June 24, 1930. A. BOYNTON 1,768,109

STAGE LIFT FLOWING DEVICE

Filed May 6, 1927 2 Sheets-Sheet 1

Fig. 1.

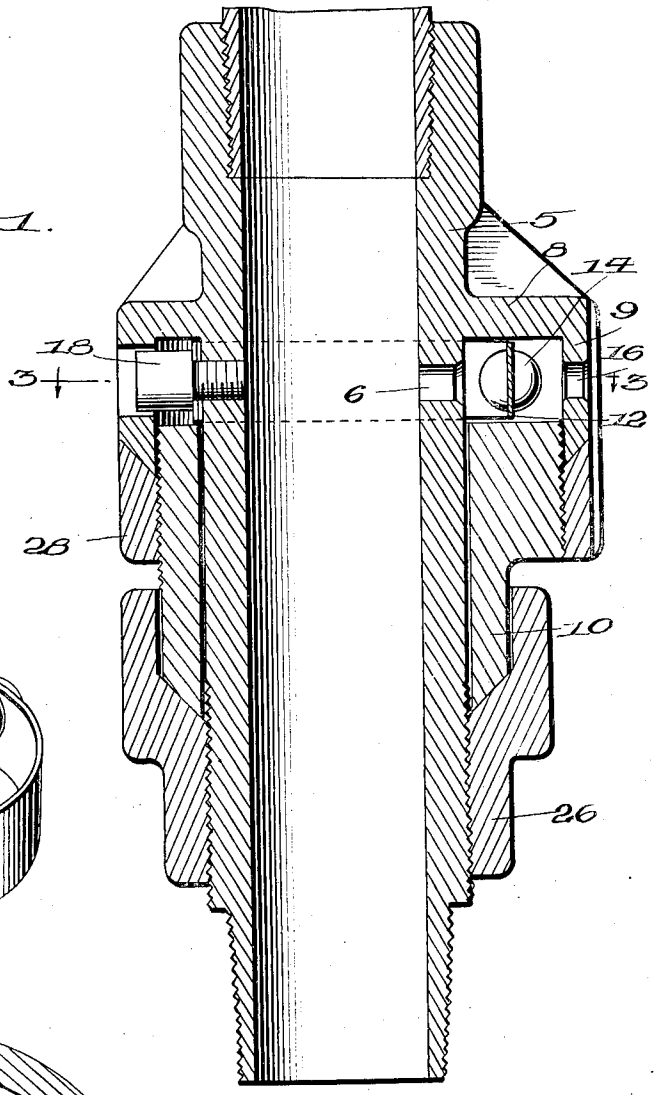
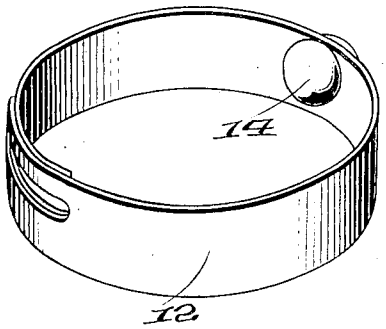


Fig. 2.



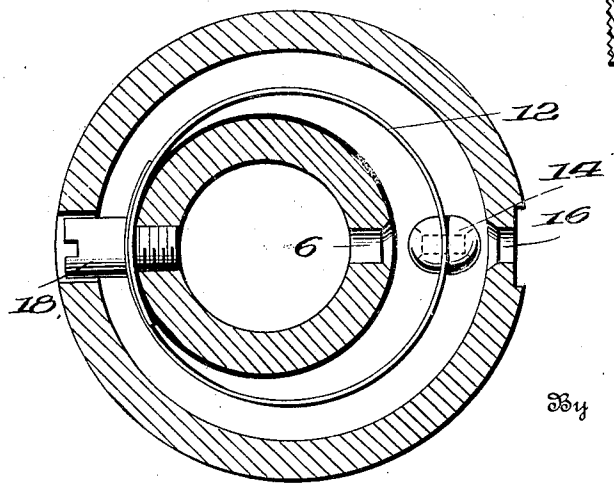


Fig. 3.

Inventor

ALEXANDER BOYNTON,

By A. G. Quesada

Attorney

June 24, 1930. A. BOYNTON 1,768,109

STAGE LIFT FLOWING DEVICE

Filed May 6, 1927 2 Sheets-Sheet 2

Fig. 4.

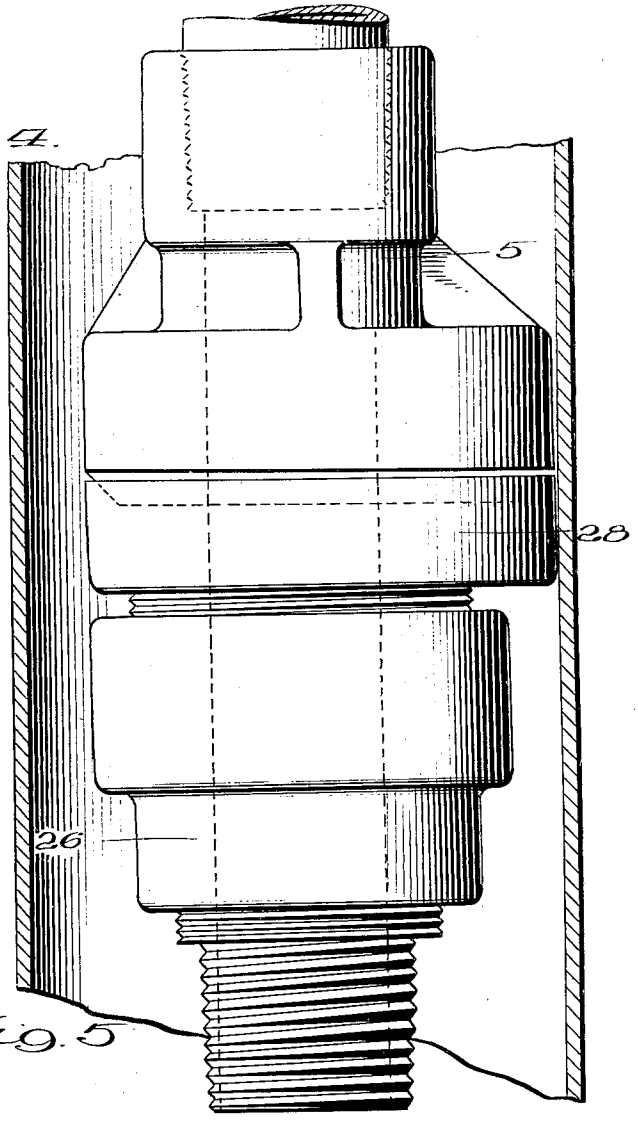
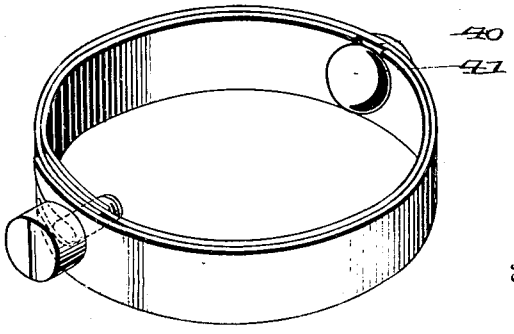


Fig. 5



Inventor
ALEXANDER BOYNTON,

By

Attorney

Patented June 24, 1930.

1,768,109

UNITED STATES PATENT OFFICE

ALEXANDER BOYNTON, OF SAN ANTONIO, TEXAS

STAGE-LIFT FLOWING DEVICE

Application filed May 6, 1927. Serial No. 189,303.

This invention relates to a fluid lift and more particularly to a means by which a well may be flowed through the tubing or casing.

Briefly stated an important object of the invention is to provide a fluid lift embodying simple means by which the responsiveness of the same to variations in the casing and tubing pressures may be regulated.

A further aim is to provide an automatic stage lift valve which is of highly simplified construction, durable in use and capable of ready adjustment preparatory to the incorporation of the same in a tubing.

Other objects and advantages will be apparent during the course of the following description.

In the accompanying drawings forming a part of this application and in which like numerals are employed to designate like parts through the same,

Figure 1 is a vertical sectional view through the flowing device applied,

Figure 2 is a perspective of a spring and a valve carried thereby,

Figure 3 is a horizontal sectional view taken on line 3—3 of Figure 1,

Figure 4 is a side elevation of the device applied,

Figure 5 is a perspective of a slight modification of the invention.

In the drawing the numeral 5 designates a tubular body having suitable means at the ends thereof by which the same may be incorporated in a well tubing and having a port 6 for the admission or discharge of a fluid lifting medium, such as compressed air or gas. For the compressed air or gas an outside source of supply may be relied on or gas from the well being flowed may be employed provided the pressure thereof is sufficient.

In carrying out the invention the body is provided adjacent the port 6 with a housing having lateral and depending flanges 8 and 9 respectively and a bushing 10. Figure 1 clearly illustrates that the bushing 10 is mounted on the body and is received within the depending flange 9 to define a chamber for the reception of an annular leaf spring 12.

The leaf spring 12 is provided between the ends thereof with a double headed valve 14 adapted to control the flow of compressed air or gas through the port 6 and a second port 16 in the depending flange 9 of the housing. Figure 3 clearly illustrates that the ports 6 and 16 are substantially in register and have the opposed ends thereof formed with seats adapted to be engaged by the double headed valve 14. The leaf spring 12 normally holds the double headed valve 14 in the unseated position illustrated in Figure 3 and has the ends thereof bifurcated to provide branches which straddle the shank of an adjusting screw 18. The adjusting screw 18 is threaded into the body and when firmly seated will hold the spring in an adjusted position. More specifically the effective length or circumference of the spring may be varied by changing the extent of overlap of the bifurcated end portions of the spring. Also the adjusting screw 18 provides a simple means by which the double headed valve may be accurately positioned in line with the ports 6 and 16. The head of the adjusting screw 18 is shown in Figure 3 to be extended through a radial opening in the flange 9 so that the same is easily accessible for adjustment.

Subsequent to the application and adjustment of the double acting double headed valve 14 and the spring 12 the bushing 10 is slipped onto the body and adjusted with respect to the leaf spring so that the movement of the lifting fluid or medium between the edges of the leaf spring and the opposed walls of the housing may be regulated. Figure 1 clearly illustrates that the spaces between the edges of the spring 12 and the opposed walls of the annular chamber within which the spring is positioned establish communication between the ports 6 and 16.

By way of further explaining the reason for providing for the adjustment of the bushing 10 it might be stated that the area of the passages between the edges of the spring 12 and the opposed walls of the valve chamber may be regulated by the longitudinal adjustment of the bushing on the body. For example, if it is desired to provide for

a diminished flow of lifting medium between the edges of the spring and the opposed walls of the chamber within which the same operates the bushing 10 is moved in the direction of the fixed flange 8 and is secured in this position. On the other hand, if it is desired to provide for an increased flow of lifting medium about the edges of the spring 12 the bushing 10 is moved in a direction opposite the fixed flange 8 so as to increase the spaces between the edges of the spring and the opposed walls of the chamber. It is believed to be clear from the foregoing that the spring is movably mounted and is retained within the zone of influence of the varying pressures within the tubing and the casing.

It will be observed that the housing, including the flanges 8 and 9 and the bushing 10 are eccentrically disposed with respect to the axis of the body to provide for the flexing of the spring 12 intermediate the ends thereof in response to variations in pressure.

The lower portion of the bushing 10 is provided with a tubular extension or neck received within the internally enlarged upper portion of an adjusting nut 26 threaded on the lower portion of the body. The lower end of the tubular neck and the adjacent portion of the adjusting nut are correspondingly beveled for contact. When the adjusting nut is advanced on the body the bushing will be moved a greater distance into the depending flange 9 and when the nut is retracted the bushing will be partly or completely withdrawn from the flange 9, depending of course on the extent of movement of the nut. When the bushing has been properly adjusted the same may be locked in place by a ring nut 28 threaded on the bushing and engaged with the lower edge of the flange 9. The opposed edges of the flange 9 and the ring nut may be beveled for gas tight contact with each other.

In practice the spring 12 and the double acting valve is first applied and adjusted and the bushing is then slipped onto the body and is adjusted as explained, after which the same is locked in place by the ring nut 28.

If it is desired to flow the well through the tubing a fluid lifting medium is introduced through the port 16 and is passed about the edges of the spring 12 and enters the body 5 by way of the port 6. When a low pressure differential obtains between the tubing and casing fluids the valve will remain unseated. However, as a result of the movement of the oil or other fluid being flowed the pressure within the tubing drops thereby increasing the differential between the casing and tubing fluids so that the valve is moved in the direction of the port 6 to diminish or possibly cut off the supply of fluid lifting medium to the tubing. The subsequent increase in pressure within the tubing will result in the outward movement of the valve so that the supply of lifting medium is increased or renewed.

If the well is to be flowed through the casing the lifting medium is supplied through the tubing and when a low differential obtains between the pressures of the casing and tubing fluids the valve will remain unseated so that the lifting medium may pass about the edges of the leaf spring and enter the casing by way of the port 16. The upward movement of the oil or other fluid being flowed will increase the pressure differential with the result that the valve is moved outwardly in the direction of the port 16 to diminish or cut off the supply of lifting medium to the casing. It will be seen that this will result in a low differential so that the double acting valve may be moved away from the port 16 to bring about an increase or renewed supply of compressed air or gas.

With reference to the foregoing description it will be seen that the successful operation of the invention is dependent on maintaining the leaf spring 12 within the zone of influence of the varying pressures in the tubing and casing and that the supply of lifting medium is conserved since the double acting valve allows of the employment of the lifting medium only at the most advantageous periods.

If desired the spring shown in Figure 1 may be laminated and by way of illustrating this point in Figure 5 I have shown a spring consisting of interfitting sections or laminations transversely slotted as shown at 40 to receive the grooved intermediate portion of a double acting double headed valve 41. The laminations of the spring shown in Figure 5 have the transverse slots therein extending out through opposite edges so that the valve 41 will be locked in place by the opposed closed ends of the slot. The laminations of the spring shown in Figure 5 may be bifurcated and overlapped for engagement by a pressure screw by which the spring may be adjusted for admitting the lifting medium in the required volume.

Having thus described the invention, what is claimed is:

1. A fluid control valve for wells comprising a body having a housing, one wall of which is adjustable, said body being provided with a port for the movement of a fluid lifting medium, and a valve within said housing and controlling said port and being provided with a movable support within the zone of influence of the varying pressures interiorly and exteriorly of the body, said support and said adjustable wall of the housing cooperating in the formation of a passage for a fluid lifting medium.

2. In a stage lift flowing device a body having a housing provided with an adjustable wall, a spring within said housing and having a double acting valve, said housing and said body being provided with ports for the passage of a fluid lifting medium, said

adjustable wall cooperating with said spring in the formation of a passage for a fluid lifting medium.

3. In a stage lift flowing device a body having a housing provided with an adjustable bushing forming one wall of the housing, a nut carried by said body and engaged with said bushing for adjusting the same said body having a port, and a valve controlling said port and having a supporting spring cooperating with said bushing in forming a flow passage.

4. In a stage lift flowing device a body having a housing provided with a movable bushing, a nut carried by said body and engaged with said bushing for adjusting the same, a valve within said housing and having a supporting spring cooperating with said bushing in forming a flow passage, and a locking device for said bushing, said body being provided with a port controlled by said valve.

5. In a stage lift flowing device a body having an eccentrically disposed housing, said housing and said body being provided with two-way ports for the passage of a fluid lifting medium, a leaf spring between said ports and having a valve to control the ports.

6. In a stage lift flowing device a body having an eccentrically disposed housing, said housing and said body being provided with two-way ports for the passage of a fluid lifting medium, and a leaf spring between said ports and having a valve to control the ports, said spring being within the housing and being exposed through said ports to the varying pressures interiorly and exteriorly of the body.

7. In a stage lift flowing device a body having a housing, provided with two-way ports for the passage of a fluid lifting medium, a leaf spring between said ports and having a valve to control the ports, a bushing cooperating with the housing in forming a valve chamber and with the spring in forming a flow passage, and means to hold the bushing in an adjusted position with respect to said spring, said housing and the bushing thereof being eccentrically disposed with respect to said body to provide an enlarged space for the movement of said valve and the adjacent portion of said spring.

8. In a stage lift flowing device a body having a two-way port for the passage of a fluid lifting medium, a leaf spring having a valve controlling said port, said leaf spring being provided with ends adapted to be overlapped, and a holding and adjusting device for clamping the ends of the spring in place, the spring being within the zone of influence of and actuated by the varying pressures interiorly and exteriorly of the body.

9. In a stage lift flowing device a body having a two-way port for the passage of a fluid lifting medium, a leaf spring having a valve controlling said port, said leaf spring being provided with ends adapted to be overlapped, and a holding and adjusting device for clamping the ends of the spring in place, said body being provided with a housing enclosing said spring.

10. In a stage lift flowing device a body having a housing provided with an eccentrically disposed annular flange and a bushing adjustably received within said flange, said body and said flange being provided with two-way ports for the passage of a fluid lifting medium, a spring within said housing and within the zone of influence of the pressures interiorly and exteriorly of the housing, and means to secure said bushing in an adjusted position with respect to said spring.

11. In a stage lift a body having a two-way port, a leaf spring encircling the body and having means to control said port, the ends of said spring being bifurcated and overlapped, and an anchoring and adjusting device extending through and clamping the bifurcated ends of said spring and regulating the effective length of the spring.

In testimony whereof I affix my signature.

ALEXANDER BOYNTON.