

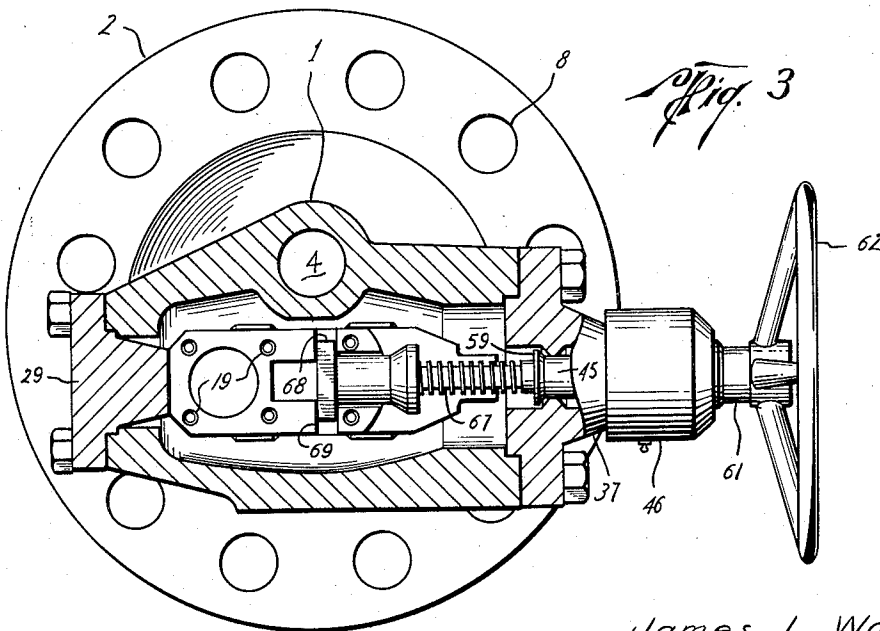
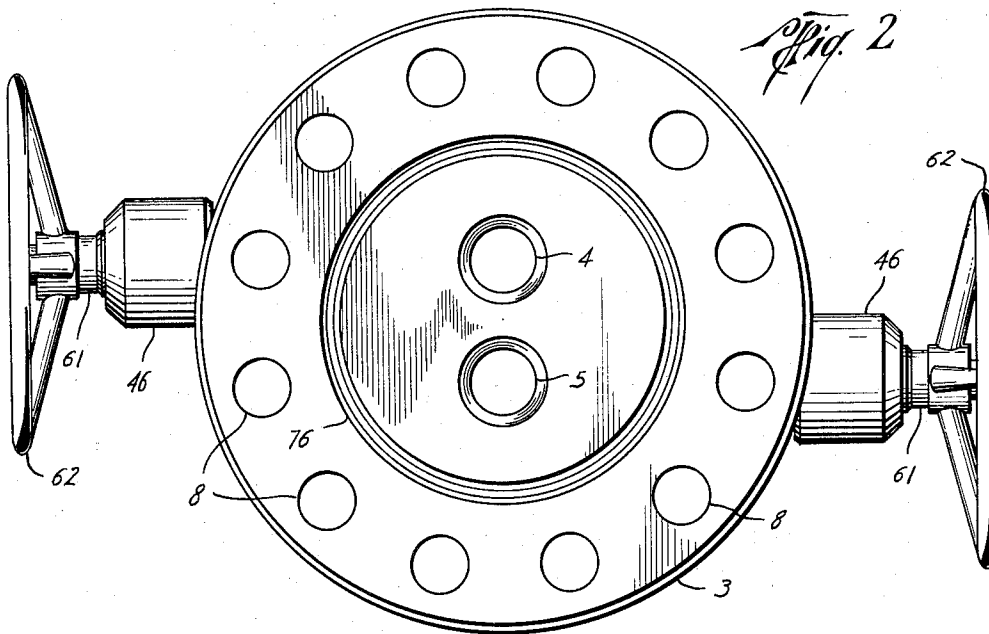
Nov. 11, 1958

J. L. WALLACE
DUAL BORE VALVE

2,859,773

Filed Sept. 16, 1955

4 Sheets-Sheet 2



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INVENTOR.

BY

ATTORNEY

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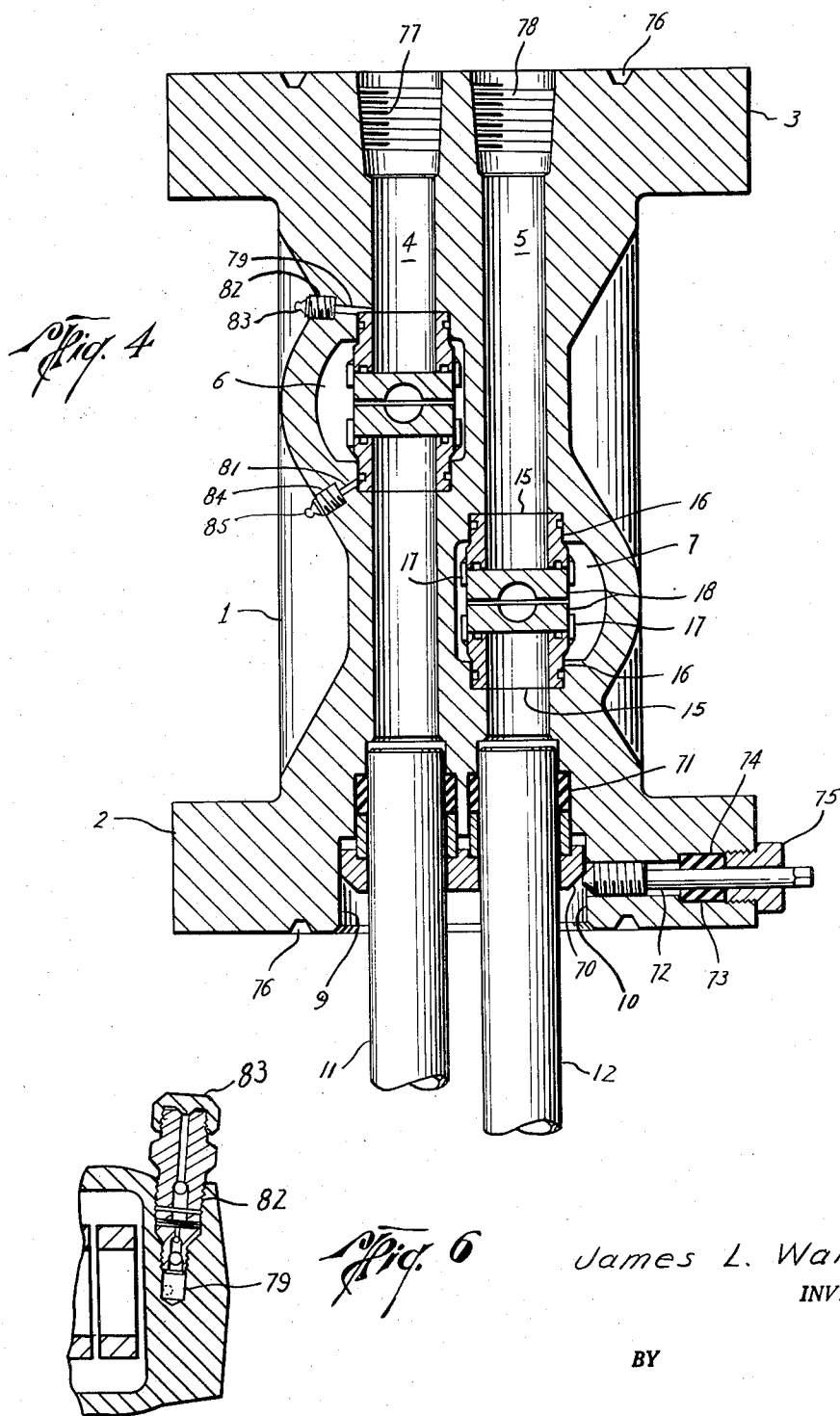
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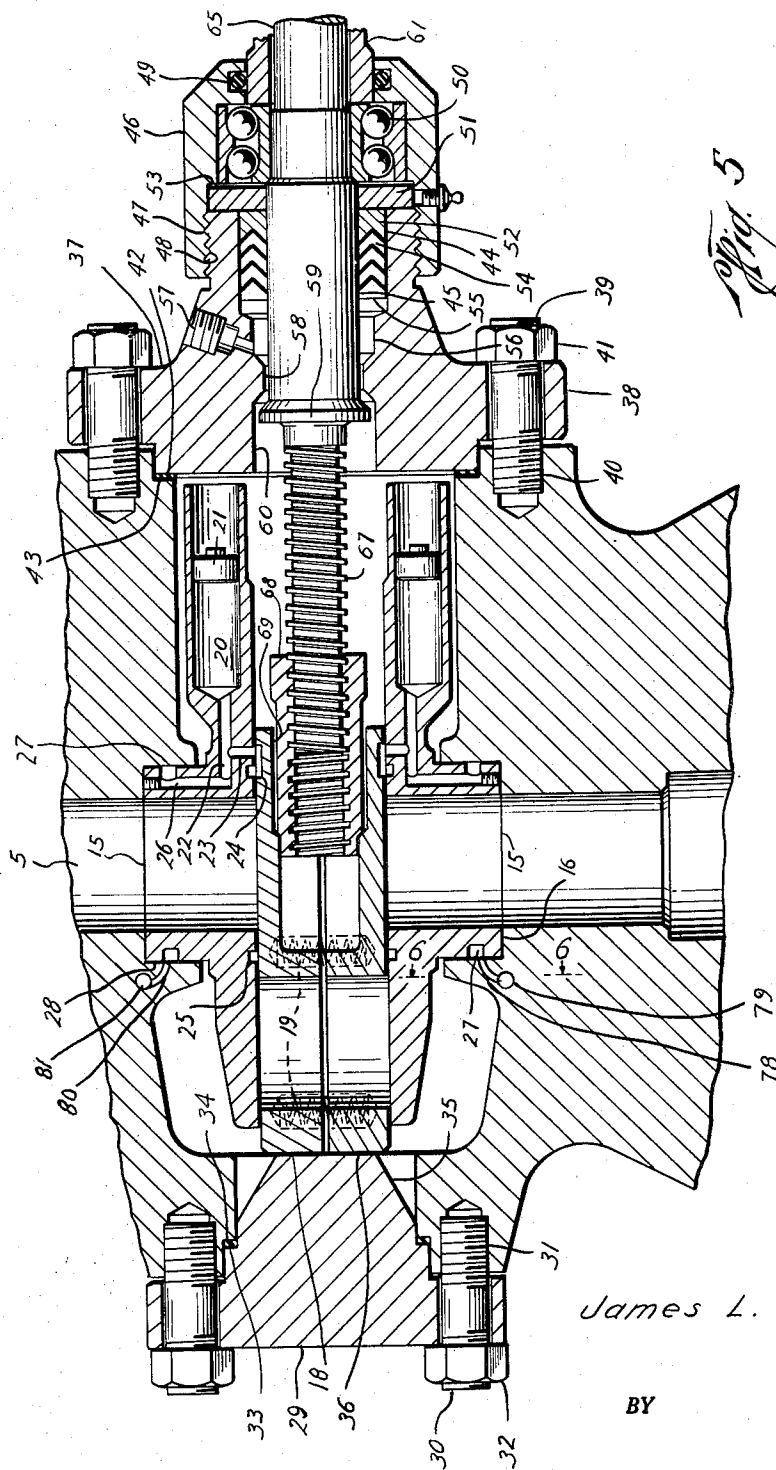
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DUAL BORE VALVE

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Application September 16, 1955, Serial No. 534,842

4 Claims. (Cl. 137—594)

This invention pertains to dual bore valves, and particularly to dual bore valves as used in "Christmas trees" or well-completion equipment.

In producing minerals such as oil or gas the well is, at the present time, usually equipped to produce only from a single producing stratum. Although most wells produce from only one stratum, there have been many dual completion wells of the concentric type in which one sand is produced through a casing annulus. These concentric types have been only moderately successful because good flow is not obtained through the annulus and because testing and workover tools cannot be run through the annulus. Therefore, well completions having parallel non-concentric production tubing strings have recently been developed. Generally the dual strings of tubing must be parallel and close together in the well and it is desirable to maintain the strings thus relatively positioned in the well head and Christmas tree equipment in order that formation testing tools and the like may be introduced into the tubing strings through the well head and Christmas tree equipment and for other reasons. Because the tubing strings are close together where they project from the hole and well head, it has been found difficult to provide in the Christmas tree above the well head valves capable of withstanding the well pressures and adapted to non-interfering operation.

It is an object of this invention to provide a dual bore valve wherein the bores are closely spaced and wherein the bores are straight and have no bends.

Another object of the invention is to provide a dual valve of small size and weight capable of withstanding high well head pressures.

Another object of this invention is to provide a dual bore valve wherein the valve bores are in line with closely-spaced parallel tubing strings and well head bores.

A further object of this invention is to provide a dual bore valve wherein valve means is provided in each bore and wherein each valve means is operated independently of the other valve means.

A still further object of this invention is to provide a dual bore valve in which the valve elements are longitudinally offset.

Other objects, uses, advantages, and improvements will be apparent from consideration of the specification, claims, and drawings, of which:

Figure 1 shows a side view, partly in cross section, of a preferred embodiment of the invention;

Figure 2 shows a top view taken at line 2—2 of Figure 1;

Figure 3 shows a horizontal section taken at line 3—3 of Figure 1;

Figure 4 shows a vertical section taken at line 4—4 of Figure 1;

Figure 5 shows an enlarged partial cross-sectional view of the valve assembly shown partly in section in Figure 1; and,

Figure 6 is a horizontal cross-sectional view of the sealant injection parts taken at line 6—6 of Figure 5.

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Referring now in detail to the drawings, wherein like reference numerals are used to designate the same parts in each of the figures, valve body 1 has lower end flange 2, upper end flange 3, longitudinal parallel bores 4 and 5, and valve chambers 6 and 7. Valve body 1 has an irregular exterior shape corresponding generally to the interior valve elements. The end flanges 2 and 3 have suitable bolt holes 8 by means of which the lower end of the valve is secured to lower well head equipment and the upper end to upper well head or Christmas tree equipment. At the lower ends of bores 4 and 5, adjacent flange 2, bores 4 and 5 have enlarged portions 9 and 10 for receiving suitable packing means whereby tubing strings 11 and 12 are sealed into valve body 1. Tubing strings 9 and 10 are supported below the valve by suitable hanger means (not shown). The packing means may be any of the conventional types and is shown in Figure 4 having a support ring 70 forced upwardly against suitable packing rings 71 by a plurality of lock screws 72 which are sealed into the flange apertures 73 by packing 74 and gland 75.

Still referring to Figure 4, sealing grooves 76 are provided in the faces of lower end flange 2 and upper end flange 3. Bores 4 and 5 may be internally threaded at their upper ends as shown at 77 and 78 to receive additional well head equipment.

Valve chamber 6 intersects bore 4 and valve chamber 7 intersects bore 5 at spaced apart levels in the valve body. The two sides of the valve are identical, and the description will be limited to only one side but will be equally applicable to both. Identical reference numerals will refer to the elements of the valves at both sides, except where it is necessary to distinguish between the two sides.

Referring now particularly to Figures 1 and 5, each valve chamber 6 and 7 has two oppositely disposed seats 15 received in seat recesses 16 around the bores. The seats have gate guides 17 welded thereto against which gate elements 18 slide when gate elements 18 are moved to open and close the valve. Gate elements 18 are in forced-apart relation one to the other by means of spring elements 19 between gate elements 18, and are therefore made to fit closely against and to coact with the seats. Reservoir means 20 having piston means 21 are provided in the upper extensions of seats 15 and communicate through passages 22, 23 and 24 with grooves 25 in the seat faces and through passages 22 and 26 with grooves 27 around the seat necks 28. Pressure in the valve chamber in which the reservoir 20 is located acts on piston means 21 to force sealant from the interior of the reservoir through the passages and into grooves 25 and 27. This occurs at only one side of the valve at a time, since the pressures across one of the reservoirs are usually balanced while the pressures across the other of the two reservoirs in a valve chamber are unbalanced. The operation of the reservoirs will be fully explained later.

Referring now to Figures 1, 3 and 5, one end of each valve chamber is closed by a flanged plug element 29 which is bolted to the body 1 by a plurality of bolts 30 which are screwed into threaded recesses 31 in the body 1 and onto which nuts 32 are screwed. Plug element 29 has an annular shoulder 33 which fits against an annular shoulder 34 in the chamber opening, there being a resilient packing ring between the shoulders. The end of plug element 29 adjacent the chamber is beveled at its sides 35 to form a diminished end 36 which abuts the gate elements when they are in the fully closed position. The other end of each valve chamber, the stem end, is closed by a bonnet 37 bolted through a suitable bonnet flange 38 to the body 1 by a plurality of bolts 39 received in threaded recesses 40 of body 1 and onto which nuts 41 are screwed. Bonnets 37 have annular shoulders 42 which

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fit against annular shoulders 43 formed in the chamber opening. Bonnet 37 has an axial opening 44 which receives a stem 45, which in the preferred embodiment is a non-rising stem. Stem 45 is rotatably sealed in the bonnet opening 44 by a series of packing means held in place by a cap 46 having an internally threaded portion 47 of increased diameter which is screwed onto a correspondingly externally threaded portion 48 of bonnet 37. An outer O-ring packing 49 is disposed in a recess in cap 46 around a sleeve 61. An anti-friction bearing 50, of the ball or other conventional type is mounted about stem 45 in cap 46 beside O-ring packing 49 and sleeve 61 and spaced from the inside edge of the packing. A gland 51 is mounted about stem 45 beside bearing 50 and gland 51 is held between a shoulder 53 formed interiorly of cap 46 and the outer end of bonnet 37. A gland collar 52 having an inward wedge-shaped recess coacts with gland 51 to retain packing rings 54 within a packing annulus 55 adjacent the gland members. A packing retainer is provided at the inner side of packing rings 54. The packing annulus 55 has a diminished portion 56 at its inward end and a bleeder port 57 is provided from annulus portion 56 to the exterior of the valve so that pressure may be bled from the annulus before dismantling of the stem packing assembly in the bonnet. The inward end of diminished annular portion 56 is provided by an annular collar 59 which is formed integrally with bonnet 37. Collar 58 is somewhat spaced from the periphery of stem 45 so that pressure from the interior of the valve may enter the packing annulus. Stem 45 has formed thereon interiorly of collar 58 a back-seal collar 59. Back-seal 59 and collar 58 are both provided with outwardly converging seat surfaces which may be seated together when the stem is moved axially outwardly during dismantling of the stem seal elements to prevent blowing-out from the valve chamber.

Stem 45 at its outer end has a handwheel 62 mounted on an adapted portion 63 of stem 45 and a nut 64 holds the handwheel on the stem and against sleeve 61. Sleeve 61 fits closely around stem 45 in the vicinity of packing 49 and loosely at a reduced stem portion 65 adjacent adapted stem portion 63, and is provided with an injection port 66 so that sealant may be injected into the annular space between stem portion 65 and the sleeve 61.

At the inner end of stem 45 a threaded portion 67 of the stem is received in a threaded bushing 68 which is received in a recess 69 formed complementarily in both gate members.

Referring to Figures 3 and 4, gate guides 17, which are welded onto seats 15, are spaced longitudinally so that there will be no interference between guides 17 and the other bore of the valve. The cross-section of the valve chambers is shown in Figure 3, the wall of bore 4 protruding into valve chamber 7 and thus making the use of one-piece guide strips difficult or impossible. The shorter, spaced, strips used as guides in the present invention function in the same way as conventional one-piece guide strips. The guides 17 must be positioned so that the gate elements are guided throughout their travel when the gates are moved to open or to close the valve.

The cross-section of the valve body 1, shown in Figures 3 and 4, is functional in that the exterior conforms to the interior valve and bore elements and also in that the structures in which the bores 4 and 5 are formed serve to support the valve elements and to impart rigidity to the structure. The bores 4 and 5 are straight, and are closely spaced so that the valve may be used with conventional well head equipment and also so that ready access may be had to the tubing or casing strings through the valve. As shown in Figure 4, the spacing between bores 4 and 5 is uniform and the valve chambers, being offset with respect to each other, do not interfere one with the other. The individual valves are independently operated, one valve being operated from one side and the other valve being operated from the opposite side of the dual valve assembly.

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Referring again to Figure 5, reservoirs 20 contain sealant which is delivered to grooves 25 and 27 through passages 22, 23, 24 and 26. Reservoirs 20 extend to near bonnet 37, which serves to hold the piston means 21 in the reservoirs, and the small clearance between a reservoir and the bonnet permits the pressure in the valve chamber to enter the top of the reservoir and act on the surface of piston means 21. In Figure 5, when a higher pressure exists in bore 5 below the valve and the valve is closed as shown, the lower gate element will be unseated by the pressure because of the resilience of springs 19, and the valve chamber will be under the same pressure as the lower part of bore 5. The pressure will cause the upper gate element to be very tightly seated against the upper seat. The pressures at the piston in the lower reservoir and at the grooves in the lower gate element and seat will be balanced, and no sealant will flow into those grooves. The chamber pressure will act on the piston means in the upper reservoir and will cause the piston to force sealant through the passages and into the grooves in the upper gate element and upper seat, since these grooves are at the lower pressure of the upper part of bore 5 above the valve. The reservoirs will function in the same way regardless of which side of the valve is under the higher pressure, making it possible to reverse the direction of flow through the valve. Thus, the valve may be used where a liquid or gas is to be withdrawn from the well or where a liquid or gas is to be introduced into the well, making it possible to withdraw production from one bore and to inject a separated gas through the other bore either at the production zone or at a deeper or shallower zone. Other possibilities will be apparent to those skilled in the art.

The sealant reservoirs in each valve chamber 6 and 7 are filled with sealant through suitable injection ports or grease fittings provided for that purpose. Referring to Figures 4, 5 and 6, fittings 83 and 85 are screwed into threaded sockets 82 and 84. The sockets communicate with the groove 27 at each seat neck of each valve through passages 79 and 81 and cross-over passages 78 and 80, respectively. The sockets, passages, and cross-over passages are formed in the valve body 1. Sealant is injected through the fittings and connecting passages into each of the sealant reservoirs 20.

While a preferred embodiment of the invention has been shown and described, many modifications thereof can be made by one skilled in the art without departing from the spirit of the invention, and it is desired to protect by Letters Patent all forms of the invention falling within the scope of the following claims:

I claim:

1. In a dual parallel bore valve for use with a pair of parallel tubings in a well comprising a body having a pair of parallel longitudinally disposed bores of predetermined size the axes of which are required to be spaced apart a predetermined distance, wherein there is a single continuous wall separating the bores in the valve body which wall must be of minimum predetermined thickness to withstand the maximum pressure to which the bores are to be subjected, and wherein there is in each of the bores a slide gate valve having a minimum predetermined width relative the size of the bore because the flow port through the gate of the slide gate valve must be equal in size with the bore which the slide gate valve closes and because the gate of the slide gate valve must have sealing surfaces of minimum predetermined width around the gate flow port and because the slide gate valves each have gate guides at the side of the gate toward the other bore of the pair of bores, such minimum predetermined slide gate valve width being such that when the bore axes are spaced apart by said predetermined distance the two slide gate valves when disposed side-by-side each in one of the bores would be longitudinally superposed and the said single continuous wall between the bores would be reduced in thickness below said minimum predetermined thickness thereof; the improved dual parallel bore valve

structure comprising, a valve body, a pair of parallel straight longitudinally disposed bores of predetermined size through said valve body having their axes spaced apart by a predetermined distance relative the sizes of the bores, a single continuous wall of predetermined minimum thickness relative the sizes of the bores separating said bores, and a slide gate valve of the type described in each bore; said gate valves being spaced longitudinally of one another in said bores; and each said slide gate valve in one of the bores having parts thereof adjacent the opposite bore disposed to partially surround the single continuous wall and the opposite bore whereby the thickness of the single continuous wall is not reduced below said minimum predetermined thickness thereof.

2. In a dual parallel bore valve for use with a pair of parallel tubings in a well comprising a body having a pair of parallel longitudinally disposed bores of predetermined size the axes of which are required to be spaced apart a predetermined distance, wherein there is a single continuous wall separating the bores in the valve body which wall must be of minimum predetermined thickness to withstand the maximum pressure to which the bores are to be subjected, and wherein there is in each of the bores a slide gate valve having a minimum predetermined width relative the size of the bore because the flow port through the gate of the slide gate valve must be equal in size with the bore which the slide gate valve closes and because the gate of the slide gate valve must have sealing surfaces of minimum predetermined width around the gate flow port and because the slide gate valves each have gate guides at the side of the gate toward the other bore of the pair of bores, such minimum predetermined slide gate valve widths being such that when the bore axes are spaced apart by said predetermined distance the two slide gate valves when disposed side-by-side each in one of the bores would be longitudinally superposed and the said single continuous wall between the bores would be reduced in thickness below said minimum predetermined thickness thereof; the improved dual parallel bore valve structure comprising, a valve body, a pair of parallel cylindrical longitudinally disposed bores of predetermined size through said valve body, the axes of said bores being spaced to provide a minimum predetermined thickness of said valve body between the bores relative the diameters of the bores, a slide gate valve of the type described in each bore larger radially of the bore than the bore radius at the side of the bore toward the opposite bore, each of said slide gate valves extending partially around the opposite bore and a wall portion of the opposite bore formed by said minimum predetermined thickness of valve body between the bores, whereby said minimum predetermined thickness of valve body between the bores is not reduced.

3. In a dual parallel bore valve for use with a pair of parallel tubings in a well comprising a body having a pair of parallel longitudinally disposed bores of predetermined size the axes of which are required to be spaced apart a predetermined distance, wherein there is a single continuous wall separating the bores in the valve body which wall must be of minimum predetermined thickness to withstand the maximum pressure to which the bores are to be subjected, and wherein there is in each of the bores a slide gate valve having a minimum predetermined width relative the size of the bore because the flow port through the gate of the slide gate valve must be equal in size with the bore which the slide gate valve closes and because the gate of the slide gate valve must have sealing surfaces of minimum predetermined width around the gate flow port and because the slide gate valves each have gate guides at the side of the gate toward the other bore of the pair of bores, such minimum predetermined slide gate valve widths being such that

when the bore axes are spaced apart by said predetermined distance the two slide gate valves when disposed side-by-side each in one of the bores would be longitudinally superposed and the said single continuous wall between the bores would be reduced in thickness below said minimum predetermined thickness thereof; the improved dual parallel bore valve structure comprising, a valve body, a pair of parallel straight longitudinally disposed bores of predetermined size through said valve body having their axes spaced by a predetermined distance depending on the bore diameters, a single continuous wall of minimum predetermined thickness depending on the bore diameters forming a part of said body separating said bores, a separate gate valve chamber equipped with a slide gate valve closure of the type described in each of said bores and each chamber in one of the bores being diminished in size toward the opposite bore by said wall, said chambers being spaced longitudinally of said bores within the valve body, each said gate valve closure in a chamber being operable from the exterior of the valve body, each said gate valve closure including a gate guide means at its side toward said wall and a gate guide means at its side opposite is side toward said wall, said gate guide means at the closure side toward said wall being divided into spaced parts because of interference of said wall whereby said minimum predetermined thickness of said wall is not reduced.

4. In a dual parallel bore valve for use with a pair of parallel tubings in a well comprising a body having a pair of parallel longitudinally disposed bores of predetermined size the axes of which are required to be spaced apart a predetermined distance, wherein there is a single continuous wall separating the bores in the valve body which wall must be of minimum predetermined thickness to withstand the maximum pressure to which the bores are to be subjected, and wherein there is in each of the bores a slide gate valve having a minimum predetermined width relative the size of the bore because the flow port through the gate of the slide gate valve must be equal in size with the bore which the slide gate valve closes and because the gate of the slide gate valve must have sealing surfaces of minimum predetermined width around the gate flow port and because the slide gate valves each have gate guides at the side of the gate toward the other bore of the pair of bores, such minimum predetermined slide gate valve widths being such that when the bore axes are spaced apart by said predetermined distance the two slide gate valves when disposed side-by-side each in one of the bores would be longitudinally superposed and the said single continuous wall between the bores would be reduced in thickness below said minimum predetermined thickness thereof; the improved dual parallel bore valve structure comprising, a valve body, a pair of parallel straight longitudinally disposed bores of predetermined size through said valve body having a single wall of predetermined minimum thickness relative the sizes of the bores therebetween, and a slide gate valve means of the type described in each said bore of larger size diametrically than the diameter of the bore; each said slide gate valve having projecting thereinto a portion of the thickness of said wall, whereby the thickness of said wall is not reduced below said predetermined minimum thickness and whereby said bore axes are spaced closer together than would be possible if said wall portions did not project into said valves.

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UNITED STATES PATENT OFFICE

Certificate

Patent No. 2,859,773

Patented November 11, 1958

James L. Wallace

Application having been made by James L. Wallace, the inventor in the patent identified above, McEvoy Company, of Houston, Texas, a corporation of Texas, the assignee, and Robert Eichenberg, of Houston, Texas, for the issuance of a certificate under the provisions of Title 35, Section 256 of the United States Code, adding the name of Robert Eichenberg to the patent as a joint inventor, and a showing and proof of facts satisfying the requirements of the said section having been submitted, it is this 22nd day of September, 1959, certified that the name of the said Robert Eichenberg is hereby added to the said patent as a joint inventor with the said James L. Wallace.

[SEAL]

ARTHUR W. CROCKER,
First Assistant Commissioner of Patents.