March 30, 1943. A. BOYNTON 2,314,868

FLOWING DEVICE, TUBING, AND CASING FLOW

Filed Dec. 8, 1939 2 Sheets-Sheet 1

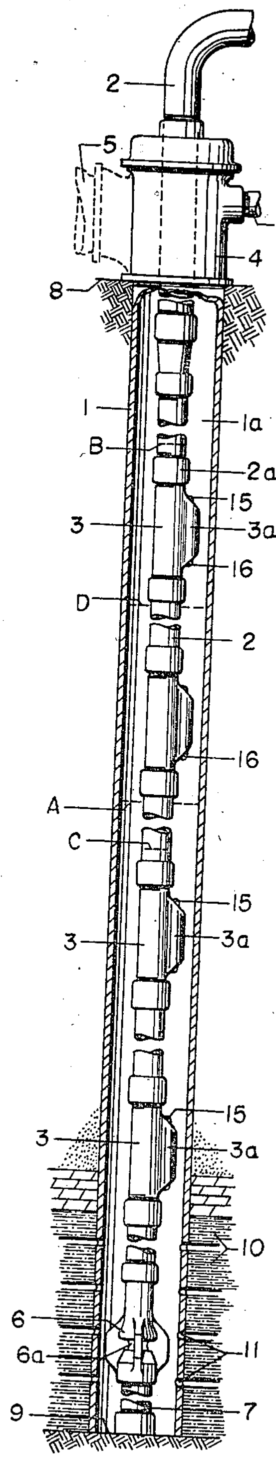

Fig. 1.

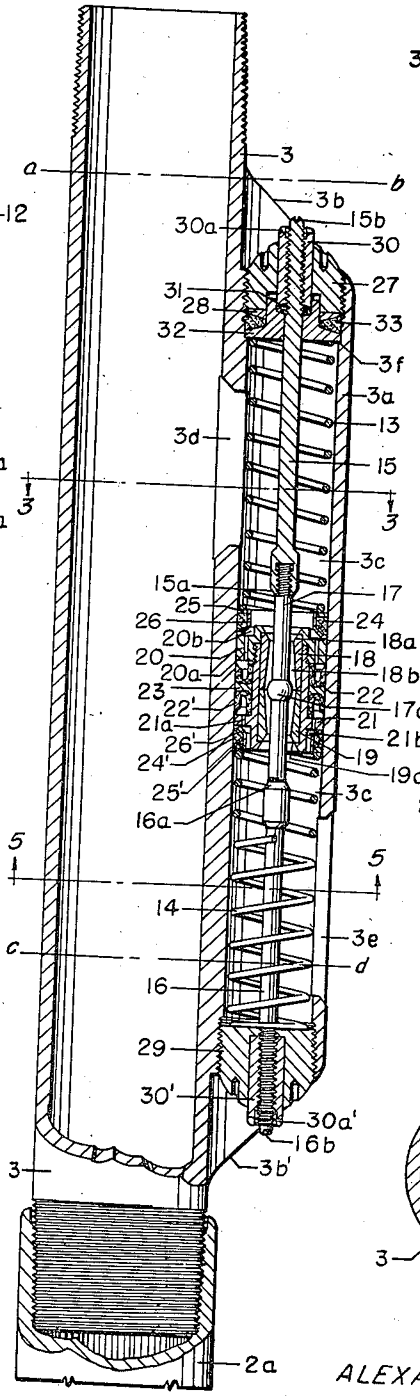

Fig. 2.

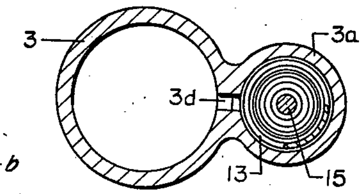

Fig. 3.

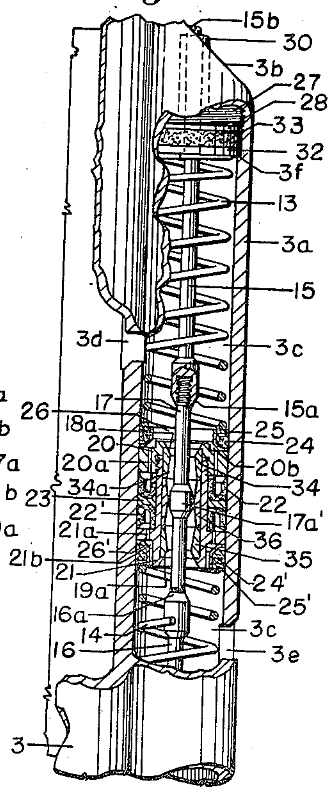

Fig. 4.

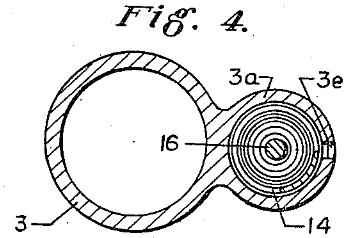

Fig. 5.

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FLOWING DEVICE, TUBING, AND CASING FLOW

Filed Dec. 8, 1939 2 Sheets-Sheet 2

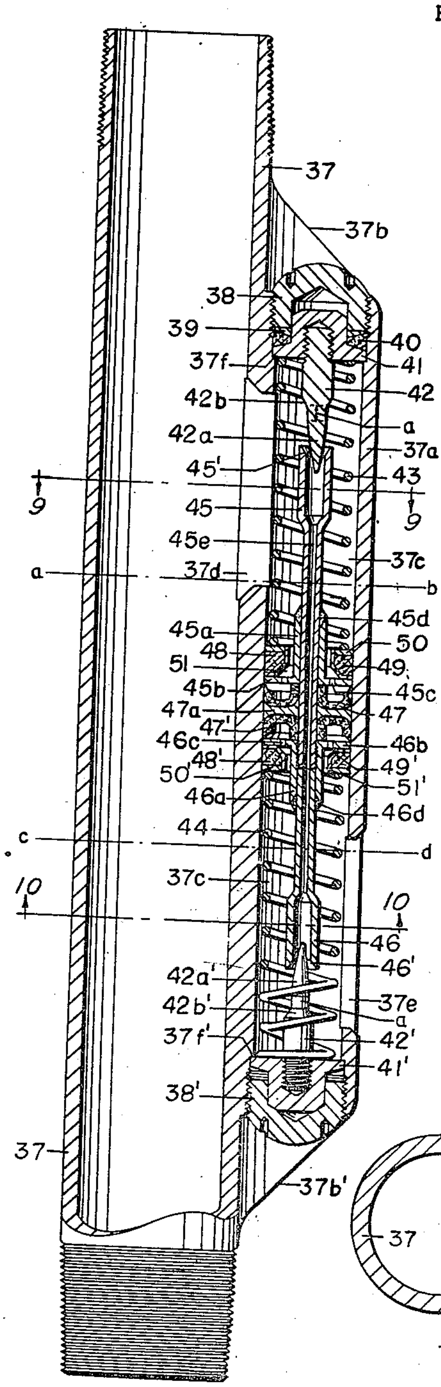

Fig. 6.

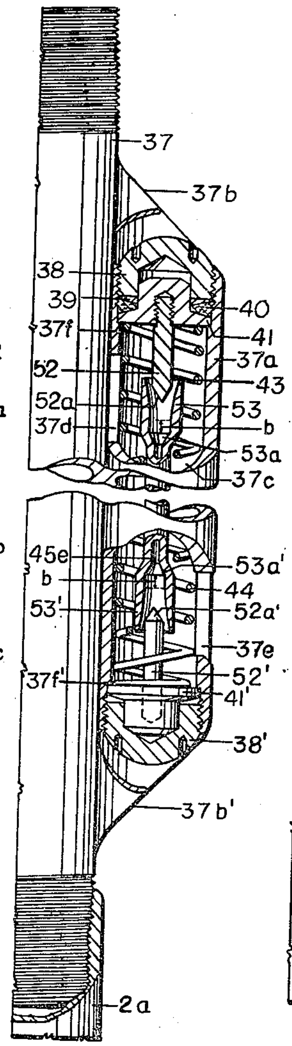

Fig. 7.

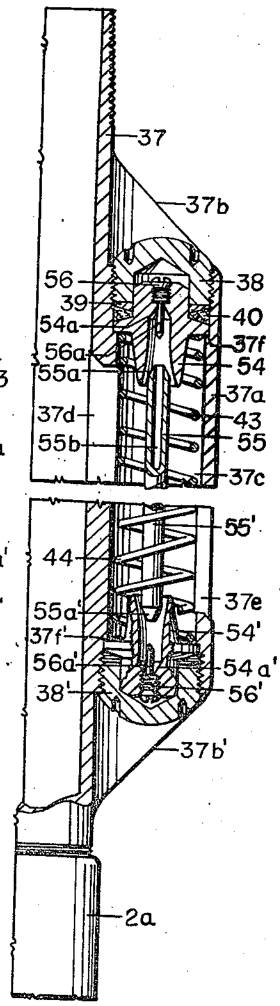

Fig. 8.

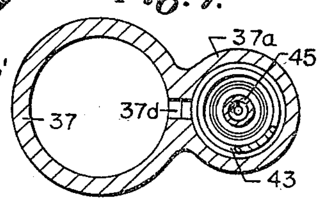

Fig. 9.

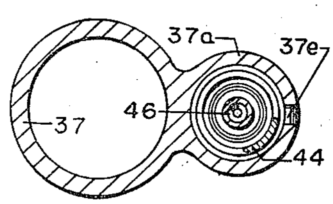

Fig. 10.

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UNITED STATES PATENT OFFICE

2,314,868

FLOWING DEVICE, TUBING, AND CASING FLOW

Alexander Boynton, San Antonio, Tex.

Application December 8, 1939, Serial No. 308,305

13 Claims. (Cl. 137—111)

My invention relates to flowing devices for wells, the flow being accomplished by the expansive force of compressed air or gas.

The principal object is to provide means for actuating the valves by pressure acting on a larger area than that of the valves.

Another equally important object is to provide means for preventing the valves from opening prematurely, due to gas breaking through the well liquid or due to slippage of the well liquid in the eduction tube.

Another object is to provide means for causing a well to flow through the tubing from progressively lower levels by pressure fluid from within the casing admitted through devices spaced at intervals in the tubing and by the employment of identical means, to cause a well to flow by stages through the casing by air or gas pressure in the tubing.

A further object is to provide valves that will seat and seal off with greater force and certainty than can be accomplished by valves now employed in the art.

Another object is to throttle the amount of pressure fluid passing each valve at high pressure so that the valves and seats will not be abraded.

A further object is to automatically throttle the pressure fluid admitted through each device according to the load to be lifted.

Two valves are movably balanced between two springs in the path of the pressure fluid employed as the lifting force, each valve being adapted to regulate the inflow of pressure fluid, and finally to close on its seat and cut off the inflow of pressure fluid at a predetermined difference between the value of the pressure fluid and the load to be lifted by it.

In carrying out this invention, air or gas under pressure in the casing causes a column of well liquid to upstand in the tubing, or air or gas pressure in the tubing causes a column of well liquid to upstand in the casing. In either event, air or gas is discharged through the devices, spaced at intervals in the tubing, the largest volume of air or gas being discharged into the upstanding column through the widest open device which is the one nearest to the base of the upstanding liquid column. The valves in the devices above the one nearest to the base of the upstanding column are progressively nearer to their closed positions, due to the fact that the force tending to close all valves contacting the upstanding column is the same, while the force resisting such closing diminishes in proportion to the lightening pressure of the upstanding column at each higher device above the base of the upstanding column.

I attain the foregoing objects by mechanism illustrated in the accompanying drawings, in which—

Fig. 1 is an installation plan of the device installed in a well.

Fig. 2 is mainly a longitudinal section of the preferred embodiment of the invention.

Fig. 3 is a cross-section on the line 3—3, Fig. 2.

Fig. 4 is mainly a longitudinal section of a slightly modified form of the valve mechanism.

Fig. 5 is a cross-section on the line 5—5, Fig. 2.

Fig. 6 is a longitudinal section of a modified form of the invention.

Fig. 7 is mainly a longitudinal section of another modified form of the valve construction.

Fig. 8 is mainly a longitudinal section of a further modified form of the valve construction.

Fig. 9 is a cross-section on the line 9—9, Fig. 6.

Fig. 10 is a cross-section on the line 10—10, Fig. 6.

Similar reference characters refer to similar parts throughout the several views.

The nipple portion 3 of the device is adapted to have threaded connection with the couplings 2*a* of the tubing string 2. These devices within the casing 1 are spaced in the tubing at intervals which may vary from approximately 150 to 300 feet.

The anchor string 7, below the tubing 2, may be landed upon the bottom of the well bore 9. The intake or discharge nipple 6, having lateral openings 6*a*, admits the well liquid if the well is being flowed through the tubing, and becomes the lower air or gas discharge from the tubing if the well is being flowed through the casing.

The perforations 11 admit the contents of the producing formation 10 into the well casing. The pipe 12 may be employed to admit external gas under pressure into the well, or may be used to convey excess gas away from the well. The casing head 4, which may be of any other conventional design, may be employed proximately above the ground surface 8 to effect a seal between the casing 1 and the tubing 2.

The upper end of the tubing 2 may extend to a flow tank, if the well is being flowed through the tubing, or the flow line 5 may extend to the flow tank if the well is being flowed through the casing.

If the well is to be flowed through the tubing 2 and does not produce enough gas to flow it, input air or gas may be supplied for that purpose into the annular space 1a through the pipe 12. Pressure fluid will be supplied through the tubing 2 if the well is to be flowed through the casing.

In flowing through the casing, i. e. the annular space 1a, the pipe 12 ordinarily will be closed. In flowing through the tubing, the pipe 5 will be closed.

Within the shell 3a, which may be formed integrally with the nipple portion 3, the valve mechanism is resiliently supported between two coiled springs 13 and 14, installed under some compression.

The proximate ends of these springs engage upon packing rings 25 and 25' which rings are slidable within the bore 3c and over the upper projection of packing housings 26 and 26'. The bore 3c may have a diameter such as one to one and one-half inches. The springs 13 and 14 have their extreme ends engaged upon plug base 32 and lower end plug 29, respectively. These springs may be of equal force.

Both movable packings 24 and 24' are constantly under compression from the springs, and, on account of the sloping interior surfaces of the housings 26 and 26', these packings are constantly urged against the surface of the bore 3c.

The upper valve member 18 and the lower valve member 19 are held abutted together by the flanged outer extremities of upper valve retainer 20 and lower valve retainer 21, threadedly joined together as appears in Fig. 2. The U cups 22 and 22', which may be of leather or any other tough, yieldable substance, fit snugly over the upper tubular portion of the lower valve retainer 21. These cups, which may be replaced by any other suitable form of packing or by metallic rings, are separated by the ring 23 and secured in position by the outer flanges of retainers 20 and 21.

The assembly of parts 18 to 25', both inclusive which has a close sliding fit within the polished bore of chamber 3c, will be referred to as the movable valve assembly.

The difference in pressures obtaining above and below the movable assembly will be referred to as the differential, which is the difference between the value of the pressure fluid and the back pressure of the well liquid at any level in the upstanding column, caused by the pressure fluid.

The opposed valve seating and unseating forces operating upon the movable assembly are equal, except the back pressure of the well liquid in the upstanding column which varies according to its place in that column.

The slot 3d in the partition wall between nipple 3 and shell 3a places the upper end of the movable valve assembly in open communication with the interior of the tubing, and the outer slot 3e places the lower end of the valve assembly in open communication with the annular space 1a. The movable valve assembly, resiliently supported between the coiled springs 13 and 14, has the central opening 18b adapted to be closed by the valve 18a when it engages the seat 15a, or by the valve 19a when it engages the seat 16a. This assembly is a floating barrier between the inside of the tubing and the annular space 1a of the casing and, therefore, is always subject to be actuated by the pressure differential. The valve seats 15a and 16a limit the piston travel between the slots 3d and 3e.

The ports 20a and 21a and the annular spaces 20b and 21b provide that pressure fluid will expand the U cups (or compress the packing if packing be employed instead of cups) on the side of the greatest pressure. The compressed packing 24 and 24' will sweep the wall of the bore 3c clean ahead of the cups or packing 22 and 22' as the valve assembly moves in either direction.

The governor enlargement 17a is of slightly less diameter, such as 1 to 5 thousandths inch, than the smallest inside diameter of the opening 18b through the upper and lower valve members 18 and 19, these places of smallest diameter being proximate the upper and lower ends of these members. The central opening 18b through the valve members 18 and 19 enlarges from their outer ends toward their proximate ends where the enlargement 17a has greatest clearance within it, such as $\frac{1}{16}$ to $\frac{3}{16}$ inch. This opening is the only communication between the inside of the tubing and the annular space 1a, except through the nipple 6 or through the bottom end of the tubing.

The upper end of bore 3c is hermetically closed. The plug base 32 is closely received within the extremity of this bore and landed upon the slight internal annular shoulder 3f. The gland ring 28, having an internal diameter slightly greater than that of the smaller end of base 32 and an external diameter slightly less than the diameter of the opening in the end of shell 3a above the shoulder 3f, serves to compress the packing 33 by means of the threaded engagement between the plug 27 and the shell 3a.

The lower end plug 29 has threaded engagement within the lower end of the shell 3a. The upper sloping end 3b and lower sloping end 3b' of the shell 3a serve to guide the device through irregularities in the casing.

Central of the bore 3c, the upper valve rod 15 and the lower valve rod 16 each has a threaded connection with the governor rod 17. The valve 18a is adapted to seal off upon the seat 15a, and the valve 19a is adapted to seal off upon the seat 16a. The upper adjustment securing ring 30 has threaded engagement over the upper end of the rod 15 and engages upon the packing 31 within the upper end of the base 32. The lower adjustment securing ring 30' has threaded engagement over the lower end of the rod 16 and is adapted to land upon an internal flange within the upper end of the plug 29.

The governor enlargement 17a may be longitudinally positioned relative to the valve assembly by means of the threaded connections at either end of the rods 15 and 16, as is apparent in Fig. 2, the slots 15b, 16b, 30a, and 30a' being to receive tools in making such adjustments.

In all forms of the invention, the devices, preferably, should be spaced apart in the tubing at such distance that the well liquid between adjacent devices will weigh somewhat less per square inch than the pounds per square inch of differential required to close the valves. Otherwise stated, the force of the springs 13 and 14 should be such that the differential per square inch required to close the valves in the devices will be somewhat more than the weight of the well liquid exerted per square inch between adjacent devices. Such adjustment will cause the upper valve to remain always open until the next lower valve has been uncovered by well liquid.

The differential force required to close the valve in all forms of the invention may be, for example, 50 to 100 pounds per square inch. This ordinarily will require the valves to be placed 150 to 300 feet apart.

The value of the pressure fluid employed to flow the well, in all forms of the invention, preferably, should be at least twice or more than twice the value of the differential necessary to close the valves. Obviously, increasing the value of the pressure fluid will increase the rate of liquid flow in either direction and vice versa.

The valves in all forms of the device are normally open by the balanced force of the opposed springs 13 and 14 on either side of the movable assembly, the valve closing movement in either direction being caused by the pressure fluid on the opposite side, which will close either valve at a predetermined differential.

It will be understood that flow of well liquid through the eduction tube results from the expansion of the pressure fluid admitted into this liquid through the devices.

Preceding the operation of flowing a well through the tubing by means of a construction such as that just described, it is assumed that the flow line 5 and the tubing 2 are both closed by valves, not shown, exterior of the well.

To flow the well through the tubing a valve in the line 12 exterior of the well is opened to admit into the annular space 1a compressed air or gas of somewhat greater value than the differential required to close the valves in the devices, if the well does not produce enough gas to flow it, then open the valve (not shown) in the tubing 2. This will cause the well liquid to be depressed in the casing to a level assumed to be at A, and to upstand in the tubing to a level indicated at B. All valves above the upstanding column in the tubing will be closed then by the greater pressure below the movable valve assembly than above it. The pressure will be greater below than above this assembly, because the pressure within the tubing will be bled off by opening the valve in the tubing. All valves in the devices then will be open opposite the upstanding column of well liquid where the pressure of this liquid, plus the compression force of spring 13 is greater than the pressure within the annular space 1a. The remaining valves will be closed.

The enlargement 17a being normally in the central position at the place of the greatest bypassing area through the central opening 18b as appears in Fig. 2, it is evident that the greatest volume of pressure fluid will pass through the device and into the upstanding liquid column during the time of least difference in pressures above and below the movable valve assembly. As the differential increases, that is, as the pressure of the upstanding column within the tubing diminishes at any device, the valve 18a will approach its seat 15a. In this manner, the greatest volume of pressure fluid is discharged into the upstanding column by devices nearest the base of the liquid column and the volume of such fluid is automatically diminished as the liquid load diminishes, due to the liquid being discharged from the well.

The valves in the upper devices will close in progression as the liquid level is lowered in the casing and lower devices are uncovered by the receding liquid. Each device is uncovered in the open position of its valve, because of the slight differential there; while the upper valves close, due to increasing differential there as the upstanding column of well liquid grows lighter above them.

Now, to flow the well through the casing, admit into the tubing 2 compressed air or gas of somewhat greater value than that required to close the valves in the devices, and then open the valve in the flow line 5. This will cause the well liquid to be depressed in the tubing to a level indicated at C and to upstand in the casing to a level indicated at D. All valves above the upstanding column in the casing will be closed then by the greater pressure above the movable valve assembly than below it. At all levels above the upstanding liquid column, the pressure will be greater above than below this assembly, because the pressure within the annular space 1a will be bled off by opening the valve in flow line 5.

All valves will be open within the upstanding column of well liquid where the pressure of the liquid, plus the compression force of the spring 14, is greater than the pressure within the tubing.

From the foregoing, it will be observed that the pressure fluid of proper value within either the casing or the tubing will cause the well to flow through the other conduit by means of these devices.

The valve action of the devices is similar whether the well is flowed through the tubing or through the casing.

The enlargement 17a being normally in the central position at the place of greatest by-passing area through the opening 18b, as appears in Fig. 2, it is evident that the greatest volume of pressure fluid will pass through the device and into the upstanding liquid column in the casing during the time of least difference in pressure above and below the movable valve assembly. As the differential increases, that is, as the pressure of the upstanding column in the annular space 1a of the casing diminishes, the valve 19a will approach its seat 16a. In this manner, the greatest volume of pressure fluid is discharged into the upstanding column in the casing by the device nearest the base of the column, and the volume of such fluid is automatically diminished as the liquid load diminishes, due to the liquid being discharged from the well.

Flowing through the tubing ordinarily will result in more economical gas-oil ratios. Generally speaking, only wells of great production should be flowed through the casing, but means to clean out wells by occasionally flowing them through the casing is an operating convenience amply justifying the installation of devices that can be employed to flow through either the tubing or the casing.

If the production of the well is to be obtained by flowing through the tubing, better results will be obtained by enlarging the tubing toward the top of the well, as illustrated in Fig. 1; but if the casing flow is to be employed, the tubing may be smaller and, preferably, all of one size.

In Fig. 4 the construction is the same as in Fig. 2, except that between the upper valve member 34 and the lower valve member 35, a governor ring 36 is interposed. These three members, being held in place by the flanged extremities of valve retainers 20 and 21, provide a central passage for pressure fluid, similar to the showing in Fig. 2. The enlargement 17a' in Fig. 4 is normally opposite the middle of the movable assembly, through which it has slight clearance within the central portion of the central opening 34a through the member 36. It will be noted that the greatest passage way around the enlargement 17a' is approximately midway of the valve travel in either direction. This construction will admit through the opening 34a, extending through the movable assembly, only a relatively small quantity of pressure fluid into the upstanding column at slight differentials, and gradually will increase the amount of pressure fluid so admitted to the maximum amount approximately midway between the least and the greatest differentials during which the valves will remain open.

It will be observed in Figs. 2 and 4 that the enlargements 17a and 17a', respectively, will be in the throat or smallest opening through one valve while the other valve is seating. This construction prevents the seating valve (whichever one it may be) from being cut by abrasive substances just before it seats, this being the time when most cutting would occur, except for the throttling action of enlargement 17a or 17a' in the throat of the other valve.

For the valve assembly in Fig. 4, the size of the largest passage around the enlargement 17a' through the movable valve assembly, ordinarily may vary between the equivalent of ⅛ to ¼ inch diameter circular openings, depending upon the size of the eduction tube, physical properties of the liquid to be lifted, and other well conditions. In the throttling operation, the size of the smallest passage-way may be, for example, ten per cent or less, than that of the greatest passageway.

The governor enlargement 17a' may have a straight portion adapted to have slight clearance, such as .001 inch, with the central opening 34a at its three places of smallest diameter. This straight portion will prevent the fluctuating pressures in the eduction tube from instantly changing the size of the opening through the throats at the extreme ends of the opening 34a. The enlargement 17a in Fig. 2 may be similarly constructed for the same purpose.

In the modified form, Fig. 6, parts 45 to 51, both inclusive, will be referred to as the movable valve assembly. The nipple portion 37, and the shell 37a may be cast integrally, the inner slot 37d communicating between the nipple and the shell and the outer slot 37e communicating between the shell and the annular space 1a within the well casing. The shell bore 37c has a smooth finished surface between the slots 37d and 37e. The movable valve assembly has a close sliding fit within this bore, the valves being adapted to seat and thus confine the piston travel between the slots. The sloping shell ends 37b and 37b' serve as guides through the well casing.

The upper governor pin base plate 41 lands upon the upper small iternal annular shoulder 37f. The packing 40 is impinged between the upper surface of the plate 41 and gland ring 39 by the top plug 38. The upper end of the bore 37c is thus hermetically closed. The lower governor pin base plate 41' lands upon the lower small internal annular shoulder 37f' and is secured thereby the bottom plug 38'.

The coiled spring 43, installed under some compression, is engaged between the upper plate 41 and the upper packing gland ring 50 of the movable assembly. The spring 44, similar to the spring 43 and likewise installed under similar compression, is engaged between the lower plate 41' and the lower packing gland ring 50'.

The upper pin base 42 has threaded connection with the plate 41, and the lower pin base 42' has threaded connection with the plate 41'. The tapered pin 42a depends centrally of the opening through the upper valve member 45, and the tapered pin 42a' upstands centrally of the opening through the lower valve member 46. The greatest clearance between each of these pins and the member into which it extends, may vary from the equivalent of a circular opening ⅛ to $\frac{5}{16}$ inch diameter when the valves are open, as shown in Fig. 6, to a clearance of 1 to 5 thousandths inch when the valves are closed. The valve 45' is adapted to engage upon the valve seat 42b and the valve 46' is adapted to engage upon the valve seat 42b'.

The governor pins 42a and 42a' may be arcuately tapered as shown and preferably each should have a straight portion a having a close valve-like fit within the mating valve members, the straight portion a being for the purpose of preventing the valves from fluttering due to the frequent difference of high and low pressure areas in the flow tubing.

The continuous central opening 45e through the movable assembly communicates with the enlarged openings within the extremities of the valve members 45 and 46. These openings constitute the only path for pressure fluid to enter the upstanding column of well liquid during the flowing operation.

The upper valve member 45 and the upper valve sheath 45a are made separately for manufacturing convenience, pressed together and secured by the weld 45d. The upper valve flange 45b has pressure fluid openings 45c. The lower valve member 46, for manufacturing convenience, is pressed into the lower valve sheath 46a and secured there by the weld 46d. The lower valve flange 46b, having pressure fluid openings 46c, and the upper flange 45b, confine between them the U cups 47 and 47', these cups being separated by the ring 47a. The upper movable packing 48 is confined within the annular housing 49 by the gland ring 50, slidable over the upper member 49, and contacting the upper spring 43. The lower movable packing 48' is confined within the annular housing 49' by the gland ring 50', slidable over the upper member 49, and contacting the lower spring 44. The upper U cup 47 is adapted to be expanded and urged against the wall of the bore 37c by pressure fluid acting from above through the openings 45c and the annular space 51. Likewise, the lower U cup 47' is adapted to be expanded and urged against the wall of the bore 37c by pressure fluid acting from below through the openings 46c and the annular space 51'. The inclined portions of the packing housings 49 and 49' are adapted to urge the packings 48 and 48' against the wall of the bore 37c.

The movable assembly is secured together by the threaded connection between the upper valve member 45 and the lower valve sheath 46a, as appears in Fig. 6.

Fig. 7 illustrates a modification which is the same as shown in Fig. 6, except for the valve mechanism and portions of other parts omitted between the lines a—b and c—d.

The movable assembly, as illustrated and described in connection with Fig. 6, will be assumed to be installed within the central broken out portion of Fig. 7.

The upper valve seat member 52, having the valve seat 52a adapted to engage the valve 53a, has threaded connection within the plate 41. The lower valve seat member 52', having the valve seat 52a' adapted to engage the valve 53a' has threaded engagement within the plate 41', said valves and valve seats being similar and operating in apposition to each other. The extreme ends of valve members 53 and 53' have tapered central openings, the diameters of which enlarge outwardly of the valves 53a and 53a', respectively. These openings communicate with the central passage 45e and constitute the only path through the movable assembly for pressure fluid to pass into the upstanding column. The clearance between the shell of member 53 and the member 52 and the clearance between the shell of member 53′ and the member 52′ may be the equivalent of a circular opening ⅛″ to $\frac{5}{16}$″ diameter when the valves are open, as in Fig. 7. This construction automatically throttles the amount of pressure fluid which may pass through the device as the differential increases by the diminishing clearance between the male and female members of the valves as they close.

A straight portion *b* of the valve members 53 and 53′ may have a close slide valve fit over the end of the members 52 and 52′ in order to prevent sudden changes of pressures within the eduction tube from causing the valve to waver and chatter.

Fig. 8 illustrates a further modification but is the same as that shown in Fig. 7, except for slight changes in the valve construction. The movable assembly, except as to the valves, will be understood to be the same as that shown and described for either Fig. 2 or Fig. 6.

The upper valve seat member 54 has a seat 54*a* adapted to engage the valve 55*a* of the upper valve member 55. The lower valve seat member 54′ is similar to the upper member 54, and has within it a seat 54*a*′ similar to the seat 54*a* which engages the valve 55*a*′ in apposition to the valve 55*a*. The upper governor pin member 56, having threaded engagement within the member 54, has a pin 56*a* adapted to be closely received within the central opening 55*b* through the member 55 as the valve seats. In apposition, the lower governor pin member 56′ has a similar pin 56*a*′ received within the other valve 55*a*′, similar to the valve 55*a*.

It will be understood that the central opening 55*b* extends through the movable assembly, the central portion of which is broken away, as in Fig. 7.

The central opening within the member 54, preferably, is arcuately tapered, the normal clearance between the members 54 and 55, when the valve is open, being the equivalent of a circular opening of ⅛ to $\frac{5}{16}$ inch diameter. The clearance between these members may be one to five thousandths inch when the valve is closed. A similar relation exists between the lower valve member 55′ and its mating member 54′.

The pins 56*a* and 56*a*′ prevent sudden changes of pressure in the eduction tube from suddenly forcing the valves open during high differentials and also protect the valve seats from becoming abraded by sand or other abrasive substances frequently present in the pressure fluid.

The installation and operation is the same as heretofore described for the preceding embodiments.

After any cessation of the flowing operation through the tubing, it is apparent that the movable assembly will be forced upon its nether valve by the weight of well liquid in the tubing above it if a check valve be provided in the tubing anywhere between the nipple 6 and the lowest flowing device.

The diameter of the movable valve assembly being many times greater than the diameter of the valves, it is evident that much greater force will be imparted to the valves in their movements and upon their seats than would result from applying the valve actuating force to the same area as that of the valve, as is the present practice in devices employed for a similar purpose.

The installation and operation of the devices is essentially the same in all forms of the invention.

Comparatively low gas-liquid ratios result from the low starting pressures and the metered flow of pressure fluid in combination with the securely seating valves operated by a balanced piston, as above set out.

It is obvious that many mechanical changes, substitutions and adaptations may be made within the scope and purpose of this invention as comprehended by the stated objects and appended claims, and I reserve the right to make such changes, substitutions and adaptations.

What is claimed:

1. A device of the class described comprising a valve body having a passageway between the exterior and the interior thereof, a pair of spaced aligned valve seats in said passageway, an orificed piston movable in the passageway and adapted to maintain sealed engagement with the walls thereof, the orifice in said piston including outwardly facing valve seating surfaces, and means resiliently urging said piston to a position intermediate said valve seats, there being spaced openings at opposite sides of said piston and leading respectively from the passageway to the exterior and interior of the valve body so that pressure fluid is metered in its flow through the openings, passageway and piston, and a movable packing at at least one end of said orificed piston engageable by said means and urged into sealing engagement with the walls of the passageway.

2. A device of the class described comprising a valve body having a passageway between the exterior and the interior thereof, opposed valve seats in alignment within said passageway, a movable valve assembly within the passageway, said assembly including a piston having an axial passage in alignment with the valve seats, outwardly facing valve seating surfaces on the piston, and means for metering the volume of fluid flowing through the piston when the valve seats and seating surfaces are out of engagement, said passageway including spaced ports at opposite sides of said assembly leading respectively to the interior and exterior of the valve body.

3. A well flowing device comprising a valve having a body with a passageway affording communication from the exterior to the interior of the body, a valve assembly movable axially of and sealably engaging the walls of the passageway, said valve assembly having a passage therethrough, outwardly facing valve seating surfaces in said passage, spaced opposed valve seats in alignment with said valve seating surfaces, and means resiliently urging said assembly to a position intermediate the valve seats, said passageway including spaced ports at opposite sides of said assembly leading respectively to the interior and exterior of the valve body.

4. A well flowing device comprising a valve having a body with a passageway from the exterior to the interior thereof, a valve member movable axially of the passageway, said member having an opening therethrough and converging toward the ends of the member, outwardly facing valve seating surfaces at the ends of said opening, a valve rod passing through the opening, opposed valve seats on said rod adapted to be engaged by said valve seating surfaces, and an enlargement on the rod within the opening for governing flow of fluid therethrough.

5. A well flowing device comprising a body having a passageway from the interior to the exterior thereof, a valve assembly movable axially of the passageway, said assembly having an opening therethrough, a tubular valve member fixed in said opening, enlargements in the ends of the bore in said member, the walls of said enlargements including an outwardly facing valve seating surface, and oppositely facing valve seat members in alignment with said valve member and adapted to enter the enlargements and meter the flow of fluid through the tubular valve member.

6. A well flowing device comprising a body having a passage from the interior to the exterior thereof, a valve assembly movable axially of the passageway, means resiliently holding said assembly at a predetermined position within the passageway, said assembly having an opening axially of the passageway, a tubular valve member fixed in said opening, enlargements in the ends of the bore in said member, the walls of said enlargement including an outwardly facing valve seating surface, and oppositely facing valve seat members in alignment with the valve member and adapted to enter said enlargements and meter the flow of fluid through the tubular valve member.

7. A well flowing device comprising a body having a passage from the interior to the exterior thereof, a valve assembly movable axially of the passageway and sealably engaging the walls thereof, said assembly having an opening therethrough, said opening being enlarged at its ends, an outwardly facing valve seating surface at each end of the opening, and a pair of opposed valve seat members on opposite sides of the assembly and in alignment with said opening, said members being adapted to enter the ends of the opening to meter the flow of fluid through the passageway.

8. A well flowing device comprising a body having a passage from the interior to the exterior thereof, a valve assembly movable axially of the passageway and sealably engaging the walls thereof, said assembly having an axial opening therethrough and the inlet and outlet to and from said passageway being at opposite sides of said assembly, outwardly facing valve seating surfaces in said opening, and opposed valve seat members in alignment with said opening, said valve seat members and opening being relatively contoured so that liquid flowing through the opening is metered by relative telescopic movement thereof as the valve seating surface approaches the valve seat.

9. A well flowing device comprising a valve having a body with a passageway from the exterior to the interior thereof, an annular piston within said passageway, a stationary rod passing through said piston, a governor enlargement on said rod within the opening in the piston, and resilient means normally holding the piston in a predetermined position relative to the enlargement, the opening within said piston being contoured so that fluid is variably metered through the passageway by differential fluid pressures between the interior and exterior of the valve body.

10. A well flowing device comprising a valve having a body with a passageway from the exterior to the interior thereof, an annular piston within said passageway, a stationary rod passing through said piston, a governor enlargement on said rod within the opening in the piston, and resilient means normally holding the piston in a predetermined position relative to the enlargement, the opening centrally within said piston having a slight clearance with said enlargement and successively converging and diverging outwardly therefrom whereby fluid is metered through the passageway by differential fluid pressure between the interior and exterior of the valve body.

11. A well flowing device comprising a valve having a body with a passageway from the exterior to the interior thereof, an annular piston within said passageway, a stationary rod passing through said piston, a governor enlargement on said rod within the opening in the piston, valves on the ends of said piston, spaced valve seats on said rod adapted to be engaged by said valves, the opening within said piston being contoured so that fluid is variably metered through the passageway by differential fluid pressures between the interior and exterior of the valve body.

12. A well flowing device comprising a valve having a body with a passageway from the exterior to the interior thereof, an annular piston within said passageway, the opening within said piston converging toward the ends of the piston, a stationary rod passing through said piston, a governor enlargement on said rod within the opening in the piston, and resilient means normally holding the piston in a predetermined position relative to the enlargement.

13. A well flowing device comprising a valve having a body with a passageway from the exterior to the interior thereof, an annular piston within said passageway, the opening within said piston converging toward the ends of the piston, valves on the ends of said piston, a stationary rod passing through said piston, spaced valve seats on said rod adapted to be engaged by said valves, and resilient means normally holding the piston intermediate said valve seats, whereby fluid is variably metered between the exterior and the interior of the valve body and the passageway is closed when the pressure differential exceeds a predetermined value.

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