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H. ALLEN
FLOW CONTROL UNIT

2,614,795

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2 SHEETS—SHEET 1

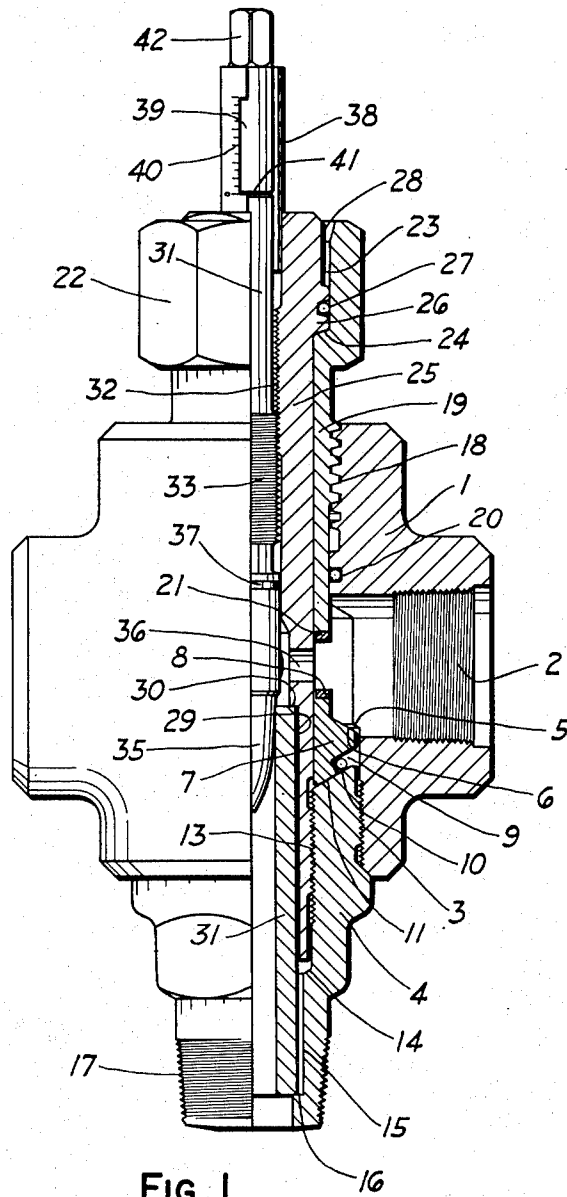


FIG. 1

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2 SHEETS—SHEET 2

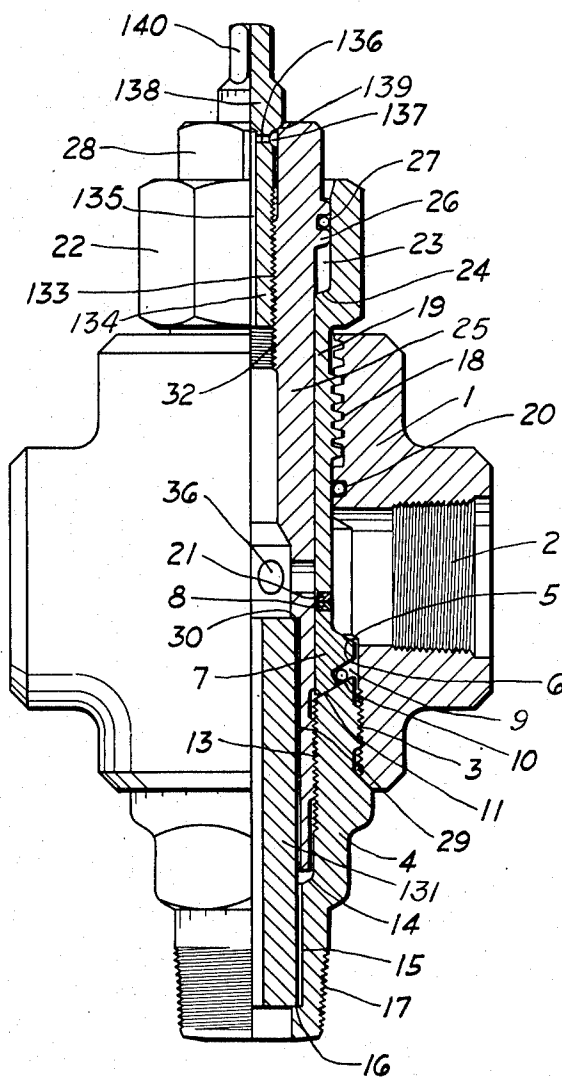


FIG. 2

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UNITED STATES PATENT OFFICE

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FLOW CONTROL UNIT

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5 Claims. (Cl. 251-156)

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This invention relates to a flow control or flow wing for use on an oil well or the like for controlling the flow therefrom.

In order to conserve oil and gas in producing the same from an oil well, and for the purpose of complying with the conservation laws of the various States and jurisdictions in which oil is produced, it is customary to provide oil wells and the like with means for throttling the flow therefrom in amounts depending upon various factors including the ability of the wells to produce oil, the ratio of the oil produced to the gas for various rates of flow, etc.

For the purpose of determining the ability of the well to produce oil, it is customary when a well is first brought in to cause it to produce for a given length of time through a standard-size of choke or orifice. After certain test periods the well may then be placed upon production through an orifice of suitable size, or it may be placed on production through what is known as a variable choke mechanism designed to be varied in its throttling effect so as to permit the production of the desired amount of oil from the well. In the case of the use of fixed chokes for testing, it is of course necessary after it has been determined what size of choke shall be used that the choke on the well be changed to provide the proper size. It is also true that in the course of production of a well a choke will eventually become eroded or cut out by the action of the liquid flowing therethrough and the solid particles contained in the liquid, and it will be necessary to remove the same and substitute a new choke of the proper size. The member having the restricted flow opening therethrough is customarily referred to either as a choke or as a flow bean.

Various means have been devised in the past for holding these flow beans and for providing a quick change from one flow bean to another with a minimum of shut-down time, but these have for the most part involved a multiplicity of parts and in nearly all cases have involved the use of separate valve elements for the purpose of shutting off the flow temporarily while the flow bean is being changed. In such cases also it is a well known fact that some danger is involved in the possibility that an unskilled or inattentive workman may attempt to remove the flow bean for the purpose of changing it without having first shut off the flow of oil to the bean.

It is therefore a general object of this invention to provide an improved flow controlling unit for use on an oil well or the like.

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Another object of this invention is to provide a simple and compact device capable of performing all of the functions heretofore sought in a flow controlling assembly.

More specifically it is an object of this invention to provide in a single compact unit a flow wing which may be readily and quickly changed to provide either an adjustable or a positive, or fixed, flow bean whichever may be desired, together with a valve for closing off flow through the flow wing while changing or replacing the choke or flow bean therein.

Another object of this invention is to provide a device of the type referred to in which the choke or flow bean cannot be removed for replacement or change while the valve which is provided for closing off flow through the flow wing is open.

Another object of this invention is to provide a structure of the type referred to in which the replacement of only two parts is necessary for the purpose of changing the flow ring or controller from a positive or fixed type of choke to an adjustable type of choke.

One other object of this invention is to provide a device in which there will be incorporated a removable adjustable indicator adapted to indicate the position of an adjustable choke.

Other objects and advantages of this invention will become apparent from the following description taken in connection with the accompanying drawings wherein are set forth by way of illustration and example certain embodiments of this invention.

In the drawing:

Fig. 1 is a view partly in side elevation and partly in longitudinal cross section illustrating a flow wing constructed in accordance with this invention and arranged for use as an adjustable choke.

Fig. 2 is a view similar to Fig. 1 but illustrating the device in use as a fixed or non-adjustable type of choke. This view also illustrates the use of the device for closing off flow to the choke for the purpose of replacing or changing the same.

Referring now more in detail to the drawings, the numeral 1 indicates the body of the flow wing or controller constructed in accordance with this invention, the same being provided with a suitably internally threaded inlet opening 2 and with a correspondingly internally threaded outlet opening 3.

Threaded into this outlet opening 3 is a special fitting which may be termed a substitute 4. The body 1 is counterbored from the threaded outlet

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opening 3 to provide an internal shoulder 5 facing toward the outlet opening.

The internal shoulder 5 is adapted to provide a limit stop for the purpose of receiving the inclined surface 6 on the valve seat member 7 which presents an annular upwardly facing valve seating surface 8 preferably surfaced with a hardened material for the purpose of reducing wear thereon. On its surface adjacent the substitute 4, the valve seat member 7 is cut away to provide a recess 9 adapted to receive a flexible annular sealing ring 10.

The seat member 7 is held in place within the body 1 by means of the substitute 4 which engages the seat member with its flared substantially conical inner end surface 11. It will be appreciated that the seal ring 10 will be formed of a type of well known sealing materials such as rubber or synthetic rubber which is pliable and flowable under pressure, and that it is initially of such a size as to engage and form an initial seal with the surface 11. It will be appreciated further that when the valve member 7 is held against the surface 11 and pressure is applied thereto through the inlet opening 2, this pressure will tend to make the material of the seal ring 10 flow into the joint between the surface 11 and the seal member 7 and seal such joint.

The substitute 4 is also internally threaded from its upper end as indicated at 13 and is counterbored from its upper end to provide an upwardly facing shoulder 14 intermediate its ends. It is further counterbored below the shoulder 14 as shown at 15 to provide an upwardly facing shoulder 16 for a purpose presently to be described. The exterior of the free end of the substitute 4 is threaded as shown at 17.

Opposite the outlet opening the body 1 is provided with an opening in alignment with the outlet opening having relatively coarse or fast lead threads 18 therein. These threads and this opening are adapted to receive an annular valve member 19 externally threaded to match the threads 18 in the body and having a cylindrical part below such threads adapted to pass through a relatively close fitting portion of the opening. This close fitting portion of the opening is provided with a groove adapted to receive a seal ring 20 similar in its characteristics to the seal ring 10 with the exception that it is of such a size that initially it will form a seal about the exterior of the annular valve member 19. This annular valve member on its lower end is provided with a valve seating surface preferably faced with a hard wear resistant material as indicated at 21. This surface is of such a size and is so positioned that when the valve member is rotated to move it downwardly within the threads 18, this seating surface 21 will be brought into seating engagement with the seating surface 8 on the valve seat member 7 thereby closing off flow from the inlet opening 2 through the outlet.

For the purpose of rotating this valve member 19 to close and open the valve in the manner just described, the upper end or the external end thereof is provided with a non-circular (preferably hexagonal) part 22 which may be engaged by any suitable wrench or the like. This part 22 is preferably counterbored as shown at 23 providing an outwardly facing shoulder 24 at the lower end of the counterbore.

Within the valve member 19 and closely fitting therein is a flow bean retainer which also may be said in a sense to serve as a guide for the valve member 19. This retainer is indicated at 25 and

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has an external flange-like portion 26 adjacent its upper end adapted to be received in the counterbore 23 in the upper end portion of the valve member 19. This flange-like part 26 is provided with an external outwardly facing groove for the purpose of receiving a seal ring 27 similar to the seal rings 10 and 20 heretofore described but of an external diameter such that it will form an initial seal with the interior of the counterbored portion 23 of the valve member 19. Above the flange 26 the retainer 25 is provided with a non-circular part 28 whereby the retainer may be rotated, but it will be noted by reference to Fig. 1 that when the valve member 19 is in its upper or open position, the non-circular portion 22 of the valve member will completely or substantially completely overlie the non-circular portion 28 on the retainer member so that the retainer member cannot be rotated to remove it while the valve is open.

Within its lower end the retainer is counterbored from its lower end as shown at 29 to provide a downwardly facing shoulder 30 opposed to the shoulder 16 in the substitute 4. Interposed between these shoulders 16 and 30 is a flow bean 31.

Adjacent its upper end the retainer 25 is provided with internal threads 32 adapted to receive the external threads 33 on the stem 34 of a needle valve 35. The needle valve portion 35 may be moved upwardly or downwardly by rotating the stem 34 within the threads 32, so that the needle valve will enter to a greater or lesser extent within the upper end of the flow bean 31 and decrease or increase the flow permitted therethrough.

Normally flow is permitted to take place from the inlet opening 2 through the outlet opening of the body 1 by way of the radial passages 36 through the retainer 25. It will be seen that with these passages 36 extending therethrough the retainer 25 takes on the form of a cage at a position located substantially centrally with respect to the intake opening 2 and just above the valve seat 8 on the valve seat member 7.

Leakage upwardly between the retainer 25 and the stem of the needle valve is prevented by means of a seal ring 37 located in an external groove formed on the stem 34 below the threads 33. This seal ring is preferably of the same form and nature as the seal rings previously described and is of such an external size that it will initially form a seal with the interior of the retainer 25.

Adjacent its upper end the retainer 25 is counterbored a short distance for the purpose of receiving the indicator sleeve 38 having an opening longitudinally thereof as shown at 39 adjacent one side so that the stem 34 of the needle valve 35 may be viewed through the sleeve. Along the edge of the opening 39 graduations are provided as shown at 40 so that by observing that graduation which is opposite the groove or indicator mark 41 on the stem one may determine the degree to which the valve 35 is closed or opened. The stem 34 may be rotated by means of a non-circular extension 42 on its upper end.

It will be seen that when the structure shown in Fig. 1 is in use and it is desired for any reason to change the bean 31 or the valve 35, flow through the body 1 may be shut off by turning the non-circular upper end 22 of the valve member 19 until the seat 21 engages and forms a seal with respect to the seat 8. This rotation of the valve member 19 will move it downwardly and thus uncover or partly uncover the non-circular portion 28 on the retainer 25. Thereupon the

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retainer 25 may be engaged with a wrench or the like and rotated to remove it from its threaded engagement with the substitute 4. The removal of this retainer 25 will likewise remove the valve 35 and will normally remove the flow bean 31. Thereupon another flow bean may be substituted and the retainer 25 and valve 35 replaced, or as will be presently set forth, a plug element may be substituted for the valve 35.

Referring now to Fig. 2 of the drawings, there is illustrated the same structure as was shown in Fig. 1 with the exception that a fixed type of flow bean 131 with a relatively smaller passage therethrough has been substituted for the flow bean 31 and a bleeder type of plug has been substituted for the needle valve 35. This bleeder plug is provided with external threads 133 on a hollow stem portion 134 having a longitudinal passage 135 therethrough. This passage 135 leads from the lower end of this stem portion upwardly to a point where it joins a radial passageway 136 leading to a groove 137 around the exterior of the stem of the plug. Just above this groove 137 the plug is provided with an enlargement 138 the lower portion of which is adapted to seat against a seat provided therefor as shown at 139 on the upper end of the retainer 25. This seat is just above the groove 137 as illustrated in the drawing.

The bleeder plug is adapted to be rotated to tighten it or remove it by means of a non-circular upper extension 140.

With the use of the structure which has just been described, it is possible to put in place a fixed type flow bean such as illustrated at 131 in Fig. 2 and to flow a well initially through such flow bean for the purpose of testing the capacity of the well to produce, and thereafter to close the valve 19 so that the parts occupy the position illustrated in Fig. 2, whereupon the retainer 25 may be removed and the fixed standard flow bean 131 taken out and replaced with a flow bean of any other size. Frequently after closing the valve 19, it is desired to bleed from the interior of the body 1 within the valve 19 the pressure which exists therein before removing the retainer 25. For this purpose, it is only necessary to loosen the bleeder plug 134 until such pressure is bled off through the passageways 135 and 136. Thereupon the retainer 25 may be removed with safety and the flow bean changed.

If desired, instead of changing to another size of fixed type of flow bean, or to a type of fixed flow bean more suited for extended flow, it is possible to substitute a flow bean of the type shown at 31 in Fig. 1 which is of larger internal diameter and is adapted to receive the needle valve 35 for the purpose of regulating the flow from the well. The needle valve 35 is threaded into place within the retainer 25 in the same manner and using the same threads 32 as were used by the bleeder plug 134. Rotation of the stem 34 of the needle valve 35 will serve to adjust the position of the needle valve until the rate of flow from the well is that which may be desired. This setting can be duplicated by rotation of the stem 34 until the indicating mark 41 on the stem is opposite the desired point on the scale 40.

The seal rings 10, 20, 27 and 37 are of a well-known type of sealing ring formed of a relatively pliable material flowable under pressure. These rings are preferably of circular cross section and of such size that they initially form a contact but not a tight engagement with the surfaces between which they are to form seals. When

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pressure is exerted upon such rings, the pressure tends to force them into the joints which they are intended to seal, and by causing them to flow toward such joints it causes them to more tightly engage the surfaces of the adjacent members and thereby provide perfect seals. This type of ring is well known to provide a low friction leak proof durable seal.

It will be seen from the foregoing that a means has been provided for carrying out and accomplishing all of the objects and advantages sought by this invention.

Having described my invention, I claim:

1. In a flow control unit, a body having inlet and outlet openings at an angle to each other and a third opening opposed to and in alignment with said outlet opening, an annular valve seat and an inwardly facing annular shoulder carried by said body surrounding said outlet opening, an annular valve member extending through said third opening and movable therein to and from seated engagement with said valve seat to close and open a flow passage from said inlet to said outlet, means including a removable guide in the valve member to plug the same against communication therethrough between the interior and the exterior of the body, said removable guide having a hollow cage-like part extending into and secured within said outlet opening to hold the guide normally stationary with respect to said body, and having an outwardly facing annular shoulder opposed to said first shoulder, and a bean clamped between said shoulders.

2. In a flow control unit, a body having inlet and outlet openings at an angle to each other and a third opening opposite and in alignment with said outlet opening, an annular valve seat and an inwardly facing annular shoulder carried by said body surrounding said outlet opening, an annular valve member extending through said third opening and movable therein to and from seated engagement with said valve seat to close and open a flow passage from said inlet to said outlet, means including a removable guide and retainer member in the valve member to plug the same against communication therethrough between the interior and the exterior of the body, said removable guide having a hollow cage-like part extending into and secured within said outlet opening to hold the guide normally stationary with respect to said body and having an outwardly facing annular shoulder opposed to said first shoulder, a flow bean clamped between said shoulders, said guide being hollow throughout its length, and a needle valve having its stem threadedly engaged in said hollow guide and retainer member and adapted to be moved toward and from said flow bean to vary the flow therethrough.

3. In a flow control unit a body having inlet and outlet openings at an angle to each other and a third opening opposite and in alignment with said outlet opening, an annular valve seat and an inwardly facing annular shoulder carried by said body surrounding said outlet opening, an annular valve member extending through said third opening and movable therein to and from seated engagement with said valve seat to close and open a flow passage from said inlet to said outlet, a removable retainer in the valve member and extending therethrough, said retainer having a hollow cage-like part extending into and secured within said outlet opening and having an outwardly facing annular shoulder

der opposed to said first shoulder, and a flow bean clamped between said shoulders.

4. In a flow control unit, a body having inlet and outlet openings at an angle to each other and a third opening opposite and in alignment with said outlet opening, an annular valve seat and an inwardly facing annular shoulder carried by said body surrounding said opening, an annular valve member extending through said third opening and movable therein to and from seated engagement with said valve seat to close and open a flow passage from said inlet to said outlet, a removable retainer in the valve member and extending therethrough, said retainer having a hollow cage-like part extending into and secured within said outlet opening and having an outwardly facing annular shoulder opposed to said first shoulder, said retainer having an operating portion projecting beyond said body and beyond said annular valve member when said annular valve member is in closed position, said operating part being of such extent as to be substantially inclosed by the outer portion of said annular valve member when said annular valve member is in open position, whereby said retainer cannot readily be removed when said valve member is in open position, and a flow bean clamped between said annular shoulders carried by the body and by said retainer.

5. In a flow control unit, a body having inlet and outlet openings at an angle to each other and a third opening opposite and in alignment with said outlet opening, an annular valve seat carried by said body surrounding said outlet opening, an annular valve member extending through said third opening and movable therein to and from seated engagement with said valve seat to close and open a flow passage from said inlet to

said outlet, and means including a removable guide in the valve member to plug the same against communication therethrough between the interior and the exterior of the body, said removable guide having a hollow cage-like part extending into and secured within said outlet opening to hold the guide normally stationary with respect to said body, said guide having an operating part adjacent its outer extremity projecting beyond said annular valve member when said annular valve member is in its closed position, and being of such extent as to be substantially inclosed by said annular valve member when said annular valve member is in open position, whereby said guide may not readily be removed when said annular valve member is in open position.

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