

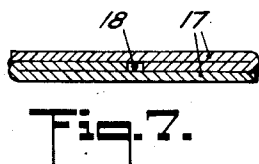
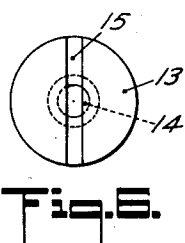
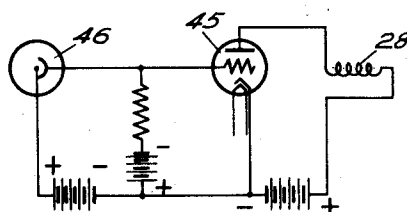
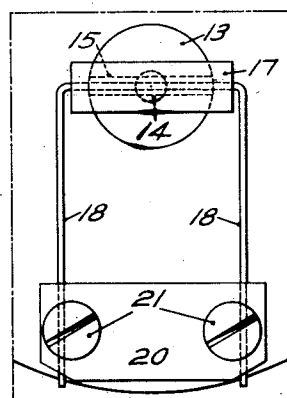
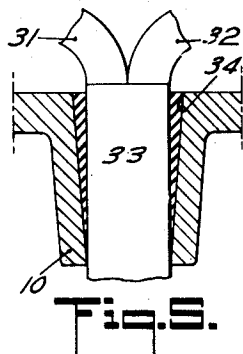
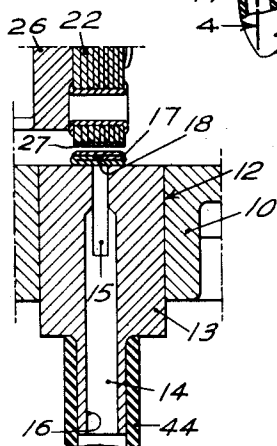
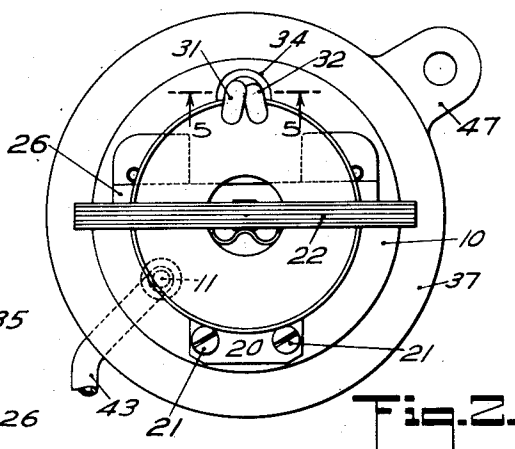
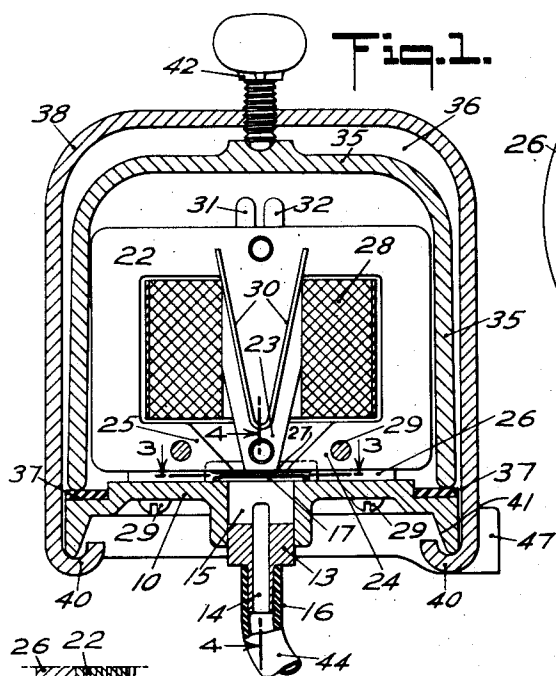
Oct. 28, 1952

E. H. BICKLEY

2,615,470

MAGNETIC AIR VALVE

Filed April 23, 1947



INVENTOR
EVERETT H. BICKLEY,

BY

Bar, Borden & Fox

ATTORNEYS

UNITED STATES PATENT OFFICE

2,615,470

MAGNETIC AIR VALVE

Everett H. Bickley, Bala-Cynwyd, Pa.

Application April 23, 1947, Serial No. 743,259

5 Claims. (Cl. 137-730)

1

The present invention relates to air control valves and more particularly to a magnetically operated valve for releasing puffs of air under pressure as an adjunct of an article-sorting machine.

Some of the objects of the present invention are: to provide an improved electrically operated valve; to provide an air control valve which will open or close in one thousandth of a second in response to an electrical signal; to provide an electrically operated valve for operating at high speed while using a relatively small current; to provide an air control valve controlled by magnetic lines of force and wherein all valve material is magnetized in operation; to provide a field structure for an electrically operated valve wherein shaped laminations subject a valve armature to maximum magnetic field; to provide a novel valve structure wherein a magnetic armature is prevented from sticking by reason of residual magnetism in the field structure; to provide a novel air discharge nozzle having a slotted opening to give a relatively large air passage controlled by a valve having an extremely small lift with small down pressure; to provide a valve having a relatively large air storage capacity so that there will be little drop in pressure when the valve opens for a short duration; to provide a valve construction suitable for rapid and economical manufacture; to provide a valve having long life with little attention; and to provide other improvements as will hereinafter appear.

In the accompanying drawings, Fig. 1 represents a sectional elevation of a magnetic puffer air valve embodying one form of the present invention; Fig. 2 represents a plan with the cover removed; Fig. 3 represents a section on line 3-3 of Fig. 1; Fig. 4 represents an enlarged section on line 4-4 of Fig. 1; Fig. 5 represents a section on line 5-5 of Fig. 2; Fig. 6 represents a plan of one form of air discharge plug; Fig. 7 represents a transverse section of the armature on an enlarged scale; and Fig. 8 represents a circuit diagram for controlling the operation of the puffer valve.

Referring to the drawings, one form of the present invention comprises a base 10 having an inlet port 11 for air under pressure, and a substantially centrally disposed bore 12, which receives an air discharge plug 13. As shown, this plug 13 has an axial bore 14 communicating at its inner end with a transverse relatively narrow slot 15, in the center of said base while its outer end traverses the projecting plug nozzle 16. In assembled condition the inner face of the plug

2

13 preferably lies in the plane of the upper face of the base 10.

For controlling the discharge of air by way of the slot 15, bore 14 and nozzle 16, an armature in the form of a magnetizable strip valve 17 is provided which is normally biased to slot-closing position by a spring 18, here shown as of piano wire bent to U-shape with its ends anchored beneath a strap 20 fixed to the base 10 by screws 21. The bridge piece of the spring 18 traverses an opening formed lengthwise in the armature valve 17 by the spaced apart intertwined ends of the novel valve construction. Thus, the valve 17 is formed from two thin rectangular blanks, each having a reversely bent end, so that when the two blanks are superposed one upon the other with the bent ends therebetween, these ends face each other with the aforesaid opening between them to form a space in which the bridge piece of the spring 18 is free to turn. When the two blanks are thus disposed they are welded together, preferably at the corners, to form the unitary thin armature valve 17 comprising three thicknesses of material in face-to-face engagement and ground to a true surface.

In order to open the valve 17, a field structure 22 is provided formed of laminations of sheet steel shaped to form a center pole piece 23 and two pole pieces 24 and 25 spaced by the pole piece 23. The field structure is generally rectangular in shape and divided at one side to receive the tapered end of the center pole 23 between the opposed pole pieces 24 and 25. It should be particularly noted that the terminal face of each piece 24 and 25 is cut back at an angle to form angles respectively with the juxtaposed sides of the center pole 23 so that each space converges into close proximity to the armature 17 and thus causes the maximum magnetic pull to influence the armature. In other words, the upwardly diverging air gaps reduce loss of magnetism from one pole to another and directs the same to the armature with minimum loss due to leakage across these air gaps. This construction is extremely critical as to angles and relation of the parts because any lag whatsoever breaks up the required sequence of valve opening and closing operations, which in accordance with the present invention, amount to sixty to six hundred per second, depending upon the articles to be sorted. This field structure 22 is mounted vertically upon the base 10 by means of a foot member 26 in such position that the aforesaid pole pieces are in close proximity to the armature valve 17. Screws 29 anchor the foot piece to the

base 10 and support the field structure 22. To prevent residual magnetism from holding the valve 17 open, a fibre strip 27 is interposed between the valve 17 and the pole pieces, being cemented or otherwise secured to the latter. The field structure 22 is arranged to be energized by a coil 28 mounted within the laminations and encircling the center pole piece 23 and there fixed in position by a V-shaped spring element 30 which is longitudinally flexed to have three point end contact with the structure 22, while its intermediate portion bears against the inner perimeter of the coil 28. Thus, the two ends of the spring element 30 bear against a face of the upper side face of the laminated structure, the U end against the lower side face of the center pole piece 23, while the bowed spring legs abut the annular periphery of the coil 28 with the desired locking pressure to prevent displacement of the coil. Current conductor wires 31 and 32 lead from the respective coil ends to form a cable 33, which is led through a hole 34 in the base to terminate in a plug or other connection in a control circuit, such as shown by way of example in Fig. 8. It should be noted that hole 34 is inwardly tapered so that the insertion of the cable 33 forms a wedge joint with such a snug fit that the addition of a suitable cement ensures an air tight joint between the cable and the base 10.

In order to retain air under pressure about the parts described, a bell cover 35 is arranged to fit over the parts and enclose the latter in a chamber 36 sealed by a gasket 37 under the action of a U-shaped clamp 38, the two legs of which terminate respectively in hooks 40 to grip opposite sides of the base flange 41. A clamping screw 42 serves to hold the cover 35 in place in leakproof condition.

For placing the sealed chamber under pressure of air, the inlet port 11 is in communication with a supply pipe 43 leading to a source of air under pressure. The discharge nozzle 16 is attached to a pipe 44 having its discharge end located where the puff of air is to function. In the present instance, since the valve is used in association with an article-sorting machine, the discharge end of the pipe 44 terminates in close proximity to the inspection point where articles of like color are to be separated from off color articles. Thus, in one use of the invention the coil 28 of the valve unit is in series with the plate circuit of a thermionic tube 45, of which the grid is in a circuit controlled by a photo-electric cell 46, the arrangement being either to eject all good articles by a puff of air into the same container or to eject all off color articles by a puff of air into the same but different container from the other. In the former case the photo-electric cell 46 will transmit a signal to the grid of the tube 45, whenever a good article appears at the inspection point to thereby energize the coil 28 to open the valve 17 so that a puff of air ejects the article into the correct container. Where beans or grains of rice are sorted, the sorting machine feeds the beans or rice in such rapid succession that the valve unit must open and close in approximately one thousandth of a second, and this the novel valve of the present invention accomplished by reason of efficient utilization of the magnetic lines of force.

For mounting the valve unit in operating position upon an associated structure, an apertured boss 47 is formed as a lateral projection of the base 10.

Having thus described my invention, I claim:

1. An air puffer unit for color sorting machines to produce short puffs of air in rapid succession comprising an open end casing, a base closing said end, means attaching said casing to said base in sealed relation to form a reservoir for air under pressure, said base having an inlet for air under pressure and an air discharge outlet, a strip valve of magnetizable material arranged over said outlet, a spring biasing said valve to closed position, a laminated field structure in said chamber and shaped to form two juxtaposed poles and a central pole interposed between said poles, said poles being in close proximity to said strip valve, an energizing coil encircling said central pole, and means in the form of a flexed spring for anchoring said coil in said field structure.

2. An air puffer unit for color sorting machines, to produce short puffs of air in rapid succession comprising a laminated field structure of rectangular shape with one side divided to form two juxtaposed poles and the opposite side having an integral transverse part forming a center pole terminating between and spaced from said juxtaposed poles, said transverse part being spaced at opposite sides respectively from the ends of said structure to form openings, an energizing coil in said openings encircling said part, a base supporting said structure having an elongated rectangular discharge slot, a thin elongated rectangular armature located in close juxtaposed relation to said poles to be attracted thereto when said coils are energized and arranged to open and close said elongated rectangular discharge slot, and a laterally disposed U-shaped spring bearing on said armature to restore said armature to its initial position when said coil is deenergized.

3. An air puffer unit for color sorting machines to produce short puffs of air in rapid succession, comprising a laminated field structure of rectangular shape with one side divided to form two juxtaposed poles and the opposite side having an integral transverse part forming a center pole terminating between and spaced from said juxtaposed poles, said center pole being spaced at opposite sides respectively from the ends of said structure to form openings, said juxtaposed poles having end faces respectively angularly disposed to said center pole to converge the magnetic lines of force to the end of said center pole, an energizing coil in said openings encircling said center pole, a base supporting said structure having an elongated rectangular discharge slot, a thin elongated rectangular armature located in close juxtaposed relation to said poles to be attracted thereto when said coils are energized and arranged to open and close said elongated rectangular discharge slot, and a U-shaped spring carrying said armature on its bridge piece lying in the plane of said armature and anchored at its ends to a fixed part.

4. An armature for an electrically operated air valve comprising a thin elongated composite strip of magnetizable material formed of two reversely folded portions, each portion having a long leg and a short leg, said portions being in superposed intimate contact with said short legs spaced apart to provide a through hole for the passage of a spring.

5. A control valve for a magnetic air ejecting unit, comprising an armature in the form of a thin composite strip of magnetizable material formed of two reversely folded portions, each portion having a long leg and a short leg, said por-

5

tions being in superposed intimate contact with said short legs in alinement and spaced apart to provide a through hole, a U-shaped spring having its bridge piece in said hole, and means to attach the free ends of said spring to a fixed part to bias said armature to a selected position.

EVERETT H. BICKLEY.

REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
338,261	Gaiser	Mar. 23, 1886
959,618	Schmidt	May 31, 1910
1,302,511	Chapman	May 6, 1919
1,319,787	Moran	Oct. 28, 1919

Number
1,697,953
1,842,595
1,852,918
1,892,917
2,072,616
2,250,021
2,370,752
2,381,309
2,391,800
2,428,269
2,471,365

6

Name	Date
French	Jan. 8, 1929
Erickson	Jan. 26, 1932
Chandler	Apr. 5, 1932
Walker	Jan. 3, 1933
Barnett	Mar. 2, 1937
Hofer	July 22, 1941
Ray	Mar. 6, 1945
Powell	Aug. 7, 1945
Russell	Dec. 25, 1945
Eaves	Sept. 30, 1947
Beer	May 24, 1949

FOREIGN PATENTS

Country	Date
Great Britain	Apr. 9, 1907
Great Britain	Sept. 3, 1937
Germany	July 30, 1935