United States Patent

Botnick

[15] **3,635,252**

[45] **Jan. 18, 1972**

[54] PUSHBUTTON-OPERATED SLIDING PLATE MIXING VALVE

[72] Inventor: **Irlin H. Botnick,** 3155 Kersdale Road, Pepper Pike, Ohio 44124

[22] Filed: **Aug. 22, 1969**

[21] Appl. No.: **852,200**

[52] **U.S. Cl.** **137/637,** 137/606, 251/176

[51] **Int. Cl.** **F16k 11/20**

[58] **Field of Search** 137/637, 637.1, 606; 251/176, 251/193, 326

[56] **References Cited**

UNITED STATES PATENTS

369,134	8/1887	Stevenson	251/176
828,280	8/1906	Firey	251/176
3,192,952	7/1965	Botnick	137/637 X
3,353,452	11/1967	Beck et al.	137/637.1 X
3,370,609	2/1968	Botnick	251/121 X

Primary Examiner—M. Cary Nelson
Assistant Examiner—Richard Gerard
Attorney—Ely, Golrick & Flynn

[57] **ABSTRACT**

Captive in two open-top rectangular-section through-bores between a central wall and end walls in a valve body block, two similar sets of ceramic hard smooth plates as valving subassemblies each include stationary port plates, one resilient gasket sealed to central wall hot and cold supply and discharge passages and a second intermediate port plate, a stationary bias plate, and also pushbutton shifted movable plates alternatingly sandwiched between, held in sliding sealing face contact with, and apertured or ported for cooperation with the stationary plates to select four respective temperatures and flow of discharged water; throttling plugs included in the central wall presetting two mixed flow temperatures between the supply temperatures. Variants of the shiftable plate assemblies are disclosed.

24 Claims, 13 Drawing Figures

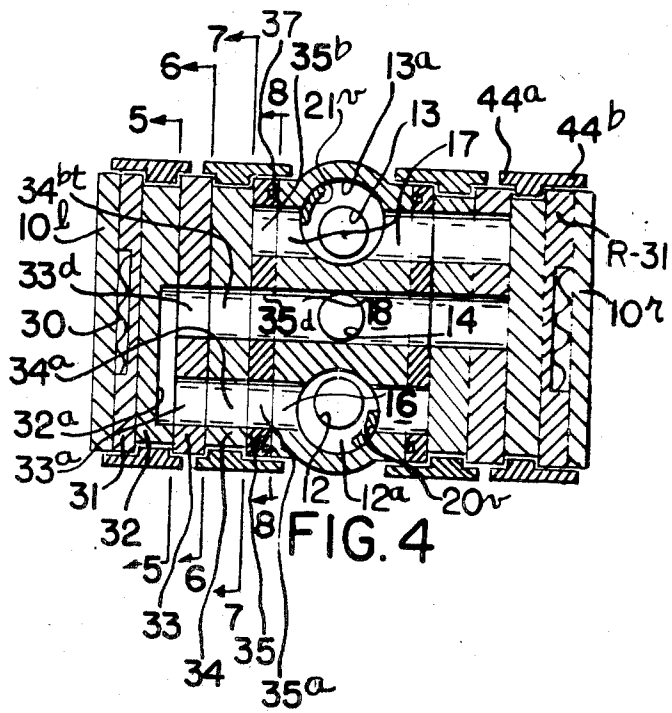


FIG. 4

PATENTED JAN 18 1972

3,635,252

SHEET 1 OF 2

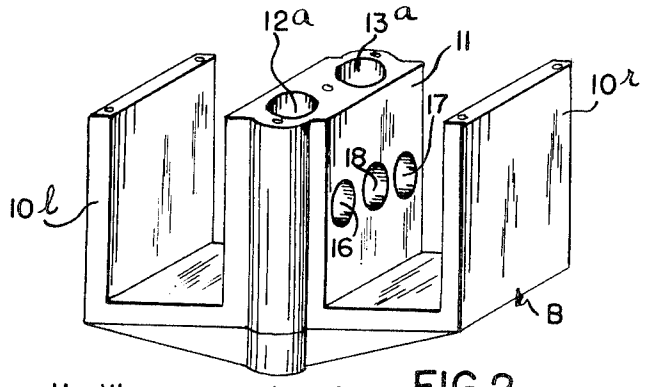


FIG. 2

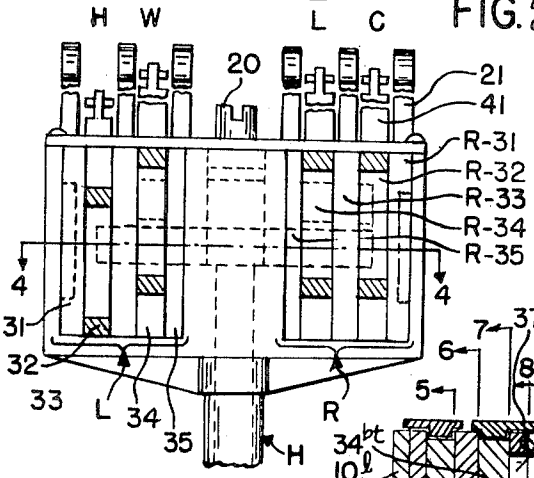


FIG. 3

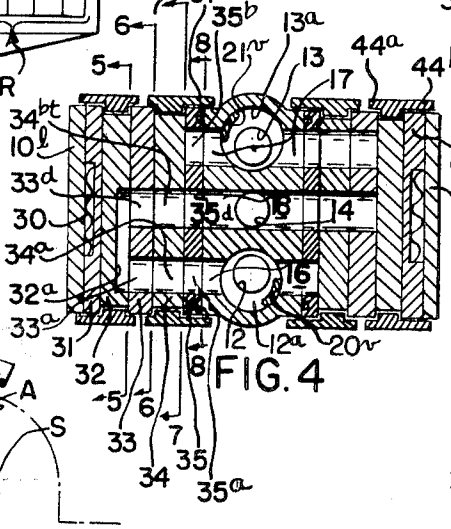


FIG. 4

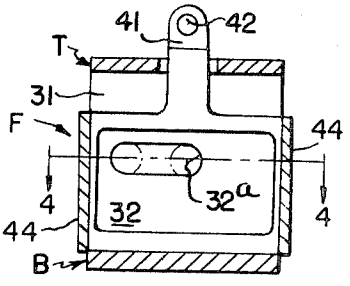


FIG. 5

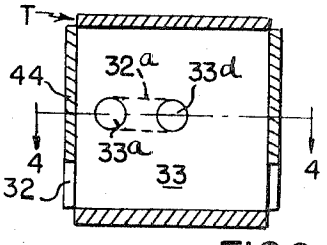


FIG. 6

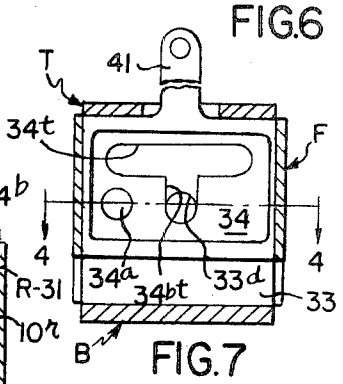


FIG. 7

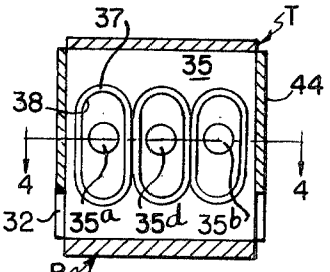


FIG. 8

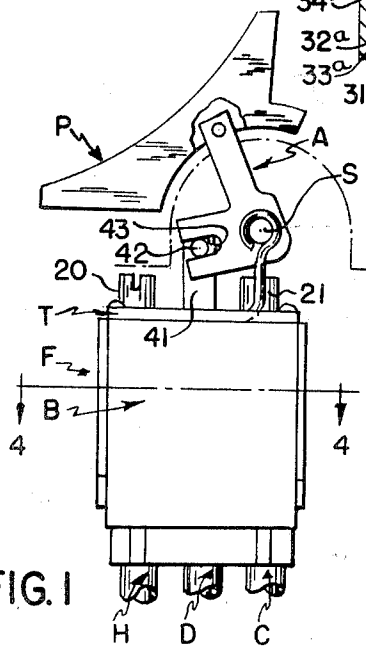


FIG. 1

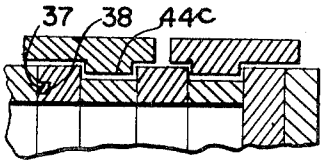


FIG. 9

INVENTOR
IRLIN H. BOTNICK
BY
Ely, Dolnick & Flynn
ATTORNEYS

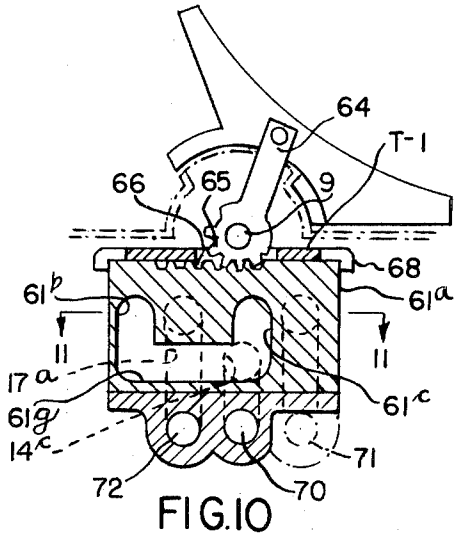


FIG.10

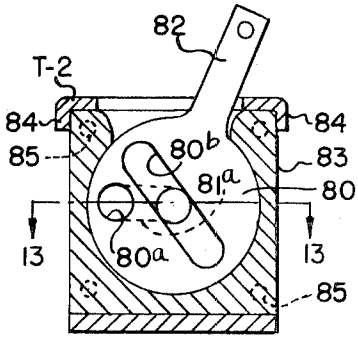


FIG.12

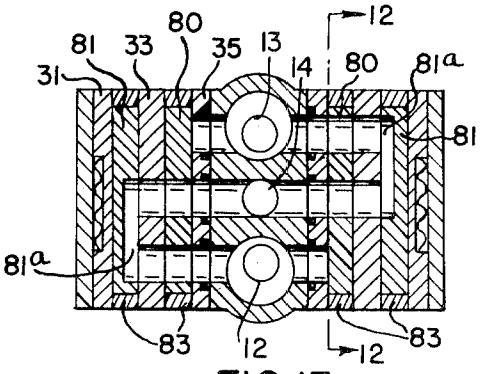


FIG. 13

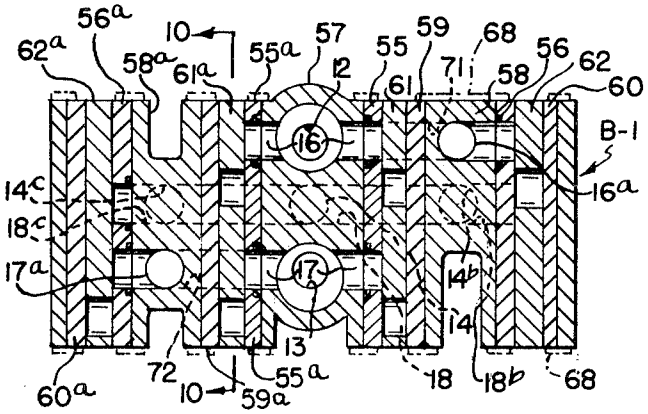


FIG.11

INVENTOR
IRLIN H. BOTNICK
BY
Ely, Golrick & Flynn
ATTORNEYS

PUSHBUTTON-OPERATED SLIDING PLATE MIXING VALVE

Various types of mixing valves or faucets have hitherto been proposed in the prior art to deliver in desired volume hot water or cold water at supply temperatures, or a mixed water flow at some intermediate temperature or temperatures by user selection and positioning of a valve operator; some being pushbutton operated, but the majority being operated by a single lever or single knob.

However, so far as known to the applicant, these prior art devices have labored under various disadvantages; not least of all in requiring at least one, in some cases several well-machined main body bores to receive the valving elements or mechanism controlling water flow to and from ports into such bores. Thus the fabrication of a main body for such devices has required not only the casting of a body, often with complex coring, but also subsequent machining of many important surfaces, especially bores or chambers. Further most of such valves also have required multiple O-rings, diaphragms, or other such sealing devices.

It is an object of the present invention to provide a mixing faucet or valve, which may utilize a quite simple body casting form, wherein required passages or spaces for liquid flow or for receiving operating elements or assemblies are readily provided basically in required form in a body as cast, with minimum machining thereafter required; and further with machining entailed being basically noncritical in character or dimensioning. Another object is to provide a valve structure which minimizes sealing by devices such as O-fings, packing and the like, particularly between elements which are continually being moved in day-to-day use.

Another disadvantage of many mixing valves is the reliance upon camming elements incorporated in valving mechanism within the valve body. It is a further object of the invention to eliminate camming surfaces in the valve operators apart from a simple-pin-and-slot connection exterior of the body.

These objects of the invention are here attained by the utilization of cooperating, ported, smooth flat hard-faced plate-type valving elements, in part known to the prior art, but here incorporated in a novel arrangement wherein their mutual disposition, mode of cooperation and their manner of assembly into the valve body allow simplification of the body casting and its fabrication, and eliminate sliding seals through O-rings, gaskets and the like between frequently moved surfaces. The valve structure further provides for quick and ready assembly of the valve in initial fabrication, as well as disassembly and reassembly in the unlikely event of need to service the sliding plate elements.

A particular embodiment of the invention, as well as other objects and advantages will appear from the following description and the drawings wherein:

FIG. 1 is a right-end view of one form of valve embodying the present invention;

FIG. 2 is a perspective view of the valve body casting;

FIG. 3 is a front elevational view of the valve with pushbutton operators removed, but with certain portions broken away for clarity of representation;

FIG. 4 is a horizontal section taken along the line 4—4 in FIG. 3;

FIGS. 5, 6, 7 and 8 are successive vertical sections taken along the lines 5—5, 6—6, 7—7, 8—8 in FIG. 4;

FIG. 9 is a fragmentary enlarged detail of the section appearing in FIG. 4;

FIGS. 10 and 11 are vertical and horizontal sections of a first modification, FIG. 11 being taken similar to FIG. 4; and

FIGS. 12 and 13 are vertical and horizontal sections of a second modification.

From FIGS. 1, 2 and 3 showing the general valve organization, it is seen to comprise, as principal components, a symmetrical body casting B (FIG. 2) of a generally blocklike shape with two broad rectangular slots; like valving element subassemblies, R in the right and L in the left slots, each including stationary plates and movable plates held in shiftable frames F; valving element retaining plate T screw-secured as a top on the body; and a parallel array of four pushbuttons P each through a respective pushbutton-supporting rocker arm A having a pin-and-slot engagement with a shiftable plate frame; the arms A being pivotally mounted and spaced on a shaft S passing through knuckles formed on legs upwardly struck from the plate T. Attention is called to the fact that the valve is shown as for hot water selection, in full "on" setting.

From casting bottom connection formations appropriate to the hot and cold water supply piping H and C and discharge pipe D (see FIG. 1), and in the longitudinal vertical center plane of the center wall 11, there extend vertical hot water and cold water inlet passages 12, 13, and discharge passage 14 (see FIGS. 2 and 4) intersecting near wall midheight corresponding horizontal bores 16, 17 and 18 each opening on each side into the plate subassembly receiving slots or spaces defined by the two body end walls 10*r* and 10*l* and the center wall. The piping H, C, D may, for example, be lengths of tubing permanently factory brazed into the body and intended to be connected to roughed-in plumbing or supply lines and to a sink spout by suitable couplings. The inlet bores 12 and 13, from the horizontal bores upwardly are enlarged into slightly offset bores 12*a*, 13*a* for temperature setting plug elements 20, 21.

In each of identical temperature setting devices 21 (warm) and 20 (tepid), a simple cylindrical plug circumferentially grooved for an O-ring sealing to the bore wall above the level of the horizontal passage has an end-slotted stem, as shown in FIG. 1 projecting through an aperture in and retained by the plate T, and a respective downward vane 20*v* or 21*v*, a local continuation of the cylindrical surface, displaceable into and out of, and thus determining the effective flow area through, one or the other half of the respective horizontal bore as indicated in FIG. 4.

Since the two plate subassemblies L and R are identical, each comprising three stationary plates 31, 33, 35 and alternating therebetween two movable plates 32, 34 in respective frames F, detailed description is given only for the left plate subassembly L, to which correspond the FIGS. 5–8 inclusive. The plates in the right set will be designated in description by the same reference numerals as those of the left, with, however, the prefix R where necessary to distinguish them. The stationary plates have height dimensions corresponding to the slot vertical depth, and longitudinal dimensions corresponding to the horizontal (front to back) length of the slot, that is, of the horizontal length of the walls of the body. The plates 32, 33, 34, 35 and preferably also 31 are made of hard, wear- and corrosion-resistant material, adapted further to receive a lapped flat surface finish; for example, a ceramic material such as alumina. Each set or subassembly is receivable from above into the respective slot and is therein held captive vertically between the top plate T and the slot bottom, endwise between the center wall and the respective slot end wall, and in the other lateral direction by an interlocking function of the frames F to be described.

As viewed from the front reading from left to right (accommodating to the conventional two-faucet disposition with hot water faucet at the left and cold on the right of a sink,) the pushbutton sequence in the array is hot, warm, lukewarm (tepid), and cold; as indicated by H, W, L, and C in FIG. 3 for elements operated by such pushbuttons, the latter not there appearing.

The outer vertical face of the outer end plate 31 adjacent wall 10*l* is recessed to receive a biasing pressure wave spring 30 reacting against the end wall as one, or part of, bias means providing a normal force for maintaining the plates in sealing relation, and its parallel inner face is finished quite smooth as a cooperating supporting sliding face for the next and movable "hot" control plate 32, somewhat loosely maintained in its hollow frame F.

At least the cooperating hard contacting faces of 32 and 33, of 33 and 34, and of 34 and 35 are lapped to a highly smooth flat finish whereby these pairs of contacting faces, under the normal forces developed by washer 30 and the hereinafter

described compressed resilient gasket 37, are in an effective watertight sealing contact. The innermost stationary plate 35 has three through-ports 35*a*, 35*d* and 35*b* aligned with the left ends of 16, 18 and 17 and thereto sealed by respective oval gaskets 37 (which may be one integral gasket) received in grooving 38 on the right face of 35, so that the ports of 35 in effect become the ports through which the cold and hot inlets and discharge passage of the central wall open to the left.

The intermediate stationary port plate 33 has but two ports, 33*d* at the center and 33*a* (at the left as seen in FIG. 6) in alignment axially with 35*d* and 35*a* and therefore with 18 and 16. A horizontal groove at 32*a* in the right face (as viewed in FIG. 4) of plate 32 (see also FIG. 5) extends from the center into its upper left quadrant for the span of 33*d*—33*a* (i.e., 18, 16) so that with 32 up in "off" position, the face of 32 in sealing contact over those ports blocks off communication therebetween; but establishes such communication in increasing degree as 32 moves down.

The second shiftable plate 34, is similar to 32 in size, shape and disposition in its frame F, but with a different porting form as appears from FIG. 7; namely, a simple round through-port 34*a* in its lower left quadrant aligned when in uppermost position with the hot inlet horizontal ports 35*a* and 16, and a lower central through-port similarly aligned with the discharge ports 35*d* and 18, represented by the bottom end of the short vertical leg 34*bt* of a T-slot having its horizontal elongated transverse slot or top cross section 34*t* in the top half of plate 34 and in dimension spanning the spacing of all three of the horizontally spaced ports 35*a*, 35*d*, 35*b*, i.e., of 16, 18, 17; the T porting here optionally being either a right face groove (as viewed in FIG. 4) above the level of the central through-port, or a T-shaped slot or aperture entirely through the plate. In any event with "warm" plate 34 in uppermost or "off" position as shown in the drawings, the hot water inlet port 16 and discharge port 18 are thus carried to the left through 35, 34 and 33 in the plate assembly, so that hot water selection and control is available by vertical downward movement of plate 32 in increasing flow.

On the other hand with plate 32 in its uppermost or "off" position, "warm" water mixture is available in increasing amounts as plate 34 descends, its T-port or slot being always in communication with discharge 14 through 18 and 35*d*, as the top portion 34*t* of the T-slot increasingly simultaneously uncovers both the hot and the cold inlet ports 35*a* and 35*b* to the left of the wall.

With sections taken successively in the right plate assembly at locations analogous to those indicated at the left, but looking to the right end, the sections would have the same appearance as in FIGS. 5–8; but the outermost port of the intermediate plate R-33 and the corresponding lower outer port in R-34 would be respectively permanently aligned and alignable with the right branch of 17; R-32 then controlling cold water flow and R-34 lukewarm or tepid water flow.

The reaction forces developed by compression of the initial projection of the sealing or gasket elements 37 from their groove formation, and the similar force of the wave spring 30 in the plate 31, exert through the sandwiched or stacked plate assembly a biasing force which first keeps 35 sealed to the wall 11, and then keeps the cooperating lapped faces between disks or plates 32, 33, 34 and 35 in good slideable sealing contact. Moreover, with a slight relief of the surface of plate 35 between each port and the groove for gaskets 38, allowing particularly the supply water pressure to act thereagainst, further sealing force may be developed.

Plate 31 need not, but may be, of the hard material, nor need its face and the cooperating face of 32 be polished so highly smooth as the other contacting faces, and similarly the seal ring groove face of plate 35 need not be so highly finished, although the faces should be quite parallel for smoothness of operation and simplicity of seal maintenance.

Each frame F (see FIGS. 1, 3, 7 particularly) has an upward tang 41 with a transverse pin 42 engaged in a slot 43 of one arm of its respective rocker arm; and the frame defines a generally rectangular hollow space for reception of the plate contained therein. The vertical dimension of the plate relative to the slot height is such as to allow the necessary vertical reciprocation for the action described; and preferably the top plate T and slot bottom serve as stops for the extremes of the off-on movements. The shiftable plates are smaller than the stationary plates (see especially FIG. 4), not only in the vertical but also in the horizontal dimension to allow sturdier frame sections while maintaining small valve dimensions.

Each of the vertical frame edges 44 has a short lateral flange 44*a* and also a wider flange projection 44*b*; the shorter 44*a* overlapping about half of an adjacent plate and the longer 44*b* overlapping an entire adjacent plate and partially over a vertical side marginal portion of a body end wall such as 10–1 where the frame for plate 32 is concerned, or of the wall 11 in the case of a frame for a plate 34. Further as shown more clearly in FIG. 9, there is a definite peripheral clearance, providing some degree of looseness of each movable plate with respect to its frame, also a similar clearance between the frame flanges and the stationary plates or body wall portions thereby overlapped. Furthermore the basic frame thickness represented by inward projection 44*c* at the sides and the top and bottom rails (actually embracing the movable plate) and its tang 41 is slightly less than the thickness of the contained plate, thereby to ensure there will be no interference with the compressive action engendered by the compressed seal or gasket 37 and the washer or wave spring 30 maintaining the lapped faces in sealing contact.

With all pushbuttons in the position shown for P in FIG. 1, that is, with all the movable frames and their plates drawn upward, the valve is entirely shut off. The totally off valve may be understood considering the condition in the right side of FIG. 4, which would also be the condition prevailing at the left if the valve were totally off. Although the ports 17 and 18 communicate through the stationary port plate R-35 and, through the ports of the first movable plate R-34, to the ports of stationary plate R-33, the latter two ports are blocked, sealed from each other by the upwardly displaced plate R-32 presenting a blank sealing wall; while, of course, passage 16 through 35*a* to the right is closed by the blank portion of R-34.

When the pushbutton either of the hot or cold valve plate is pressed downwardly toward the position shown for the hot water valve plate 32 in FIGS. 3, 4 and 5, the slot 32*a* thereof begins to overlap the ports 33*a* and 33*d* of the adjacent intermediate stationary port plate 33 by increasing amounts for increasing flow as the plate is moved further downward. The same thing would occur on the right-hand side for the cold water.

On the other hand, if the warm pushbutton is moved, the movable plate 34 in the left assembly is started on a downward shift; and as the cross slot portion 34*t* thereof begins to uncover the fixed plate ports 35*a* and 35*b*, mixed flow from both the hot and cold water inlets and ports ensues, going to the central discharge port 35*d* through the vertical bar 34*bt* and then into transverse passage 18 for discharge through the discharge line D; the increasing amounts of downward displacement increasing the flow.

It is noted that the port 35*d* is always in full communication with the T-slot in plate 34, so that the flow control is essentially dependent upon the uncovering of the ports 35*a* and 35*b*. In this case, since the warm water temperature presetting valve 21 has its vane 21*v* set to the left branch or half of the passage 17, while the tepid water temperature presetting valve 20 has its vane 20*v* set to the right, there is a partial throttling by 20*v* of flow from the cold water inlet 13 going to port 35*b*, while that from the hot water inlet 12 is unimpeded toward the left. With depression of the warm (left) plate 34, the higher rate of flow is readily available from the hot supply without throttling, whereby plug 21 throttling the cold is most aptly used for obtaining the high side of the warm intermediate temperatures.

Conversely 20 is used for establishing the lukewarm or tepid water (that is, low) temperature side of the intermediate tem-

perature range in mixed flow; and in similar fashion a mixing of cold and warm water in the tepid range, as may be preset, is obtained upon downward motion of the right movable plate R-34 by the tepid pushbutton.

With various modern methods, by virtue of the structure above described, the entire body B may be produced essentially in its necessary form as cast by appropriate coring for the passages 12, 12*a*, 13, 13*a*, 14, 16, 17 and 18, also for the rectangular slots, and machining is then required only to size the bottom inlet connection formations for the piping H, C and D; or possibly to size more precisely the bores 12*a*, 13*a* for receiving the temperature setting plugs. However, with particular casting practices light milling passes may be desirable to clean up flashing or other imperfections by way of projections or in the case of sand castings roughness on opposed wall or top surfaces. Holes for the retaining screws of plate T, of course, also have to be drilled and tapped in the top of walls 11 and 10*l*, 10*r*.

Although five different plates are used in the assembly, corresponding plates in the two assemblies are identical; the frames F are identical; and also the plug valves 20, 21; and this by virtue of the symmetry of the structure, keeping the number of part types to a minimum for the purpose intended.

With the body B finished, and with the tubes H, C and D brazed in place, each of the like assemblies of the plates and frames with springs 30 and gaskets 37 is slid in from the tops of the slots, with the long projections 44*b* of the frames of each assembly embracing the slot end wall and the adjacent center wall portion. The frames thus hold not only their respectively contained movable plates, but also embrace the outer edges of plates 31 and 35 wholly, two frames jointly embracing in intermediate stationary plate; so that the frames serve not only as means for vertically shifting or reciprocating their respective contained plates, but also to hold captive at the ends of the slots the stationary plates within the assembly, as well as each entire plate assembly in its slot.

With the regulator plugs and plates thus in place in the body, the top plate T is passed over the several tangs 41 and the plug stems, and screw-secured to the body. Thereafter the button rocker arms are placed between the knuckles and the shaft S inserted to complete the assembly. The pushbuttons may be removable from the arms to allow a decorative cover, as indicated by the dashed arched outline in FIG. 1, to be mounted in the sink environment with the upper arms projecting therethrough, with the buttons thereafter replaced.

Advantageously the frames F may be molded from tough, dimensionally stable, durable plastic, such as Delrin, or Zytel, not only for low-cost fabrication but also favorable friction characteristics in the sliding system.

FIGS. 10 and 11 represent a modification of the valve wherein a four-slot body B*l* is used with a three-plate assembly in each slot. Considering the right half of the valve, in each subassembly, analogous to plate 35, a port plate 55 (or 56) is gasket-sealed to an adjacent ported wall such as central wall 57 (or intermediate wall 58) of the body; a seal plate 59 (or 60,) against an unported adjacent wall face; and there is sandwiched therebetween a shiftable plate 61 (or 62).

The horizontal section in FIG. 11 (in which the front of the valve is on top) shows the body form and porting; the vertical section of FIG. 10 further showing a modification in the actuators. The movable plates 61, 61*a*, 62, 62*a* are reciprocated horizontally in the slots by pushbutton levers 64 having gear segments 65 engaged in respective rack tooth formations 66 on the top edges of the movable plates; the segment being concentric with the arm-mounting shaft S supported again by the top plate T-1. In the latter, downwardly bent edge tabs 68 engage the ends of the stationary plates.

The casting bottom center again has connection formations for hot, cold and discharge piping (not shown). As seen in FIG. 11, the body central wall 57 receives the hot and cold connections into vertical bores 12, 13 which open through respective opposed side branches 16, 17 to the adjacent slots, and therethrough the fixed port plates 55, as in FIG. 1, gasketed to the central wall 57. However, the discharge connection vertical passage 14 is not carried upwardly to the level of the water inlet ports 16, 17, but branches in the center wall through oppositely directed ports 18 slightly above the adjacent slot bottoms; and, by first branching into a longitudinal passage 70 running along the bottom to turn up at 14*b*, 14*c* into the intermediate walls 58, 58*a*, also opens to the end slots in discharge ports 18*b*, 18*c* in alignment with the discharge ports 18 in the central wall.

A hot water inlet bottom branch 71 (a projection of the location of which is indicated by the dash-dotted outline 71 in FIG. 10) runs over to a vertical portion in the right intermediate wall 58 through which it opens by a single port 16*a* into the extreme right (hot) slot at the level of the ports 16, 17 in the central wall; and similarly the cold water inlet bottom branch passage 72 runs to the left to turn upward in and open at 17*a* through the left intermediate wall 58*a* to the extreme left of "cold" slot at the same level as 16*a*. The innermost faces of the hot and cold slot port plates 56, 56*a* are again gasketed to the wall about their ports which are aligned with the hot (or cold) branch port at the upper level and the discharge branch port at the lower level.

The form of the movable plates is seen from an intermediate temperature plate 61*a* appearing in FIG. 10, as having a broad squared U-shaped through-slot with bottom horizontal yoke 61*g* at the level of the discharge ports, and vertical legs 61*b*, 61*c* running up to the level of the hot and cold ports 16, 17. The hot and cold plates, 62, 62*a* are of the same general form, with the exception that these, lacking the inner vertical leg 61*c* shown in FIG. 10, have merely L-shaped through-slots.

In the modification shown by FIGS. 12–13, the body is similar to that of FIG. 1, but the plates 80, 81 are disks rotationally slidable, by pushbuttons (not shown) on integral radial tangs 82. FIG. 13 shows both the hot and cold plates turned to full "on" condition; and FIG. 12 shows one of the intermediate (lukewarm) plates as "off."

Here the disks are held captive in thinner round centrally apertured fixed square frames 83, each frame top notched or slotted into the aperture to accommodate the radial tang. The pressure and port plates 31, 33, 35 may again be held edgewise by downward tabs 84 of the top plate T-2 and, so also the frames 83; though loose pinning at 85 may be used through the corner regions of the frames and fixed plates, preserving the necessary freedom and clearances for bias effect as described for the FIG. 1 form.

The two five-plate assemblies are again identical to each other; and the fixed port and pressure plates may be identical to those of FIG. 1. The hot and cold plates again have a shallow face groove 81*a* here radially extending and having an inner centered end coincident with the discharge port level; while the intermediate temperature plates or disks 80 (see FIG. 12) have a diametric through-slot 80*b* and, displaced therefrom by 45°, a single separate port 80*a* at a radial distance equal to the spacing between 17 (or 16) from 18, so that the same effect is attained as in FIG. 1.

I claim:

1. A fluid controlling valve comprising:

a body including spaced first and second wall portions rigidly joined by a bottom wall,

said first and second wall portions having parallel opposed faces and with the bottom wall defining a slotlike, valving element receiving space open at the top and at opposite ends,

said body having fluid supply connections and a discharge connection and, from said connections, body passage discharge and inlet openings through at least the face of said first wall portion to controlled discharge and inlet ports, a set of face-to-face abutting stationary and shiftable plates parallel to said faces as a valving member subassembly in the slotlike space including

a stationary port plate with a discharge port and at least one inlet port therethrough in alignment with and sealed to respective inlet and discharge openings in the said first wall portion,

a stationary pressure plate in face-to-face relation with the second said wall portion,

resilient means interposed between the second wall section and the pressure plate biasing the latter toward the first wall portion to hold the successive plates of the set in face-to-face relation, and

at least one shiftable plate in said set having valving passages therein adapted at a first position of the plate as an "off" position to shut off communication of said discharge port from any inlet port, at a second position as a full "on" position to provide maximum communication between said discharge port and at least one inlet port, and in advancing from said off to said on position to provide an increasing flow passage between said discharge port and said one inlet port;

cooperating faces of said shiftable and stationary plates, through which open said ports and valving passages, being wear-resistant and highly smooth and flat thereby to afford a slidable sealing contact under the biasing force applied through the pressure plate to the set;

means for retaining said set in the slotlike space; and shiftable plate shifting means.

2. A valve as described in claim 1 wherein

the shiftable and stationary plates having the highly smooth and flat faces comprise hard-lapped ceramic plates.

3. A valve as described in claim 1 wherein:

said first and second wall portions and stationary plates terminate in coplanar top end surfaces adjacent the slotlike space and coplanar lateral end surfaces at opposite open ends of said space;

said stationary plates seated on said bottom wall;

said means for retaining the set including a cover plate secured on said top end surfaces.

4. A valve as described in claim 3, wherein

said shiftable plate is shorter in vertical dimension than the stationary plates and is vertically shiftable,

said plate shifting means comprises a vertically reciprocable hollow frame peripherally embracing the edges of the shiftable plate and having clearances with respect to the shiftable plate and adjacent stationary plates to ensure communication of the pressure plate force through the plates of said set without interference by said frame.

5. A valve as described in claim 4 wherein,

as a part of said means for retaining the set, said hollow frame includes flanges extending from its opposite vertical ends across an adjacent stationary plate to overlap respective said vertical lateral end surfaces of one of said wall portions.

6. A valve as described in claim 4, wherein

the shiftable plate reciprocating means includes a frame tang extending slidably through said cover plate and mechanism including a pushbutton pivoted with respect to the cover plate for reciprocating said tang.

7. A valve as described in claim 3 wherein

said shiftable plate is longitudinally slidable on said bottom wall and has an upper edge substantially coplanar with said coplanar top surfaces of the wall portions,

said upper edge of the shiftable plate including a toothed rack formation extending over a part of its length, an actuating arm pivoted on said cover plate and having a gear segment formation projecting through the cover plate to mesh with said rack, whereby swinging of said arm reciprocates said shiftable plate between said off and on positions;

said cover plate including depending formations engaging opposite ends of said stationary plates for retention against longitudinal sliding.

8. A valve as described in claim 3 wherein:

said shiftable plate is a disk and said shifting means includes a radial arm on the disk extending through an elongated slot in said cover plate,

said disk being retained in a stationary framing plate thinner than the disk and having an opening therethrough providing a circularly arcuate seat engaging a portion of the disk circumference and a top slot for arm shifting in alignment with the cover slot.

9. A valve as described in claim 1 wherein:

said stationary port plate has two said inlet ports respectively in communication with distinct fluid supply connections of said body;

said set of plates includes at least a second shiftable plate and said shiftable plates are disposed respectively adjacent the said stationary port plate and pressure plate; an intermediate port plate sandwiched between said two shiftable plates;

the first said shiftable plate having first and second apertures therethrough respectively in communication with a one said inlet port and said discharge port of said stationary port plate when the first said shiftable plate is in said off position,

the second aperture movable into increasing coincidence with both of said inlet ports after the first shiftable plate moves from its off position to provide an increasing mixed fluid flow to the discharge port;

said intermediate port plate including first and second apertures therethrough communicating with said first and second apertures of the first shiftable plate in off position;

said second shiftable plate in off position closing off said apertures of the intermediate plate from each other and including a passage putting said apertures of the intermediate plate and thereby said first inlet port and discharge port into communication with each other after, and increasingly with, movement of the second shiftable plate away from its off position; the second shiftable plate and adjacent stationary plates having wear-resistant and highly smooth cooperating faces as described with respect to the first shiftable plate.

10. A valve as described in claim 9 wherein

the shiftable and stationary plates having the highly smooth and flat faces comprise hard-lapped ceramic plates.

11. A valve as described in claim 9 wherein:

said first and second wall portions and the stationary plates terminate in coplanar top end surfaces adjacent the slotlike space and coplanar lateral end surfaces at opposite open ends of said space;

said stationary plates seated on said bottom wall;

said means for retaining the set including a cover plate secured on said top end surfaces.

12. A valve as described in claim 11, wherein:

said shiftable plates are shorter in vertical dimension than the stationary plates and are vertically shiftable;

said plate shifting means comprises for each shiftable plate a vertically reciprocable hollow frame peripherally embracing the edges of the respective shiftable plate and having clearances with respect to that shiftable plate and the adjacent stationary plates to ensure communication of the pressure plate force through the plates of said set without interference by said frame.

13. A valve as described in claim 12 wherein,

as a part of said means for retaining the set, each said hollow frame includes flanges extending from its opposite vertical ends across an adjacent stationary plate to overlap respective said vertical lateral end surfaces of a respective one of said wall portions.

14. A valve as described in claim 13, wherein

the shiftable plate reciprocating means includes for each frame a frame tang extending slidably through said cover plate and mechanism including a pushbutton pivoted with respect to the cover plate for reciprocating said tang.

15. A mixing-type water valve for providing a controlled flow of water selectively at hot supply temperature, cold supply temperature and at least one preset temperature intermediate the hot and cold, comprising:

a body having at least two parallel slot formations,

each formation having parallel opposed wall faces and respective wall portions rigidly joined by bottom wall portions,

and providing slots as respective valving assembly receiving spaces,

said body having hot and cold water supply connections and a discharge connection and, from said connections, body discharge and inlet passageways with openings through at least one of said faces of at least each of two said slots to controlled discharge and inlet ports,

respective sets of plates forming valving assemblies received in the respective slot space;

each said assembly including a set of face-to-face sealingly abutting stationary and shiftable plates disposed parallel to said faces, and each assembly further including

a stationary port plate with a discharge port and at least one inlet port therethrough in alignment with and sealed to respective discharge and inlet passageway openings in one face of the respective slot,

a stationary pressure plate adjacent the other face of the respective slot,

at least one shiftable plate in each said assembly having valving passages therein adapted at a first position of the plate as an "off" position to shut off communication of said discharge port from any inlet port, at a second position as a full "on" position to provide maximum communication between said discharge port and at least one inlet port, and in advancing from said "off" to said "on" position to provide an increasing flow passage between the said discharge port and said one inlet port, and

resilient means biasing the plates of the assembly into face-to-face contacting relation;

cooperating faces of said shiftable and stationary plates, through which open said ports and valving passages, being wear-resistant and highly smooth and flat thereby to afford a slidable sealing contact under the biasing force applied by said resilient means in the assembly;

means for retaining each said assembly in the respective slot space; and

shifting means for each said shiftable plate; among said assemblies, a first shiftable plate controlling communication of a hot water inlet port to a discharge port, a second shiftable plate controlling communication of a cold water port to a discharge port, and at least a third shiftable plate controlling simultaneous communication to a discharge port of both a hot water port and a cold water port, thereby to deliver unmixed water at supply temperature from the respective supply connections by individual operation of the first and second shiftable plates, and mixed water at a said intermediate temperature by individual operation of the said third shiftable plate.

16. A mixing valve as described in claim 15 wherein:

the body passageway from one supply connection to a second inlet port of a first slot space is provided with an adjustable flow-restricting means as a means of presetting a first mixed flow temperature.

17. A valve as described in claim 16 wherein:

the body passageway from the other supply connection to a second slot space is also provided with an adjustable flow-restricting means as a means of presetting a second mixed flow temperature.

18. A mixing valve as described in claim 15 wherein the frames and the corresponding plates of the assemblies are identical.

19. A mixing valve as described in claim 15 wherein the shiftable and stationary plates having the highly smooth and flat faces comprise hard, lapped ceramic plates.

20. A valve as described in claim 15, wherein said shiftable plates are rectilinearly shiftable parallel to the slot faces.

21. A valve as described in claim 20, wherein said shiftable plates have top edges provided with a rack formation, and each is shifted by a respective lever arm having a gearlike formation engaged in the respective rack and concentric with the axis of pivoting of the lever.

22. A lever as described in claim 20, wherein to provide said shifting means said shiftable plates are peripherally enclosed in respective like frames, each having a respective tang extending in the direction of rectilinear shiftability and each tang is engaged by a device including a pushbutton whereby the individual shiftable plates are finger-operable.

23. A valve as described in claim 15, wherein:

said shiftable plates have a disklike form with respective tangs projecting from the circumference;

and including for each shiftable plate a frame plate having a circular aperture embracing the major extent of the shiftable plate circumference, each said frame plate having an edgewise slot opening to said aperture for accommodation of a respective plate tang whereby each shiftable plate is rotationally shiftable in the respective frame plate by angular displacement of its tang.

24. A valve as described in claim 15, wherein:

said body has two slot formations defining therebetween a central wall portion wherein are located said supply and discharge connections and body passageways opening through respective wall faces of the central wall portion;

said stationary port plate in each slot has two said inlet ports respectively in communication with the hot and cold supply connection passageways of said body;

each said assembly includes at least a second shiftable plate, and an intermediate port plate sandwiched between the two said shiftable plates, the two said shiftable plates being disposed respectively adjacent the said stationary port plate and pressure plate of the assembly;

the first said shiftable plate in each assembly, as valving passages, having first and second apertures therethrough respectively in communication with a one said inlet port and said discharge port of said stationary port plate when the first said shiftable plate is in its said "off" position,

the second aperture movable into increasing coincidence with both of said inlet ports after the first shiftable plate moves from its "off" position to provide an increasing mixed water flow to the discharge port;

said intermediate port plate in each assembly including first and second apertures therethrough communicating with said first and second apertures of the first shiftable plate in "off" position;

said second shiftable plate in "off" position closing off said apertures of the intermediate plate from each other and including a passage putting said apertures of the intermediate plate and thereby said first inlet port and discharge port into communication with each other after, and increasing with, movement of the second shiftable plate away from its "off" position; the second shiftable plate and adjacent stationary plates having wear-resistant and highly smooth cooperating faces as described with respect to the first said shiftable plate.

* * * * *