Jan. 4, 1949. G. A. HUMASON 2,458,270

GAS CONTROLLER FOR WELL PUMPS

Filed Aug. 25, 1945 4 Sheets-Sheet 1

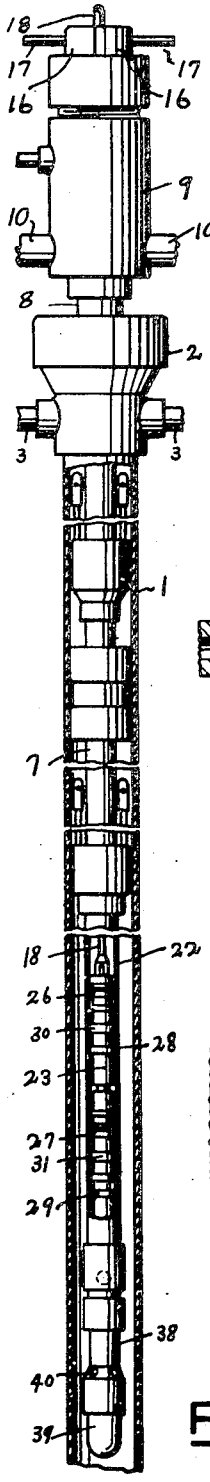


Fig. 1.

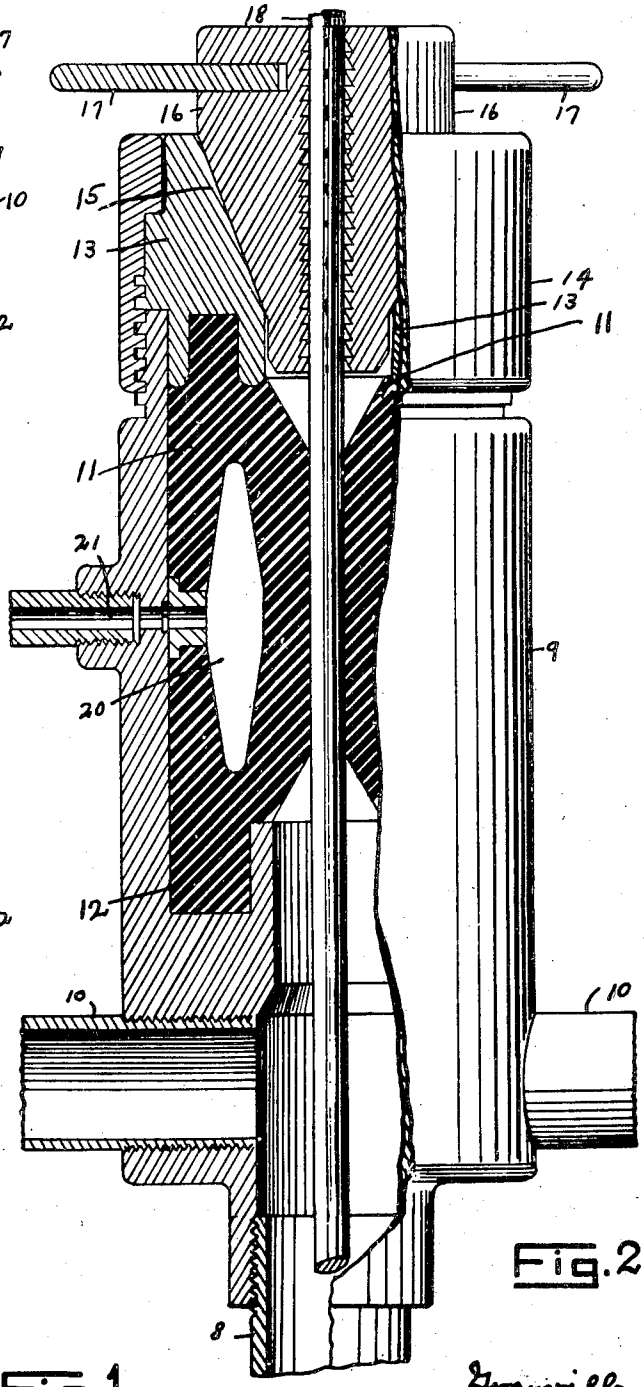


Fig. 2.

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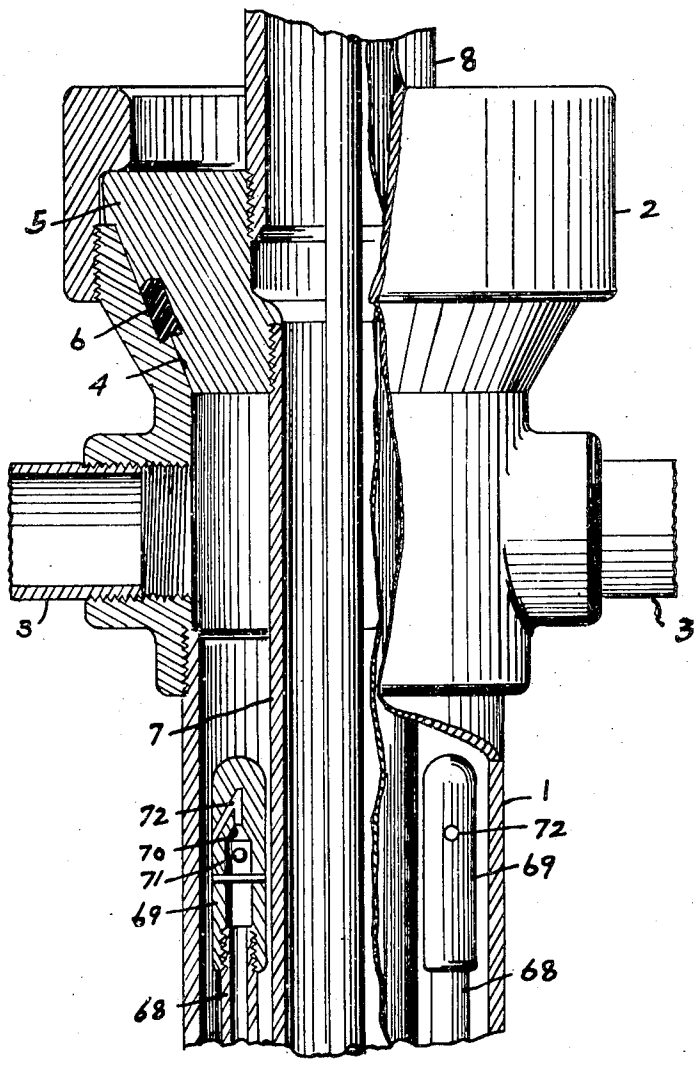


Fig. 3.

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Filed Aug. 25, 1945 4 Sheets-Sheet 3

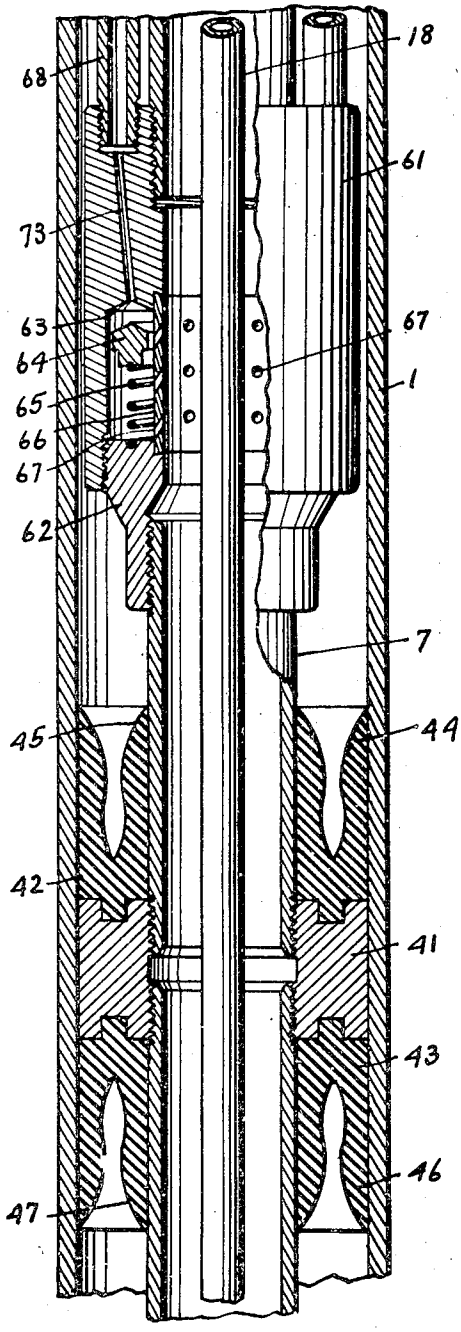


Fig. 4.

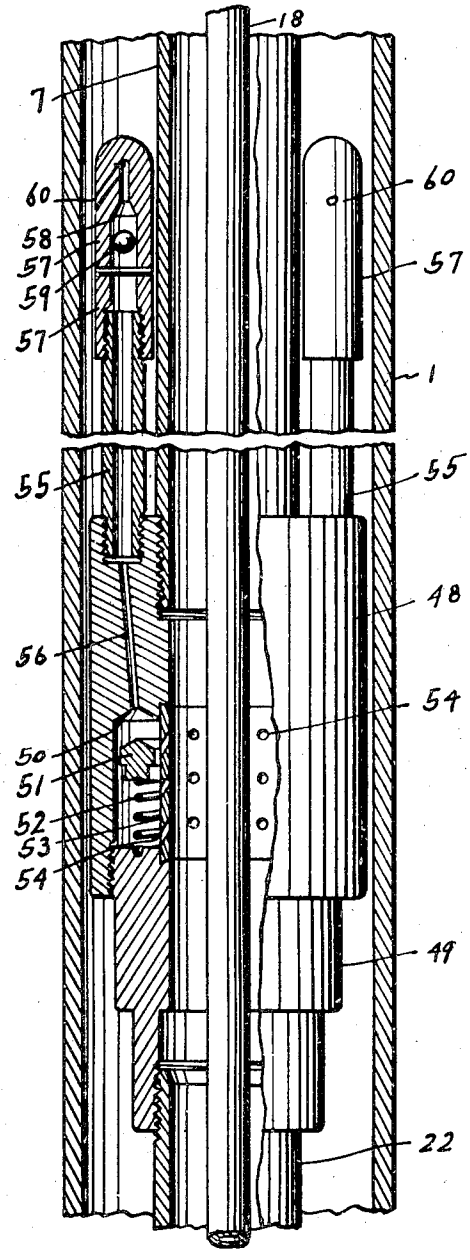


Fig. 5.

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GAS CONTROLLER FOR WELL PUMPS

Filed Aug. 25, 1945 4 Sheets-Sheet 4

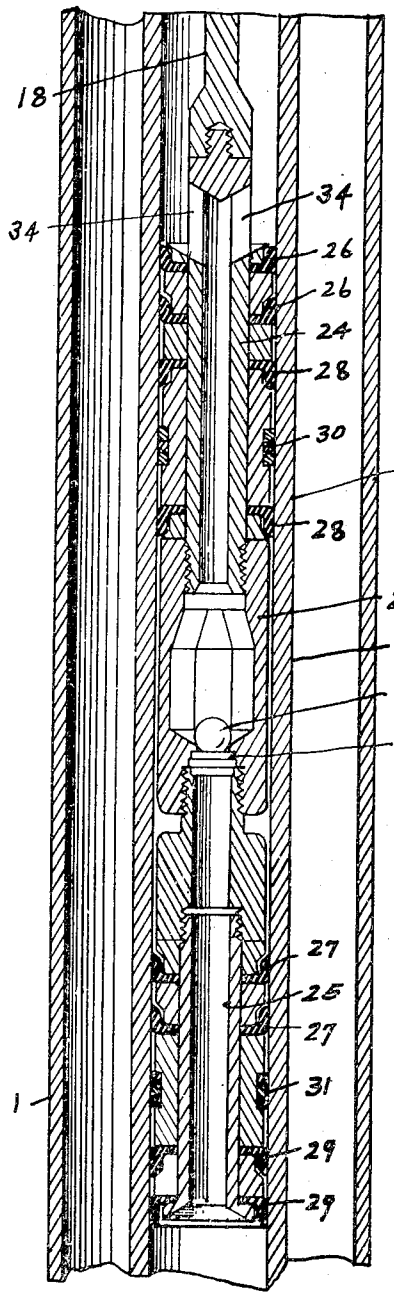


Fig. 6.

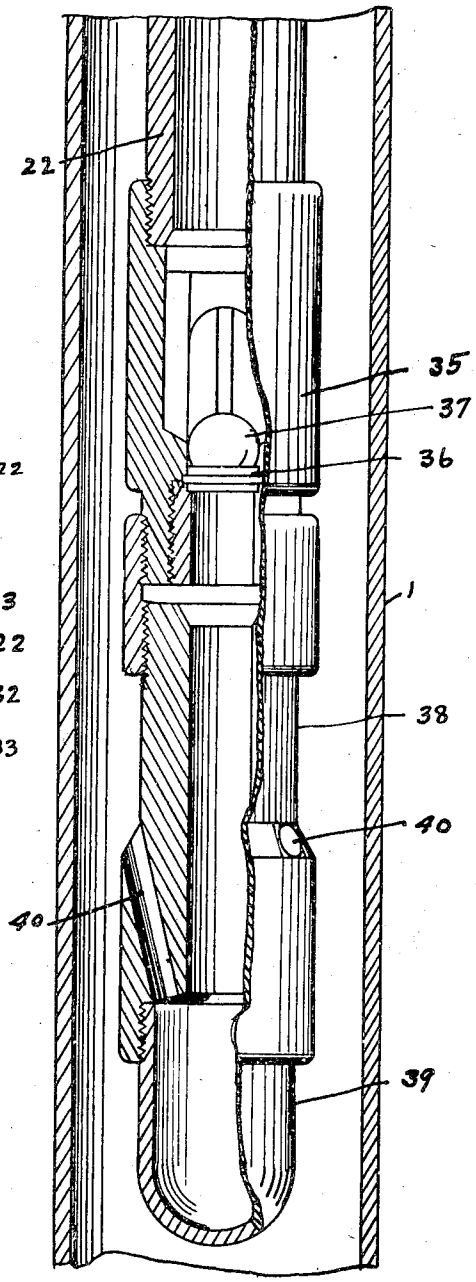


Fig. 7.

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Patented Jan. 4, 1949

2,458,270

UNITED STATES PATENT OFFICE

2,458,270

GAS CONTROLLER FOR WELL PUMPS

Granville A. Humason, Houston, Tex.

Application August 25, 1945, Serial No. 612,657

2 Claims. (Cl. 103—5)

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This invention relates to a gas controller for well pumps.

An object of the invention is to provide, in a well pump, means whereby the gas, under pressure, accumulating in an oil well may be bypassed around the pump, so as not to interfere with the operation of the pump, and introduced into the liquid column in the pump tubing above the pump so as to assist in lifting said column and discharging it from the tubing.

Another object of the invention is to provide equipment of the character described whereby a lifting fluid, such as gas under pressure, may be introduced, at the ground surface, into the well and thence into the column of liquid being pumped to assist in the elevation and discharge of the well liquid.

Other objects and advantages will be apparent from the following specifications which are illustrated by the accompanying drawings, wherein—

Figure 1 is an elevational view of the complete pumping equipment, shown partly in section.

Figure 2 is a side, elevational view, partly in section, of the tubing head showing the pump rod packing and rod supporting slips.

Figure 3 is a side view, partly in section, of the casing head and associated parts.

Figures 4, 5 and 6 are vertical, sectional views of intermediate portions of the equipment from above downwardly; and

Figure 7 is a side view, partly in section, of the lower end of the equipment.

Referring more particularly to the drawings, the numeral 1 designates the well casing having the casing head 2 fixed thereon and provided with one or more inlet lines as 3, 3. The casing head 2 has the inside downwardly converging seat 4 in which a special coupling 5 is seated. This coupling is tapered, externally to conform to the taper of, and to rest on, the seat 4 and between said coupling and seat there is an annular seal ring 6 to form a fluid tight seal between them.

There is the pump tubing 7 whose upper end is screwed into the coupling 5 and this tubing depends into the well casing.

There is a tubular nipple 8 whose lower end is screwed into the coupling 5 and whose upper end supports the tubing head 9. The lower end of the head 9 has one or more out flow lines 10, 10 and mounted in said head 9 there is a pump

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rod wiper 11. This wiper is formed of rubber, or similar material, and is sleeve-like in form. Its lower end is countersunk into an annular groove 12 in the lower end of the tubing head and its upper end is countersunk into an annular slip bowl 13. This slip bowl is clamped on the tubing head by means of a suitable surrounding clamp nut 14. The slip bowl has an inside downwardly tapering seat 15 to receive the slips 16, 16 which may be handled by the handles 17, 17. The slips are tapered downwardly externally to fit into the seat 15 and they have the inside teeth to engage and support the pump rod 18 while the pump is being installed in, or withdrawn from, the well. During the installation of the pump or while it is being withdrawn the wiper 11 may be removed if desired but during the operation of the pump the wiper will be installed so as to fit closely around the rod 18 and the slips 16 will be removed.

The wiper 11 is formed hollow, thus providing an annular chamber 20 therein and fluid, under pressure, may be forced into said chamber through the duct 21 so as to maintain the wiper 11 in sealing relation with the pump rod 18.

Connected to the lower end of the pump tubing 7 there is the tubular working barrel 22 and within this barrel there is the pump plunger which is connected to the lower end of the pump rod 18. The pump plunger comprises a tubular plunger body 23, connected to the upper and lower ends of which are the tubular packing ring supports 24 and 25. Surrounding these supports are the upper, upwardly opening packing rings 26, 26 and the lower upwardly opening packing rings 27, 27; as well as the upper downwardly opening packing rings 28, 28 and the lower downwardly opening packing rings 29, 29. These packing rings are suitably spaced apart by conventional spacers and surrounding and countersunk into the intermediate spacers are the upper and lower packing rings 30, 31.

Within the body 23 there is an upwardly opening ball valve 32, which is mounted on, and controls the conventional valve seat 33 therein.

The upper end of the packing support 24 is connected directly to the pump rod 18 and has the lateral outlets 34 into the working barrel.

Connected to the lower end of the working barrel 22, there is a tubular valve cage 35 whose

lower end is provided with a conventional annular valve seat 36 which is controlled by the upwardly opening ball valve 37.

Attached to and depending from the valve cage 35, there is a tubular nipple 38 whose lower end is closed by the guide plug 39 and said nipple is provided with the downwardly converging passageways 40, 40.

Incorporated into the pump tubing 7 above the working barrel there is a special coupling 41, and anchored to the coupling 41, above and beneath it are the upper and lower seal rings 42, 43. These seal rings are formed of rubber, or similar resilient material. The upper seal ring has the upwardly flared, outer and inner annular lips 44, 45 which form seals with the outer casing 1 and the pump tubing 7 respectively. The lower seal ring 43 has the outer and inner downwardly flared annular lips 46, 47 which form seals with the outer casing 1 and the pump tubing 7, respectively.

Spaced beneath the seal ring assembly above described and also spaced above the working barrel 22 there is a tubular valve cage 48 which is connected to the lower end of the pump tubing 7. Screwed into the lower end of the valve cage 48 there is a tubular reducing nipple 49 into the lower end of which the upper end of the working barrel 22 is threaded. Within the cage 48 there is an annular, downwardly facing valve seat 50 and co-operating with this seat there is an annular valve 51 which is seated on and normally held closed by the coil spring 52 which is seated on the upper end of the nipple 49. Within the valve 51 and having its ends anchored to the cage 48 and the nipple 49, respectively, there is the sleeve like liner 53 which is provided with the upwardly converging passageways 54.

Screwed into the upper end of the cage 48, and upstanding therefrom are the valve supporting tubes 55, and leading from the seat 50 up through the cage 48 and communicating with the tubes 55 are the ducts 56.

Supported on the upper ends of the tubes 55 are the tubular valve cages 57 having the inside seats 58 which are controlled by the downwardly opening ball valves 59 and leading upwardly from the seats 58 and outwardly through the valve cages 57, are the inlet ducts 60.

Incorporated into the pump tubing 7 near its upper end there is a tubular valve cage 61 whose lower end is anchored to the tubing beneath by the reducing nipple 62. Within the cage 61 there is an annular downward facing valve seat 63 which is controlled by the annular downward opening valve 64. This valve is seated on, and normally closed by a coil spring 65 which is seated on the upper end of the nipple 62. Within the valve 64 and having its ends anchored to the cage 61 and nipple 62, respectively, there is a sleeve like liner 66 having the upwardly converging passageways 67 therethrough.

Anchored to and upstanding from the upper end of the valve casing 61 are the tubes 68, 68 and anchored to the upper ends of these tubes are the tubular valve casings 69, 69 each provided with a downwardly directed seat 70 which are controlled by the downwardly opening valves 71. Leading upwardly from each seat 70 and outwardly through the casing 69 are the inlet ducts 72.

Leading from the seats 63 and entering the lower ends of the tubes 68 are the ducts 73 which are normally closed by the valve 64.

The equipment may be installed as shown in Figure 1, and the slips 16 then removed for the pumping operation. The pump plunger may be reciprocated by reciprocating the pump rod 18 by suitable pumping equipment at the ground surface. Upon upstroke of the plunger the valve 32 will be closed and the valve 37 will be opened and the liquid will enter through the passageways 40 and will pass upwardly through the valve seat 36 into the working barrel 22 and upon down stroke of the plunger the valve 32 will be lifted and the liquid will pass on up and out through the outlets 34 into the working barrel above and will be lifted by the next succeeding up stroke of the pump plunger.

Any gas that may accumulate will pass on up through the casing 1 around the pump, but will be sealed off by the seal ring 43 and will collect in the casing and build up pressure and will enter the valve cages 57 and the pressure will open the valve 51 and the gas under pressure will enter the passageways 54 and pass on into the upwardly flowing column of liquid in the pump tubing, thus rendering the same buoyant and assisting in its discharge from the well.

If desired gas may be forced under pressure through one of the lines 3 into the casing and this gas will accumulate above the seal ring 42 and the built up pressure will force it through the valve casings 69 and tubes 68 and it will open the valve 74 and will enter the upwardly flowing column of liquid through the passageways 67 and will assist in discharging the liquid from the well.

The invention also comprehends the method of producing liquid from a well.

The drawings and description are illustrative merely while the broad principle of the invention will be defined in the appended claims.

What I claim is:

1. Production equipment for wells comprising, a casing in a well having a casing head thereon, a pump tubing in the casing, a tubing head on the casing head to which the upper end of the tubing is connected, a pump on the lower end of the tubing adapted to pump well liquid through the tubing, a pump rod in the tubing adapted to operate the pump from the ground surface, a seal above the pump between the tubing and casing, tubular valve cages forming couplings in the tubing one above and the other beneath said seal, each coupling having an inside downwardly facing seat and having ducts leading upwardly therethrough from said seats, downwardly opening valves in the couplings for controlling said ducts, yieldable members normally holding the valves closed, there being passageways leading inwardly through the wall of the tubing within said couplings whereby fluid passing through said ducts may enter the tubing, tubes anchored to the upper ends of the respective couplings in communication with said ducts, valve cages on the upper ends of said tubes having inlet passageways, downwardly opening valves controlling said inlet passageways and a seal around said rod and between it and the tubing head.

2. Production equipment for wells comprising, a casing in a well having a casing head thereon, a production tubing in the casing, a tubing head above the casing head to which the upper end of the tubing is connected and having an outflow line above the tubing, a seal above the lower end of the tubing between the tubing and casing, tubular valve cages forming couplings in the tubing one above and the other beneath said seal, each coupling having an inside downwardly facing seat and having ducts leading upwardly therethrough

from the seats, yieldably mounted downwardly opening valves in the couplings for controlling said ducts, there being passageways leading inwardly through the wall of the tubing within each of said couplings whereby fluid passing through said ducts may enter the tubing, tubes anchored to the upper ends of the respective couplings in communication with said ducts, valve cages on the upper ends of said tubes having inlet passageways, downwardly opening valves controlling said inlet passageways and a seal closing the tubing head above said outflow line.

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