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FULL OPENING VALVE WITH ELASTIC, SELF SEALING CLOSURE MEANS

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2 Sheets-Sheet 1

Fig. 1

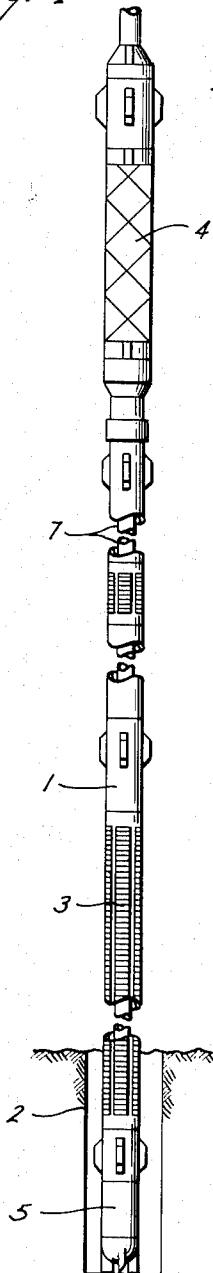
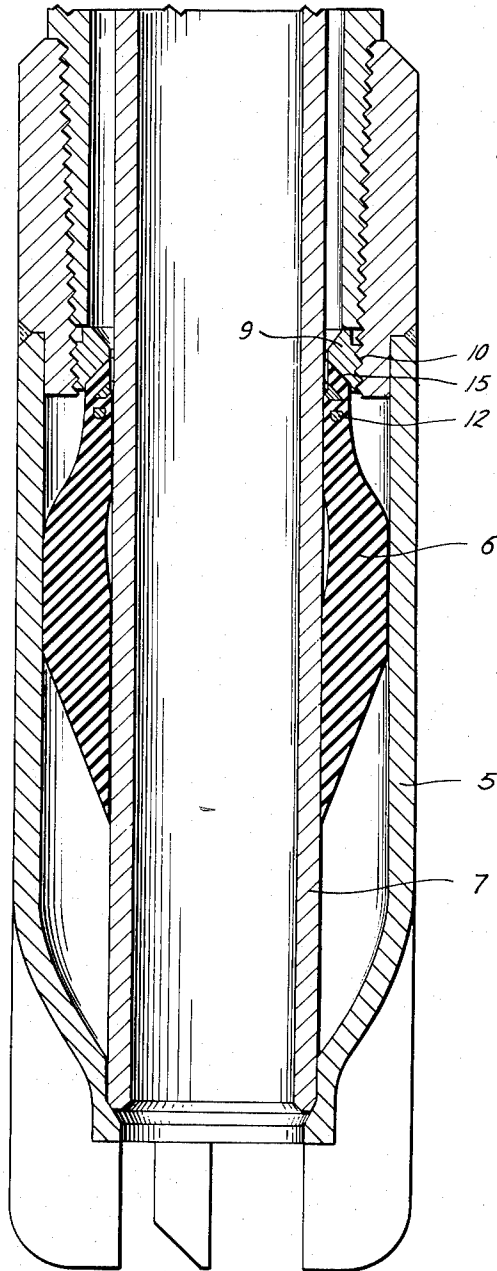


Fig. 2



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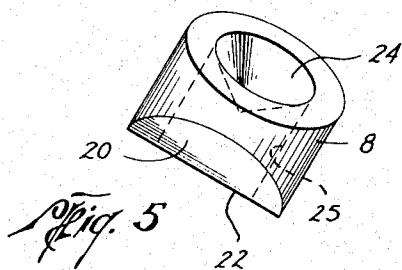
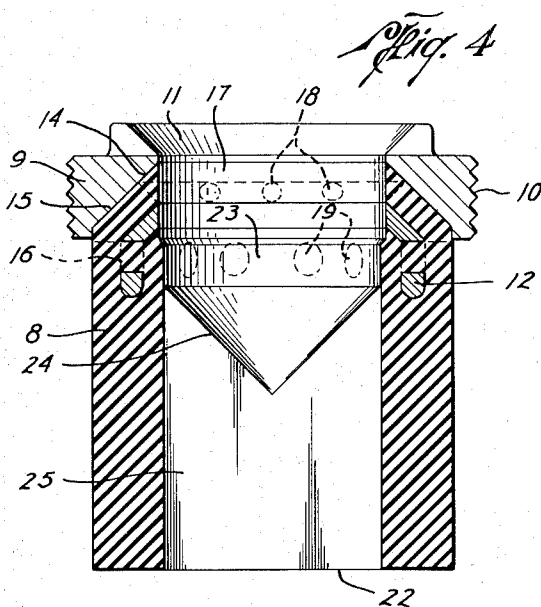
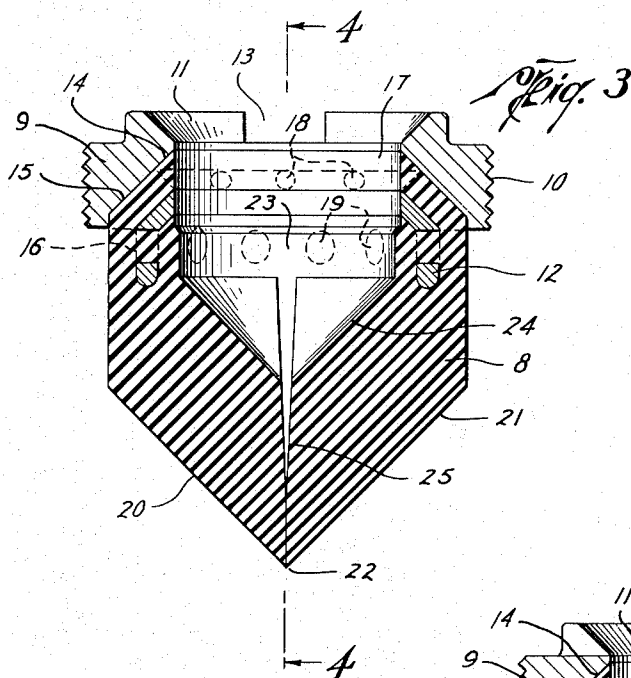
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FULL OPENING VALVE WITH ELASTIC, SELF SEALING CLOSURE MEANS

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5 Claims. (Cl. 166—225)

The invention concerns a full opening valve having elastic, self sealing closure means.

It is an object of the invention to provide a valve which is particularly adapted for use in locations where space is limited, and which requires a minimum of space.

It is a further object of the invention to provide a valve having a tubular body and which permits unrestricted flow thru the valve in one direction while preventing the passage of fluids thru the valve in the opposite direction.

Another object of the invention is to provide a valve having a tubular body and which permits a tubular member having an outside diameter corresponding to the inside diameter of the valve body to be passed thru the valve.

The invention contemplates a valve having a tubular body which is formed in part by a resilient, tubular body member, and in which an elastic, self sealing opening is formed in one end of the body member. The arrangement is such that the opening may be expanded to the diameter of the valve body by the pressure of fluids passing thru the valve.

The invention will be readily understood by referring to the following description and the accompanying drawing, in which:

Fig. 1 is a diagrammatic view in elevation showing an arrangement in which a set shoe having incorporated therein a back pressure valve embodying the invention is connected to the lower end of a screen and liner setting disposed in a well bore.

Fig. 2 is an enlarged sectional view of a portion of the apparatus shown in Fig. 1. As shown in Fig. 2, the back pressure valve is fully opened and a smaller pipe, having an outside diameter corresponding to the inside diameter of the back pressure valve, is disposed within the bore of the valve and projects outwardly therefrom at both ends.

Fig. 3 is a sectional view in elevation of the valve shown in Fig. 2, showing the valve in closed position.

Fig. 4 is a sectional view in elevation, taken on the line 4—4 of Fig. 3.

Fig. 5 is a diagrammatic view showing a portion of the valve illustrated in Figs. 3 and 4.

Referring to Figs. 1 and 2 of the drawing, a screen and liner setting 1 is shown disposed in the bore 2 of a well. The screen and liner setting 1 ordinarily is lowered into the well after casing has been set, and includes an imperforate pipe or liner having a screen 3 connected to its lower end and a collapsible packer 4 connected to its upper end. A set shoe 5 is mounted on the lower end of the screen 3. A valve embodying the invention, designated by the numeral 6, which in this instance serves as a back pressure valve, is incorporated in the set shoe 5.

A pipe 7, which has an outside diameter corresponding to the inside diameter of the valve 6, is disposed within the screen and liner setting 1 and extends thru the valve 6, the valve 6 being fully opened. The pipe 7 is the wash pipe which ordinarily is used for washing out the hole. This washing procedure involves pump-

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ing water downwardly into the hole thru the pipe 7. Thereafter the packer 4 is collapsed, the pipe 7 is withdrawn from the hole, and the well is ready to produce. Heretofore it has not been possible for the wash pipe to be passed directly thru the set shoe, and it has been customary to provide the set shoe with complicated arrangements of ports and valves whereby the wash water may be discharged into the bottom of the hole as desired.

Another advantageous feature of the arrangement shown is that it permits gravel to be introduced into the well bore, for gravel packing, thru the pipe 7, and in the same operation, without removing either the screen and liner setting 1 or the pipe 7 from the hole. Heretofore gravel packing has been accomplished as a separate operation, and thereafter the apparatus shown has been placed in the well.

Referring to Figs. 3 to 5 of the drawing, a valve is shown having a tubular body which is formed in part by a tubular body member 8. The body member 8 is made of resilient material, such as rubber, and one end thereof is secured to a rigid annular member 9 as hereinafter described. The annular member 9 is threaded at 10 for engagement with a pipe or other apparatus in connection with which the valve is to be used. An upstanding portion 11 and a depending portion 12, each of which is of smaller diameter than the threaded portion 10, extend above and below the threaded portion 10. A pair of diametrically opposed slots 13 are formed in the upper surface of the upstanding portion 11 for engagement by a wrench. A V-shaped annular groove 14 is formed about the inner surface of the annular member 9, immediately below the upstanding portion 11, and a plurality of circumferentially spaced ports 15 extend outwardly and downwardly from the V-shaped groove 14, terminating below the threaded portion 10 and outside the periphery of the depending portion 12. A plurality of circumferentially spaced ports 16 extend radially thru the depending portion 12.

The adjacent end of the body member 8 is secured to the annular member 9 by molding. The material of the body member 8 is molded around the depending portion 12. The V-shaped annular groove 14 and the ports 15 and 16 are filled with rubber-like material to form a V-shaped ring 17 and plugs 18 and 19, all of which are formed integrally with the body member 8. The plugs 18 are connected at one end to the V-shaped ring 17, and at the other end to the portion of the body member 8 surrounding the depending portion 12. The plugs 19 are connected at their ends to the portion of the body member 8 surrounding the depending portion 12. Thus the adjacent end of the body member 8 is securely attached to the annular member 9.

An elastic, self sealing opening is formed in the end of the body member 8 opposite the annular member 9 as hereinafter described. The end of the body member 8 opposite the annular member 9 is tapered inwardly on two opposite sides, designated by the numerals 20 and 21, each of which lies in an inclined plane. The sides 20 and 21 intersect to form a chisel type straight edge 22. The body member 8 has a cylindrical bore 23 adjacent the end which is attached to the annular member 9. The bore 23 is tapered inwardly intermediate the ends of the body member 8 to form a hollow cone 24. The tapered end of the body member 8, except as hereinafter described, comprises a solid mass of resilient material. Beginning at the base of the hollow cone 24, and extending thru the tapered end of the body member 8, a slit 25 is formed in the material of the body member 8. The width of the slit 25 corresponds to the diameter of the bore 23 at the base of the hollow cone

24. The slit 25 is aligned with and bisects the chisel type straight edge 22.

The arrangement is such that an elastic, self sealing opening is formed in one end of the body member 8. The opening formed by the hollow cone 24 and the slit 25 may be expanded to the diameter of the bore 23 at the base of the hollow cone 24 by the pressure of fluids passing thru the valve. This arrangement permits unrestricted flow thru the valve in one direction while preventing the passage of fluids thru the valve in the opposite direction. The tapered sides 20 and 21 tend to close the opening thru the valve against the passage of fluids thru the valve in reverse direction. As shown in Fig. 2, the elastic opening above described is expanded as necessary to permit a pipe having an outside diameter corresponding to the diameter of the bore 23 at the base of the hollow cone 24 to be passed thru the valve.

The invention may be modified in various ways without departing from the spirit and scope thereof.

I claim:

1. In a set shoe, a back pressure valve having a tubular body comprising a resilient, tubular body member, one end of the body member being secured to a rigid annular member, the end of the body member opposite the annular member being tapered inwardly on two opposite sides to form a chisel type straight edge, the body member having a cylindrical bore adjacent the end thereof which is secured to the annular member, the bore being tapered inwardly intermediate the ends of the body member to form a hollow cone, a slit being formed in the material of the body member, beginning at the base of the hollow cone and extending thru the tapered end of the body member, the width of the slit corresponding to the diameter of the bore at the base of the hollow cone, the slit being aligned with and bisecting the chisel type straight edge.

2. The combination of a set shoe with a back pressure valve having a tubular body comprising a resilient, tubular body member, one end of the body member being cylindrical and the opposite end thereof being tapered inwardly on two opposite sides to form a chisel type straight edge, the body member having a cylindrical bore throughout a portion of its length, beginning at the cylindrical end thereof, a slit being formed in the material of the body member, the slit communicating with the inner end of the bore and extending thru the tapered end of the body member, the width of the slit corresponding to the diameter of the bore, the slit being aligned with and bisecting the chisel type straight edge, and a wash pipe receivable bodily within the back pressure valve and extending downwardly thru it when in its lowermost position.

3. The combination of a set shoe with a back pressure valve having a tubular body comprising a resilient, tubular body member, one end of the body member being cylindrical and the opposite end thereof being tapered inwardly on two opposite sides to form a chisel type straight edge, the body member having a cylindrical bore adjacent the cylindrical end thereof, the bore being tapered inwardly intermediate the ends of the body member to form a hollow cone, a slit being formed in the mate-

rial of the body member, beginning at the base of the hollow cone and extending thru the tapered end of the body member, the width of the slit corresponding to the diameter of the bore at the base of the hollow cone, the slit being aligned with and bisecting the chisel type straight edge, and a wash pipe receivable bodily within the back pressure valve and extending downwardly thru it when in its lowermost position.

4. The combination of a set shoe with a back pressure valve having a tubular body comprising a resilient, tubular body member, one end of the body member being secured to a rigid annular member, the end of the body member opposite the annular member being tapered inwardly on two opposite sides to form a chisel type straight edge, the body member having a cylindrical bore adjacent the end thereof which is secured to the annular member, the bore being tapered inwardly intermediate the ends of the body member to form a hollow cone, a slit being formed in the material of the body member, beginning at the base of the hollow cone and extending thru the tapered end of the body member, the width of the slit corresponding to the diameter of the bore at the base of the hollow cone, the slit being aligned with and bisecting the chisel type straight edge, and a wash pipe receivable bodily within the back pressure valve and extending downwardly thru it when in its lowermost position.

5. The combination of a set shoe with a back pressure valve having a tubular body comprising a resilient, tubular body member, one end of the body member being secured to a rigid annular member, the end of the body member opposite the annular member being tapered inwardly on two opposite sides to form a chisel type straight edge, the body member having a cylindrical bore adjacent the end thereof which is secured to the annular member, the bore being tapered inwardly intermediate the ends of the body member to form a hollow cone, a slit being formed in the material of the body member, beginning at the base of the hollow cone and extending thru the tapered end of the body member, the width of the slit corresponding to the diameter of the bore at the base of the hollow cone, the slit being aligned with and bisecting the chisel type straight edge, and a wash pipe receivable bodily within the back pressure valve and having an outside diameter approximating the diameter of the bore at the base of the hollow cone.

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