United States Patent [19]

Foster et al.

[11] **3,918,489**

[45] **Nov. 11, 1975**

[54] **VALVE BLOCK**

[75] Inventors: **Thomas Vincent Foster; Frank Alan Fenton,** both of Doncaster, England

[73] Assignee: **Emhart (U.K.) Limited,** Doncaster, England

[22] Filed: **Nov. 13, 1974**

[21] Appl. No.: **523,784**

Related U.S. Application Data

[63] Continuation of Ser. No. 369,693, June 13, 1973, abandoned.

[30] **Foreign Application Priority Data**

June 23, 1972 United Kingdom 29561/72

[52] **U.S. Cl.** **137/596.16;** 137/608

[51] **Int. Cl.**[2] **F15B 13/08**

[58] **Field of Search** 137/596.16, 608, 625.6, 137/625.64

[56] **References Cited**

UNITED STATES PATENTS

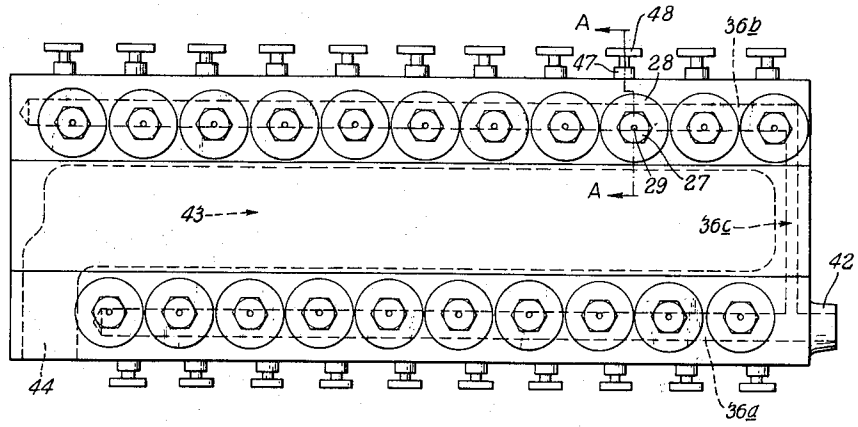
2,460,908	2/1949	Scott	137/625.64
3,135,290	6/1964	Carls	137/608
3,504,704	4/1970	Becrett et al.	137/625.64
3,550,621	12/1970	Lansky	137/608
3,688,797	9/1972	Sorenson	137/625.64
3,785,389	1/1974	Friedland	137/608 X

Primary Examiner—Alan Cohan
Assistant Examiner—Gerald A. Michalsky
Attorney, Agent, or Firm—Laurence A. Savage

[57] **ABSTRACT**

A compact valve block for an I.S. glassware forming machine comprises two rows of valve combinations each of which comprises a pilot-operated poppet valve under the control of a solenoid-operated pilot valve which directs pilot air to the poppet valve, and a plenum chamber, preferably an exhaust chamber, which is located adjacent to all the valve combinations and which is common to either all the supply ports or, preferably, all the exhaust ports of all the poppet valves.

9 Claims, 6 Drawing Figures



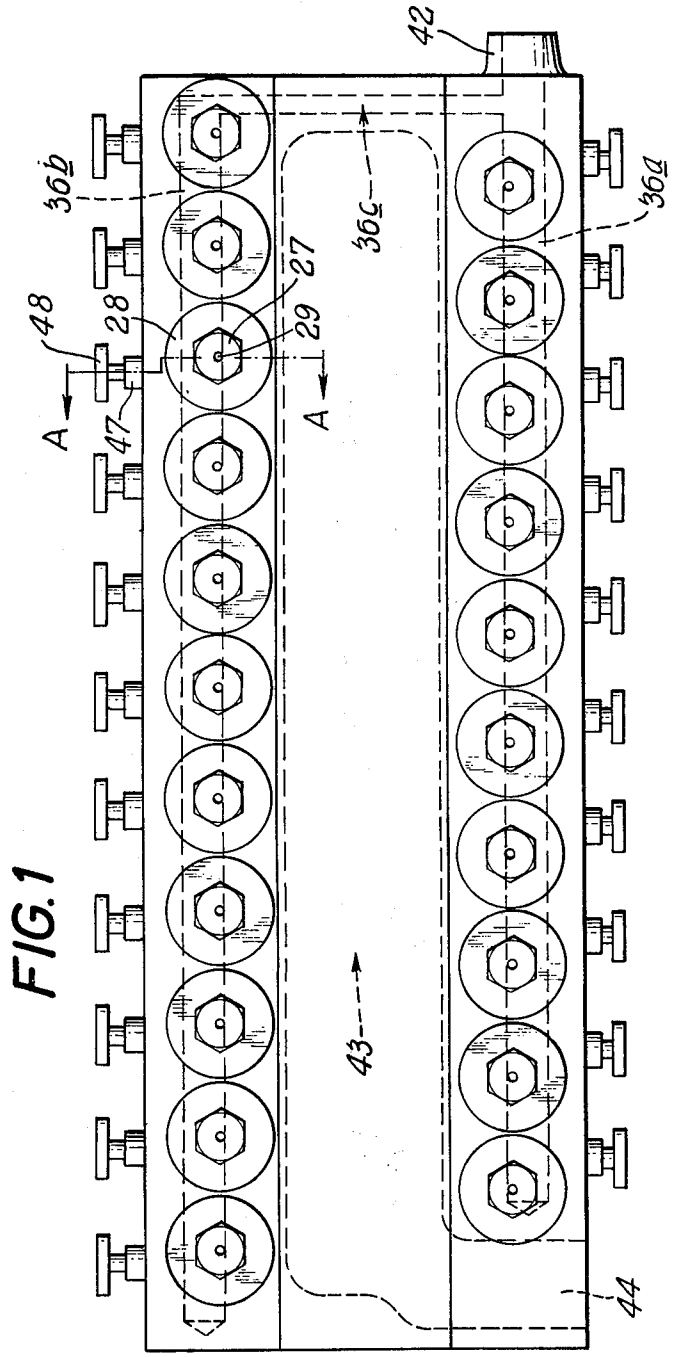


FIG. 1

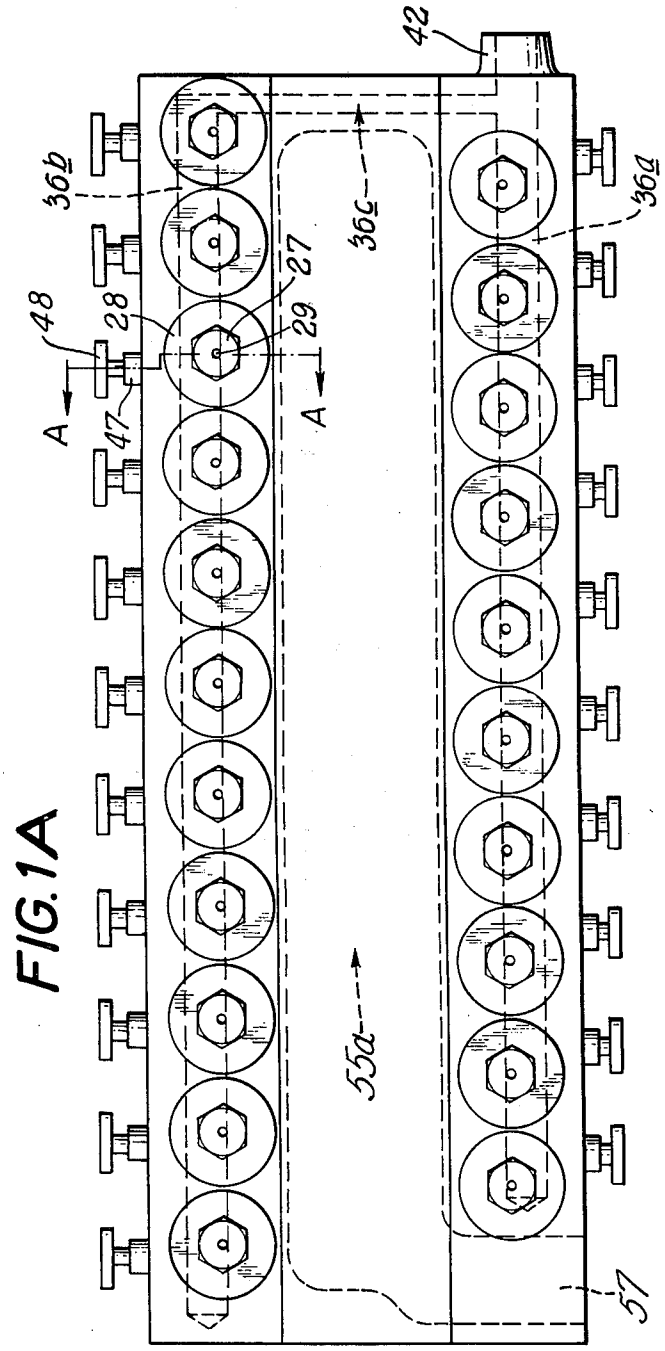


FIG. 1A

FIG. 2

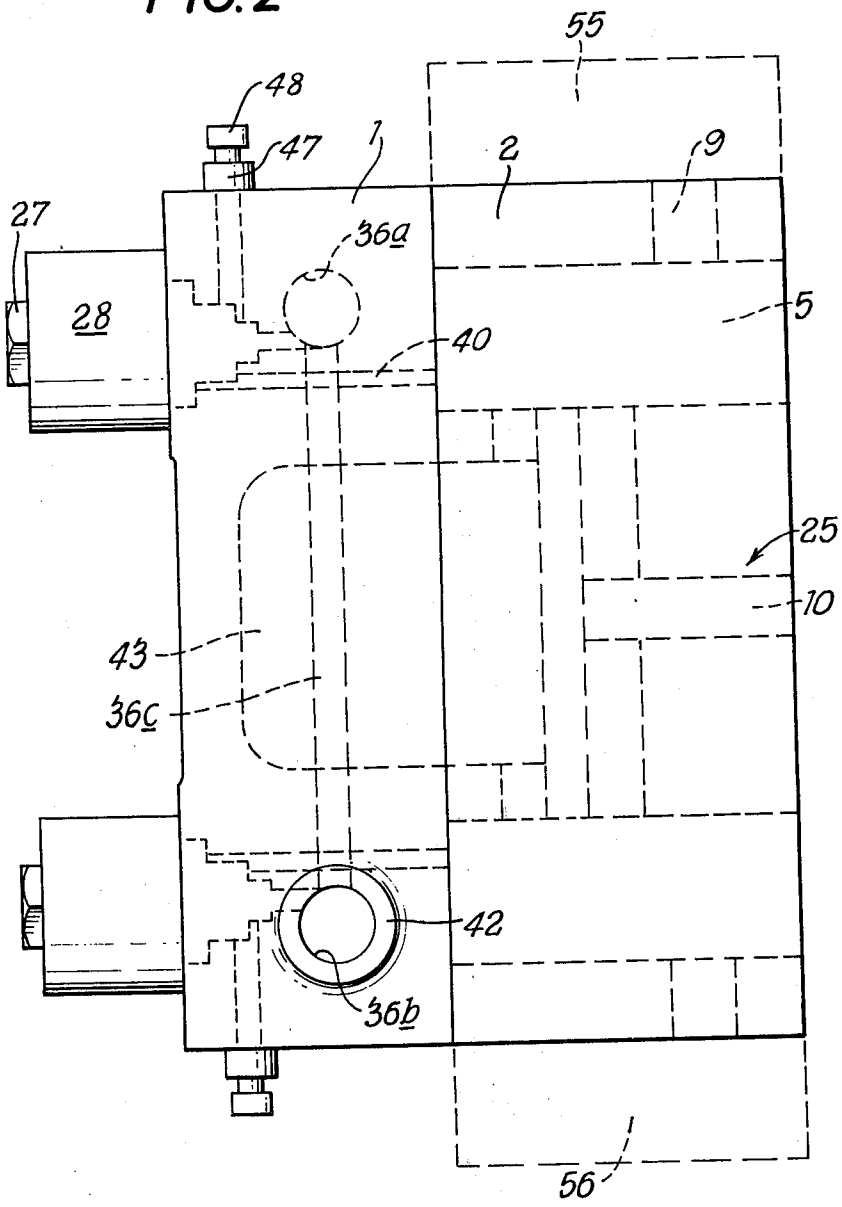


FIG. 2A

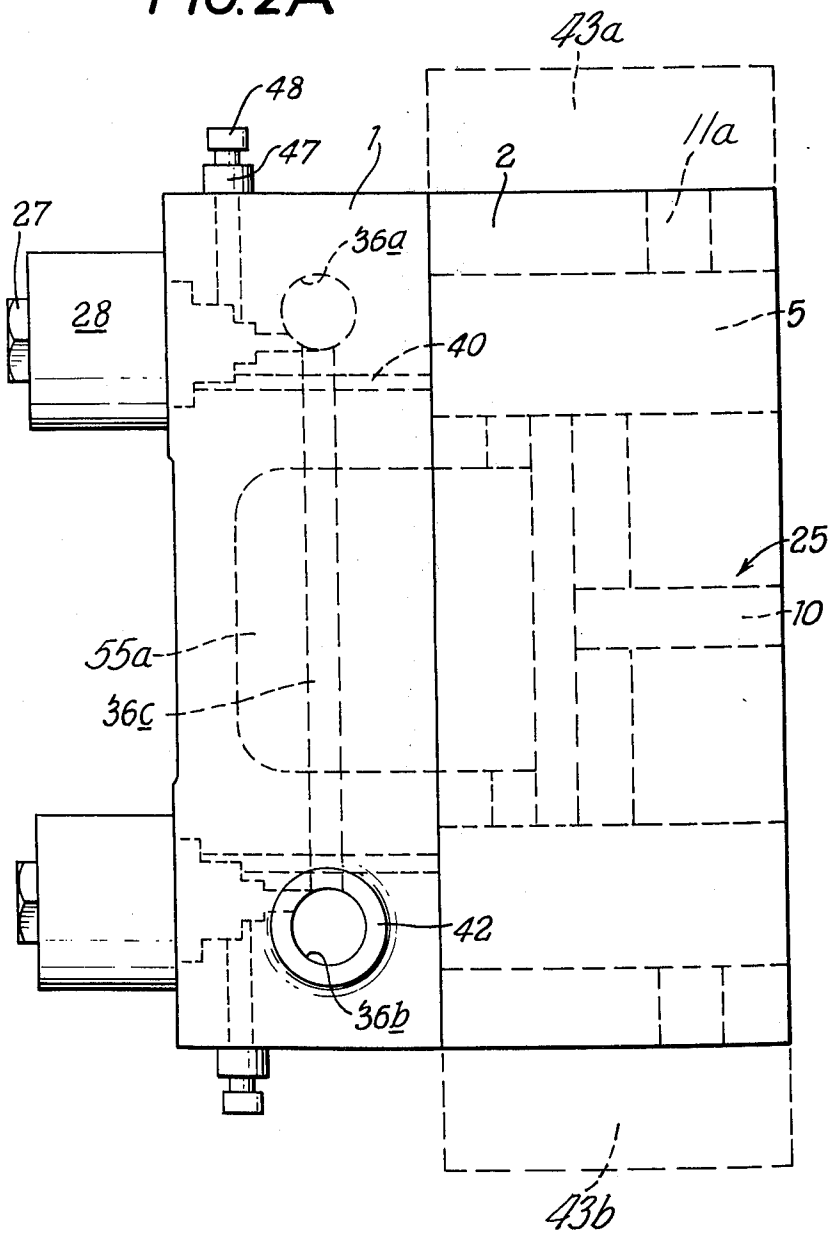


FIG.3

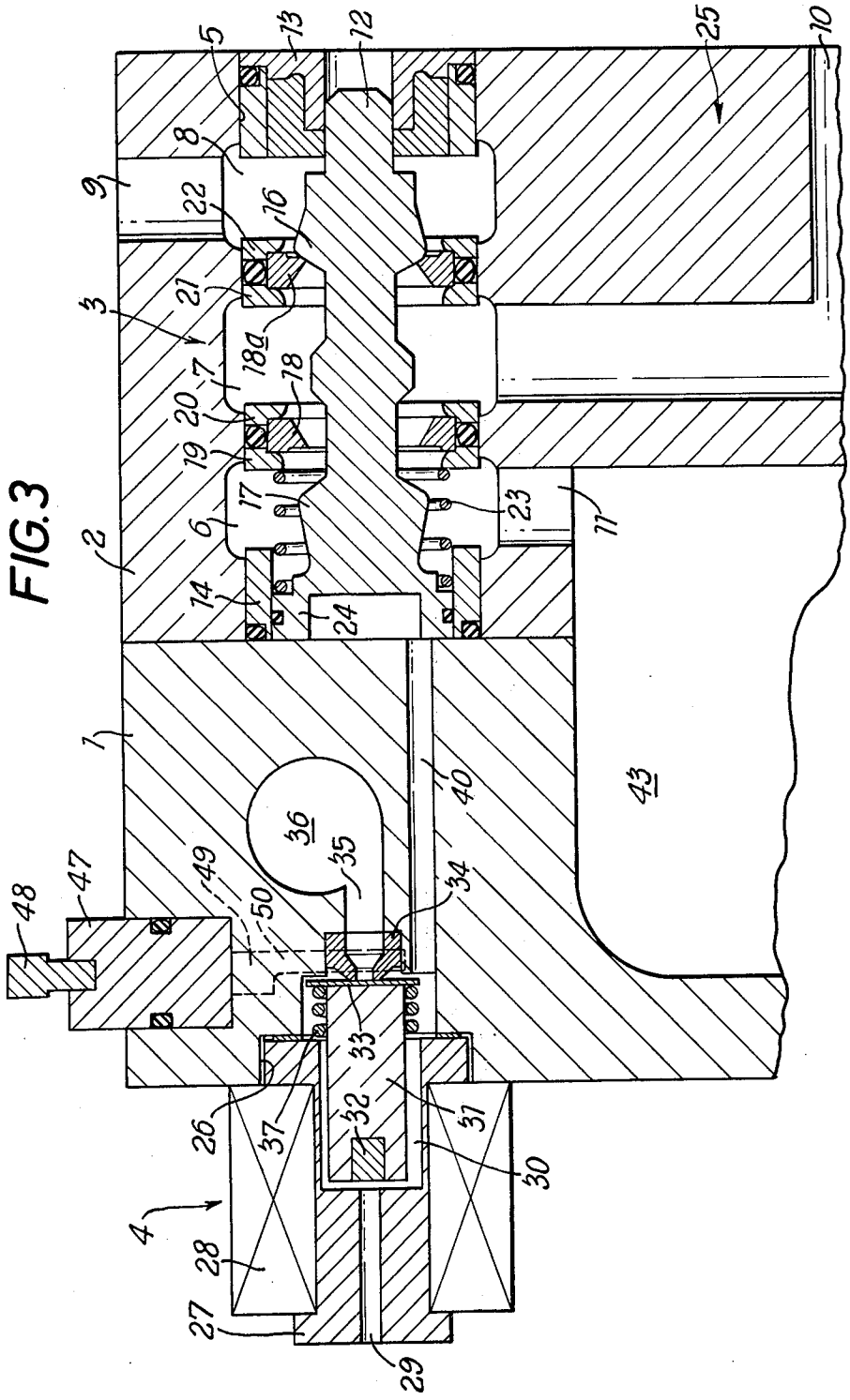
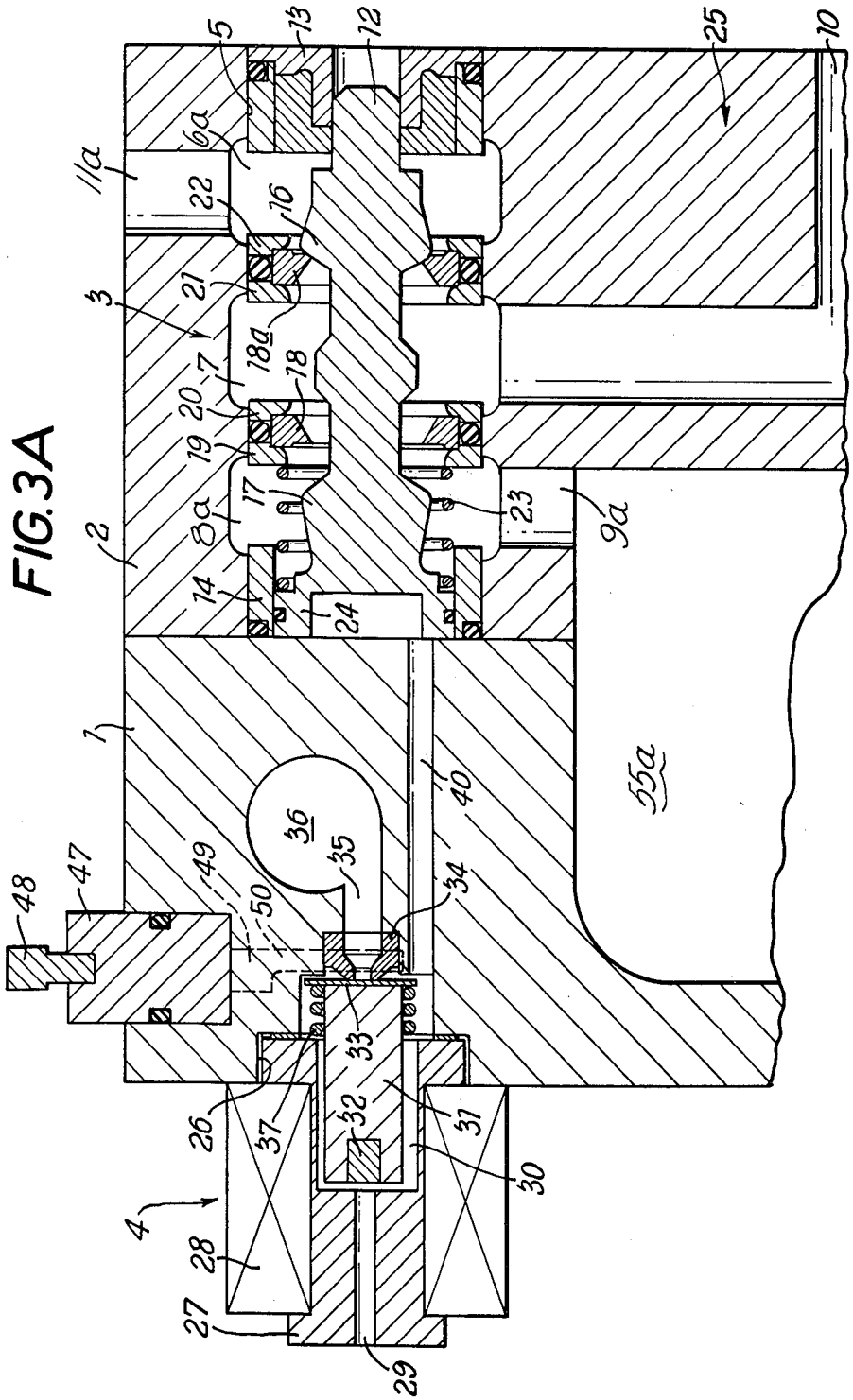

1
2
3
4
5
6
7
8
9
10
11
12
13
14
16
17
18
18a
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
40
43
47
48
49
50

FIG. 3A


5
13
12
25
10
11a
6a
22
16
3
21
18a
18
7
20
19
17
8a
2
14
24
23
9a
1
55a
40
36
35
34
47
48
49
50
33
32
37
31
30
26
4
28
27
29

VALVE BLOCK

This is a continuation of application Ser. No. 369,693, filed June 13, 1973, now abandoned.

BACKGROUND OF THE INVENTION

This invention relates to valve blocks and particularly to valve blocks incorporating a set of pneumatic valves for controlling the operation of a Hartford IS Glassware Forming Machine.

Conventional IS Glassware forming machines comprise one or more sections in each of which one, two or three gobs of molten glass are formed into bottles or other glassware by handling apparatus which is operated pneumatically. Each part of the handling apparatus which carries out a separate step in the formation of the ware from the glass gobs is controlled by a pneumatic valve, and normally 19 or 21 separate valves are required to control the complete forming sequence. Each valve is conventionally operated by a separate lever and latch system and each lever and latch system is controlled by a respective rotatable and adjustable cam. All the cams are normally housed together on a timing drum in a space some 21 inches wide, the width of this space being the widest part of the section of the machine.

In the development of an electronic control for an IS glassware forming machine in which the operation of the pneumatic valves is controlled by solenoid valves rather than cams and latch and lever systems, we have encountered the problem of incorporating all the 21 pneumatic valves and their associated solenoids in the relatively narrow space normally occupied by the lever and latch system, and in such a way that the existing mechanical valve operating system can be removed and replaced by the solenoid valves quickly and easily.

SUMMARY OF THE INVENTION

We have found that, if the valves are arranged in two rows in a single valve block which also contains at least one common plenum chamber communicating with all the supply or exhaust ports of the pneumatic valves, the resulting valve block is very compact and can easily be incorporated into the available space in an IS glassware forming machine.

The valves which we propose to use in our electronically controlled glassware forming machine are pneumatic valve combinations. Each valve combination includes a pilot-operated poppet valve which is controlled by pilot air directed to the poppet valve by a solenoid-operated pilot valve. Accordingly, the present invention provides a valve block for an IS glassware forming machine comprising a plurality of valve combinations arranged in two rows, each valve combination comprising a pilot-operated poppet valve having a supply port, an outlet port and an exhaust port and a solenoid-operated pilot valve for directing pilot air to the poppet valve, a pilot line in the valve block common to the pilot valves on all the valve combinations and a plenum chamber located adjacent all the valve combinations and common to either all the exhaust ports or all the supply ports of all the poppet valves.

Preferably, the valve block includes two further plenum chambers each associated with either the exhaust ports or the supply ports of each of the poppet valves in respective ones of the rows of valve assemblies.

In one embodiment of the invention, the plenu chamber located adjacent all the valve combinations a common exhaust chamber which is located betwee the two rows of valve combinations. In accordance wit this embodiment of the invention, therefore, there provided a valve block comprising a plurality of pne matic valve combinations arranged in two rows, eac valve combination comprising a pilot-operated popp valve having a supply port, an outlet port and an e haust port, and a solenoid-operated pilot valve for d recting pilot air to the poppet valve, a pilot line in th valve block common to the pilot valves of all the valv combinations, and an exhaust chamber located b tween the two rows of valve combinations and commo to the exhaust ports of all the poppet valves. Not onl does this valve block fit easily into the space availabl on the IS machine, but also, the arrangement of th valve combinations and exhaust chamber renders th operation of the valve block surprisingly quiet.

This embodiment of the valve block may be mad even more compact by providing an outlet manifol which communicates with the outlet ports of all th poppet valves and locating the outlet manifold betwee the two rows of valve combinations.

BRIEF DESCRIPTION OF THE DRAWINGS

In order that the invention may be better understoo a preferred embodiment thereof will now be describe by way of example only and with reference to the ac companying drawings, in which:

FIG. 1 is a front elevation of a preferred embodimer of a valve block in accordance with this invention:

FIG. 1A is a front elevation of another embodimer of a valve block in accordance with this invention;

FIG. 2 is a side elevation of the valve block of FIG. 1

FIG. 2A is a side elevation of the valve block of FIC 1A;

FIG. 3 is a part cross-section of the valve block c FIGS. 1 and 2 taken along the line A-A of FIG. 1;

FIG. 3A is a partial cross-section of the valve block c FIGS. 1A and 2A taken along the line A—A of FIC 1A.

DETAILED DESCRIPTION OF THE INVENTION

The drawings show a valve block which is made up c two castings, 1 and 2, in which are located 21 pne matic valve combinations. The valve combinations e tend laterally across the valve block, as best shown i FIGS. 2 and 3, and are arranged in two rows which e tend longitudinally along the valve block. The upp row includes 11 valve combinations, and the lower ro includes 10 valve combinations, the valve combinatio in each row being vertically offset from each other. Th castings 1 and 2 define an exhaust chamber 43 which located between the two rows of valve combinatior and which is provided with an outlet 44 to the atm sphere.

All the valve combinations are identical and one c the valve combinations is shown in detail in FIG. 3. Th valve combination shown comprises a pilot-operate poppet valve located in the casting 2 and indicated ge erally by the reference numeral 3, and a solenoi operated pilot valve located in the casting 1 and ind cated generally by the reference numeral 4. The popp valve 3 is located in a bore 5 in the casting 2. The bo 5 is provided with three enlarged annular portions 6, and 8. The annular portion 8 is connected to a suppl port 9 in the casting 2. Annular portion 6 is connecte

to an exhaust port 11 in the casting 2 which communicates with the exhaust chamber 43, exhaust chamber 43 being common to all the exhaust ports of the 21 poppet valves in the valve block. Annular portion 7 is connected to one of 21 outlet ports 10 arranged in one row in an outlet manifold 25 defined in the central portion of the casting 2 between the two rows of valve combinations adjacent the exhaust chamber 43. It will be appreciated that the arrangement of the outlet ports in a single row enables the outlet ports to be connected directly to the existing supply lines of the pneumatic cylinders of a conventional IS glassware forming machine.

A piston 12 is located within the bore 5 by glands 13 and 14 and is provided with two enlarged portions 16 and 17. Two abutment rings 18 and 18*a* are carried and located within the bore 5 by fixed support rings 19, 20, 21 and 22. A spring 23 acts between an enlarged end portion 24 of the spool 12 and the support ring 19 and biases the spool to the left of the bore 5, as shown in FIG. 3, into a position in which the enlarged portion 16 of the spool 12 abuts with the abutment ring 18*a*.

The pilot valve 4 is solenoid-operated and is effective to direct pilot air from a pilot air line 36 in the casting 1 of the valve block into the poppet valve 3 in order to operate the valve. The pilot line 36 is common to each of the pilot valves in the 21 valve combinations and is shown more clearly in FIG. 1 of the drawings in broken lines. The pilot line 36 is fed with air under pressure from an inlet 42 on one side of the valve block and has two branches 36*a* and 36*b*, one for each of the rows of valve combinations, the branches being connected by a cross-bore 36*c*.

Referring particularly to FIG. 3, the pilot valve 3 includes a bobbin 27 which is threaded into an aperture 26 in the casting 1 and which carries the windings of a solenoid coil 28. The bobbin 27 is provided with an axial bore 29 which communicates with an enlarged axial recess 30 in the inner end of the bobbin 27. The recess 30 receives a cylindrical core 31 of magnetisable material. One end of the core 31 includes a rubber seal 32 which can abut with and seal the inner end of the bore 29 in the bobbin 27. The other end of the core 31 carries a disc 33 which is shown in FIG. 3 in abutment with a rubber mouthpiece 34 received in one end of an inlet 35 which communicates with the pilot line 36. A spring 37 acts between the disc 33 and the bobbin 27 and biases the core 31 into engagement with the mouthpiece 34 and thereby seals the inlet 35. A bore 40 connects the aperture 26 with the bore 5 in the casting 2.

All the pilot valves are operated in response to energisation of the solenoids in accordance with a programme of electronic control signals supplied to the solenoids of the valve block by an electronic timing control unit (not shown). In the position of the pneumatic valve combination shown in FIG. 3, the solenoid 28 is de-energized and the core 31 is biased to the right by the spring 37, and the disc 33 on the core 31 abuts the mouthpiece 34 and seals the outlet 35 from the pilot line 36. Any pilot air which does escape past the mouthpiece can pass into the recess 30 in the bobbin 27, through the axial bore 29 and into the atmosphere. The spool 12 of the poppet valve is biased to the left as shown in FIG. 1, so that the enlarged portion 16 is in sealing engagement with the abutment ring 18*a* and, therefore, prevents passage of pressurized air from the inlet port 9 through the poppet valve.

When the solenoid 28 is energized, the core 31 is drawn into the recess 30 against the bias of the spring 37 so that the seal 32 covers the inner end of the bore 29 and so that the disc 33 on the core 31 simultaneously uncovers the mouthpiece 34 of the inlet 35. Pilot air then flows from the pilot air line 36 along the bore 40 in the casting 1 and into the bore 5 in the casting 2 which contains the poppet valve 3. As a result of the pressure of the pilot air, the spool 12 is moved to the right, as seen in FIG. 3, against the bias of spring 23, until the enlarged portion 17 engages with the abutment ring 18. Pressurized air can then flow from the inlet port 9 into the enlarged portion 8 of the bore 5, through the abutment ring 18*a*, into the enlarged portion 7 and out of the outlet 10 in the manifold 25. This outlet is connected to an operating cylinder of one part of the handling apparatus of the glassware forming machine and the said one part therefore operates for as long as the solenoid 28 is energized.

When the solenoid 28 is de-energized, the spring 37 moves the core 31 to the right, as seen in FIG. 3, until the disc 33 is again brought into engagement with the mouthpiece 34 and thereby cuts off any further flow of pilot air through the inlet 35 and thence into the bore 5. Pressure in the bore 40 is relieved by the simultaneous opening of the axial bore 29 by the seal 32 and the spring 23 then moves the spool 12 to the left, as seen in FIG. 3, into the position shown in FIG. 3, so that air under pressure can no longer flow from the inlet 9 to the outlet 10. In addition, air under pressure in the outlet 10 and in the operating cylinder of the part of the handling apparatus of the glassware forming machine to which the outlet 10 is connected can exhaust through the enlarged portion 7 of the bore 5, the abutment ring 18 the enlarged portion 6 of the bore 5, and the exhause port 11 into the exhaust chamber 43.

Each of the pilot valves includes an override device 47 which is manually operable. As shown in FIG. 3, this device comprises a cylindrical barrel 47 which carries at one end a lever 48 which can be grasped by an operator and at its other end a co-axial cylindrical shank 49 of smaller diameter. This shank 49 has a semi-cylindrical extension 50, the planar surface of which is located immediately adjacent the disc 33 of the core 31. Rotation of the barrel 47, about an axis in the plane of FIG. 3 and perpendicular to the direction of movement of the core 31, brings the extension 50 of the shank 49 into engagement with the disc 33 and, therefore, moves the core 31 to the left, as seen in FIG. 3, so that the seal 32 covers the bore 29 and so that pilot air can pass along the bore 40 to operate the poppet valve 12.

Whilst it is preferred to use manual override devices in the valve block of the present invention, it is envisaged that pneumatic override devices may be incorporated in the valve block. Such a device could, for example, comprise a three-way tap, one port of which is connected to the bore 29 in the bobbin 27, another port of which is connected to atmosphere and another port of which is connected to the pilot air line 36. In its normal operating position, the tap of the override device would effect communication between the bore 29 and the atmosphere. In its override position, the tap would direct air at pilot air pressure along the bore 29 into the recess 31 and along bore 40 to operate the poppet valve 3.

In the valve block shown in the drawings, the inlet ports 9 of the poppet valves 3 are connected individually to a supply of air under pressure. If desired, however, a pair of supply chambers 55, 56 can be provided

on the valve block, as indicated by the broken lines in FIG. 2. Each supply chamber is located adjacent a respective one of the rows of valve combinations and is separated from the exhaust chamber 43 by its associated row of valve combinations.

The arrangement of valve combinations, exhaust chamber, pilot line and outlet manifold in the valve block described above is particularly compact, in all three dimensions, and can be located in the space normally occupied by the latch and lever systems used to operate conventional IS glassware forming machines, without requiring extensive rebuilding of the glassware forming machine. Consequently, the valve block can be used as a "conversion unit" in the replacement of the conventional mechanical timing system on an existing IS machine with an electronic timing system. In addition, in view of the fact that the two castings 1 and 2 in which the valve combinations are located define an exhaust chamber which is large in comparison with the overall size of the valve block, the noise generated by the exhausts of the 21 valves in the valve block during operation of the valves is very low.

In an alternative embodiment of the invention shown in FIGS. 1A, 2A and 3A, the plenum chamber common to all the valve combinations is an air supply chamber 55*a* which communicates with all the supply ports 9*a* of the poppet valves. In one suitable arrangement for such a valve block the two rows of valve assemblies which are parallel are located in a segment, or slice, of the valve block parallel to one face of the block, the valve combinations in each row extending in opposite directions from a center line along the segment of the block, and the common supply chamber 55*a* is located in an adjacent segment or slice of the block to one side of the valve combinations and has an inlet 57.

A preferred arrangement in this embodiment of the invention includes two further exhaust plenum chambers 43*a* and 43*b* each associated with the outlet ports 11*a* of the poppet valves in respective ones of the rows of valve combinations, and both located in the same segment of the valve block as the supply plenum chamber. Up to 24 valve combinations can be incorporated into a valve block of this construction in two rows of 12, the valve combinations in each row being aligned with each other rather than being offset from each other.

This embodiment of the valve block may also be provided with an outlet manifold 25 common to the outlet ports 10 of all poppet valves and located adjacent the valve combination on the side of the block remote from the plenum chambers.

We claim: a

1. A valve block for an I. S. glassware forming machine comprising a plurality of valve combinations arranged in two rows, each valve combination comprising a pilot-operated poppet valve having a supply port, an outlet port and an exhaust port and a solenoid-operated pilot valve for directing pilot air to the poppet valve, a pilot line in the valve block common to the pilot valves on all the valve combinations, a first plenum chamber located adjacent all the valve combinations and in fluid communication with the exhaust ports of all said poppet valves, said first plenum chamber being sufficiently large relative to each exhaust port such that the opening of one of said exhaust ports of one of said poppet valves to admit exhaust air to said first plenum chamber does not result in a large fluctuation in the pressure of the air in the exhaust chamber, and a pair of supply plenum chambers each mounted adjacent a respective one of the rows of valve combinations and separated from said first plenum chamber by the associated row of valve combinations, each supply chamber being in fluid communication with the supply ports of the poppet valves of the valve combinations in its associated row.

2. A valve block as defined in claim 1, wherein the two rows of valve combinations are located in a segment of the block which extends parallel to one face of the block, the valve combinations in the two rows extending in opposite directions from a center line along said segment, and said first plenum chamber is located in an adjacent and parallel segment of the block.

3. A valve block as defined in claim 1, wherein said first plenum chamber is disposed between said two rows of valve combinations.

4. A valve block as defined in claim 3, additionally comprising an outlet manifold in fluid communication with the outlet ports of all the poppet valves and disposed between the two rows of valve combinations.

5. A valve block for an I. S. glassware forming machine comprising a plurality of pneumatic valve combinations each extending laterally across the valve block and arranged in two rows which extend longitudinally along the valve block and are separated vertically from each other, each combination comprising a poppet valve having a supply port, an outlet port and an exhaust port and a solenoid-operated pilot valve for directing pilot air to the poppet valve, a pilot line in the valve block common to the pilot valves of all the valve combinations, a supply plenum chamber disposed between the two rows of valve combinations and common to the supply ports of all the poppet valves, said supply plenum chamber being sufficiently large relative to each supply port such that the opening of one of said supply ports of one of said poppet valves to supply air to said poppet valve does not result in a large fluctuation in the pressure of the air in the supply plenum chamber, an outlet manifold located adjacent the supply chamber between the two rows of valve combinations and communicating with the outlet ports of all the poppet valves, and a pair of exhaust chambers, each mounted adjacent a respective one of the rows of valve combinations and separated from the supply chamber by the associated row of valve combinations, each exhaust chamber being in communication with the exhaust ports of the poppet valves of the valve combinations in its associated row.

6. A valve block for an I. S. glassware forming machine comprising a plurality of pneumatic valve combinations each extending laterally across the valve block and arranged in two rows which extend longitudinally along the valve block and are separated vertically from each other, each combination comprising a poppet valve having a supply port, an outlet port and an exhaust port and a solenoid-operated pilot valve for directing pilot air to the poppet valve, a pilot line in the valve block common to the pilot valves of all the valve combinations, an exhaust chamber located between the two rows of valve combinations in fluid communication with the exhaust ports of all the poppet valves, said exhaust chamber being sufficiently large relative to each exhaust port such that the opening of one of said exhaust ports of one of said poppet valves to admit exhaust air to said exhaust chamber does not result in a large fluctuation in the pressure of the air in the exhaust chamber, an outlet manifold located adjacent the exhaust chamber between the two rows of valve combi-

nations and in fluid communication with the outlet ports of all the poppet valves and a pair of supply chambers, each mounted adjacent a respective one of the rows of valve combinations and separated from the exhaust chamber by the associated row of valve combinations, each supply chamber being in fluid communication with the supply ports of the poppet valves of the valve combinations in its associated row.

7. A valve block as defined in claim **6**, wherein the valve combinations in the two rows are vertically offset from each other.

8. A valve block as defined in claim **6**, wherein each pilot valve includes an override device.

9. A valve block as defined in claim **8**, wherein said override device is a manually operable override device.

* * * * *