2,884,495

CONTROL DEVICE

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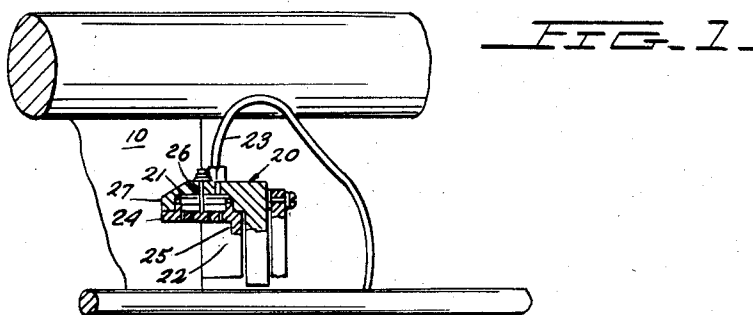


FIG. 1

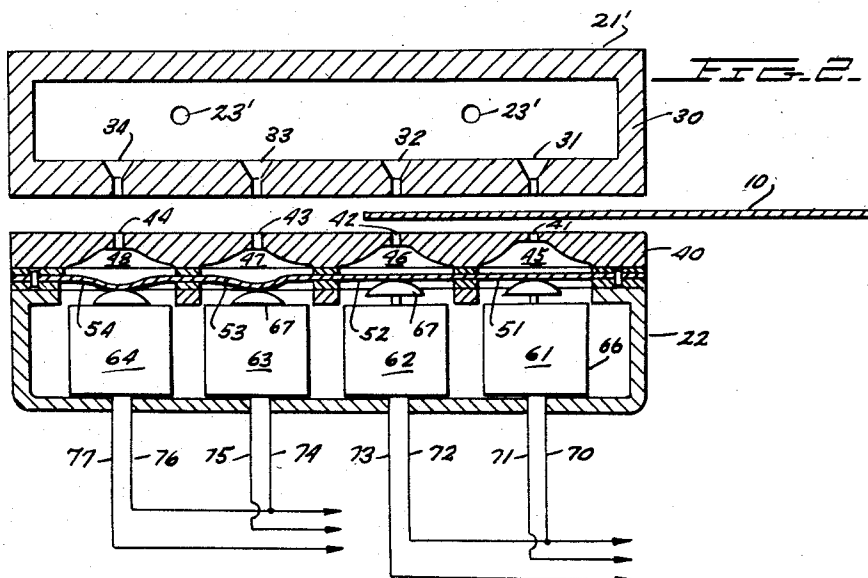


FIG. 2

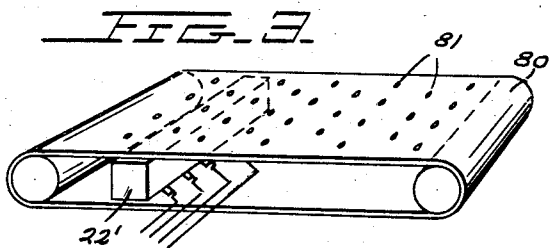


FIG. 3

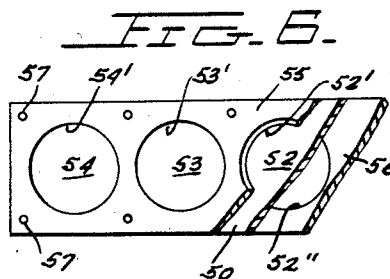
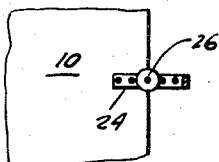
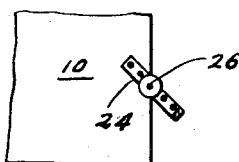


FIG. 4

FIG. 5



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CONTROL DEVICE

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2 Claims. (Cl. 200—61.13)

This invention relates to a control device and more particularly it relates to a device for guiding the edges of webs such as papers, textiles, sheet metal and plastic sheets, for example, and filaments such as cable wire, thread, etc.

In such operations as the slitting, embossing, dyeing, printing, coating, laminating, reeling, etc. of sheet material it is very important to control the position of the edges of the sheet material being treated. However, for such flexible sheet material this must be done without injuring the edge of the sheet being treated.

Among the objects of this invention is to provide a simple control device suitable for guiding the edges of sheet materials without actually contacting the sheet material.

Among other objects of the invention is to provide a control device operated by gas or air under low pressure which is readily available and which cannot harm the material being treated in any way.

Aside from operating as an edge guide for sheet material the device is capable of controlling various other operations such as testing a sheet material for defects and controlling other devices such as a typewriter, a jacquard weaving machine, a computer circuit, a musical instrument, for example, or any type of punched card controlled machine when employed with a sheet material having one or more predetermined sets of perforations. Any device or operation that can be controlled by photoelectric cells can be controlled by the device of this invention as the operation is analogous. The photoelectric cell operates by interception of a ray of light (or vice versa) and the device of the invention operates by interception of a jet or air (or vice versa).

These objects of the invention and others ancillary thereto are obtained by providing a plurality of air nozzles or jets spaced from a corresponding and coinciding number of sensing devices containing an orifice and a cavity. Internally, each cavity is fitted with a diaphragm which is flexible and responsive to the velocity head of an air jet entering the cavity from its corresponding nozzle. A separate diaphragm effect may be obtained by a single diaphragm which is compartmentalized. Each diaphragm is adapted to operate a snap action switch or similar device. A snap action type of microswitch is very satisfactory. The sheet being aligned is passed through the space between the air nozzles or jets and the air receiving cavities permitting or preventing the velocity head of the air jet from acting on the diaphragm of the air receiving sensing device. The switches may be connected to relays, solenoids, valves and similar actuating devices.

Gas at low pressure suitable for operating the device is, for example, at a pressure of 2-10 lbs. per square inch. Air is a very satisfactory gas but in some cases it may be desirable to employ a gas which is not inflammable and does not support combustion. Obviously gas at higher pressures can be employed but the low pressures of 2-10 lbs. p.s.i. are satisfactory.

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When guiding the edges of sheets, two, three, four or more nozzle of jet units each comprising a corresponding number of sensing devices are sufficient, greater accuracy and faster reaction being obtained with the larger number of units. When employed for controlling the keys of a typewriter, for example, a separate jet unit is required for each symbol. Then employed for the discovery of pinholes in a non-porous sheet material sufficient jet units to extend across the sheet are required. Where dense sheets are made of explosive material such as cellulose nitrate or when made from solutions of plastic materials in volatile and inflammable solvents the device of the invention has the distinct advantages over electrical control devices or sheet contacting devices in that there is no danger from sparks. All the electrical switching elements of applicant's device are contained in hermetically sealed housings.

The invention itself, together with additional advantages thereof, will be best understood from the following description of a specific embodiment thereof when read in connection with the accompanying drawing in which:

Fig. 1 is a view of a typical installation of the device on a paper treating machine.

Fig. 2 is a cross sectional view and a wiring diagram of a modified form of control device similar to that shown in Fig. 1.

Fig. 3 is a view of a perforated control sheet such as may be employed in jacquard weaving machine, typewriter control, etc.

Figs. 4 and 5 illustrate an adjustment for increasing the sensitivity of the device of Fig. 1.

Fig. 6 illustrates an easy way of making a series of diaphragms.

In the device of Fig. 1 the web or sheet 10 is being treated and is aligned by means of the edge guide 20. The edge guide 20 comprises an upper air supply chambered member 21 and a lower set of alignment sensing devices in a chambered member 22. Obviously the positions of the chambers 21 and 22 can be reversed. The edge of web 10 passes between the chamber 21 and 22. The air supply chamber 21 is fed by a low pressure line 23. The air supplied to this line is preferably filtered so that no dust or dirt get into the air jets and nozzles on which the operation of the device depends. The chambered members 21 and 22 are held in the desired spaced relation to each other. In the form shown in Fig. 1, the lower chamber 22 is rigidly connected at 25 to the lower plate 24 of chamber 21. Plate 24 is rotatable with respect to the upper part 27 of chamber 21 about the bolt 26 as an axis.

The structure of the alignment sensing device is shown in Fig. 2. The upper or air supply chamber 21 has the air inlets 23' and includes an inner wall 30 containing a number of air jet or nozzle openings 31, 32, 33 and 34. The nozzles 31, 32, 33 and 34 are positioned directly above a similar series of orifices 41, 42, 43 and 44 contained in the inner wall 40 of the chamber 22. Orifices 41, 42, 43 and 44 lead directly to cavities or chambers 45, 46, 47 and 48, respectively. The lower end of each cavity or chamber 45, 46, 47 or 48 is closed by a flexible diaphragm 51, 52, 53, 54, respectively. A single diaphragm may extend over all the lower ends of cavity or chambers 41, 42, 43 and 44. Diaphragms 51, 52, 53 and 54 are adapted to expand under low pressure.

Fixed in the lower or outer part of cavity or chamber 22 are a number of microswitches 61, 62, 63 and 64 one for each orifice 41, 42, 43 and 44. The switch 61, for example, comprises an electrical switch portion 66 of conventional design and an actuating button 67. There are a number of such switch devices on the market and the operation of the device does not depend on the particular internal structure of the microswitch employed.

The switches 61, 62, 63 and 64 may be hermetically sealed in housing 22 so that all danger of sparks resulting on connecting or disconnecting the switches acting on explosive gases or bodies being manufactured, is avoided. Also, the sealing of the switches prevents moisture, dust, fumes, etc. from penetrating into the switch devices. Pressure on the diaphragm 51 is adapted to actuate the switch 61 by pushing button 67 inwardly with respect to the body 66 of the switch. Electric supply lines 71, 72, 73, 74, etc. are connected or disconnected by the various switch boxes 61, 62, etc. to a relatively powerful adjusting means. In the case of Fig. 1 the switch boxes may control a device which moves the web supply roll to the left or right.

A very satisfactory arrangement for the device of Fig. 1 is to employ a device with four nozzle units comprising four air supply nozzles or jets and four corresponding sensing devices. The edge of the web passes between the two center units. The switches 61 and 62 then, as shown in Fig. 2, are adjusted to hold the lines 70-73 open when the buttons 67 are not depressed by diaphragms 51 and 52. The switches 63 and 64 are adjusted to hold the lines 74, 75, 76, 77 open when the buttons 67 thereof are in depressed position. Then if the edge of sheet 10 moves to the left in Fig. 2, it will eventually cover nozzle 43 operating switch 63 which connects to an actuating device to move the supply roll for web 10 to the right rather slowly. If the edge suddenly gets to a position where it covers nozzle 44, switch 64 causes the supply roll moving device to move faster to the right.

If on the other hand, the edge of web 10 goes too far to the right, the depressing of diaphragm 52 closes switch 62 to operate a means to move the web supply roll slowly to the left, etc. It is obvious that the switch devices of the invention may be employed with any type of servomotor adjusting means and the movement of the web supply roll has been used as an illustration.

Figs. 4 and 5 show how the device may be adjusted to increase the sensitivity. In the position shown in Fig. 4 the device has the least sensitivity. To increase sensitivity it is only necessary to pivot the plate 24 and chambered member 22 about axis 26' as illustrated in Fig. 5. The pivoting of the plate 24 and chambered member 22 brings the spacing between the holes closer together with respect to the edge of the sheet and thereby increases the sensitivity.

Fig. 3 shows a perforated roll 80 that may be employed with a device of the invention to operate various other devices. For example, if each one of the openings 81 in sheet 80 controls a corresponding switch sealed in housing 22' which switch in turn controls a corresponding key of an electric typewriter, one prepared sheet 80 may be employed to mechanically reproduce as many original copies of the message on said sheet as desired. Similarly the holes 81 may control the keys of a player piano or the shuttles of a weaving machine. In this figure the air supply nozzles are omitted.

A simple method of making a series of diaphragms for the unit is shown in Fig. 6. A single sheet 50 of flexible material provides the diaphragms. This sheet 50 is sandwiched between two metal members 55 and 56. The metal members 55 and 56 contain a series of openings 52', 53', 54' and 52'' which form the diaphragms 52, 53 and 54. The sandwich is held together in any way as by rivets 57.

The loss of power through air loss in the device is negligible. No dust, lint, oil or other impurities enter the system contrary to systems which operate by means of a vacuum. There need be no physical contact between the web which is being guided or the web which acts as a control for another means, although, if desired, and not otherwise harmful the web may contact one or both of the air supply or alignment sensing arms. This is an especial advantage where the web is in tacky condition or is coated with a soft or tacky material. The common

tendency of webs to bounce or to sag under tension variations does not influence the accuracy of the edge guide. Since there are no moving parts, no friction and no wear, there is a minimum of maintenance required. The device is very accurate. For example, an accuracy of $\pm .012''$ on webs with a wander of $\pm \frac{1}{8}''$ for every 100' of web length has been obtained with the speed of the web being 750 ft. min.

The features and principles underlying the invention described above in connection with specific exemplifications will suggest to those skilled in the art many other modifications thereof. It is accordingly desired that the appended claims shall not be limited to any specific feature or details thereof.

I claim:

1. A control device for a web guiding means of a web feeding machine operated by the position of the moving edge of said web being fed, comprising a pair of spaced, substantially parallel members, a first of said members comprising a chamber having at least two spaced nozzle openings extending toward the second of said members, means for feeding gas under relatively low pressure to the chamber of the first of said members, the second of said members having at least two spaced cavities and correspondingly spaced, gas-admitting orifices facing the respective nozzle openings of said first member, the internal diameter of each of said cavities being relatively large with respect to the diameter of its orifice, diaphragm means mounted for axial movement with each of the cavities of said second member, each of said diaphragms extending over substantially the entire area of the enlarged portion of said cavity and being anchored only at the edge portions of the cavity and diaphragm whereby the pressure of the low pressure gas jet received by the orifice is amplified in said chamber, at least two snap action switch means in said second member, one of said switch means being positioned on the opposite side of each diaphragm from the corresponding nozzle, each of said switch means having a movable control button extending toward its corresponding diaphragm whereby expansion of the diaphragm by the velocity head of the gas entering the cavity operates the control button of said switch, said switch being adapted to connect an operating device to a source of electricity in one position of the control button and to disconnect said operating switch in the other position of the control button, said first and second members being spaced apart sufficiently to permit the moving web of a web feeding machine to pass between the nozzles of the first member and their respective cavities in the second member without contacting either of said spaced parallel members, means for mounting said control device on a web feeding machine so that the edge of the web fed by said machine normally moves in the space between said two spaced nozzle openings in the first member and their corresponding cavities in the second member whereby the jet of air from a first of said nozzle openings to its corresponding cavity is normally cut-off by said moving web whereas the jet of air from the second of said nozzle openings to its corresponding cavity is normally unhindered by said moving web.

2. A control device as claimed in claim 1 wherein said means for mounting said control device on a web feeding machine includes a pivoting connection whereby the sensitivity of the device to variations in the movement of the edge of the web may be varied by changing the angle between the moving edge of the web and the line of nozzle openings in the device.

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