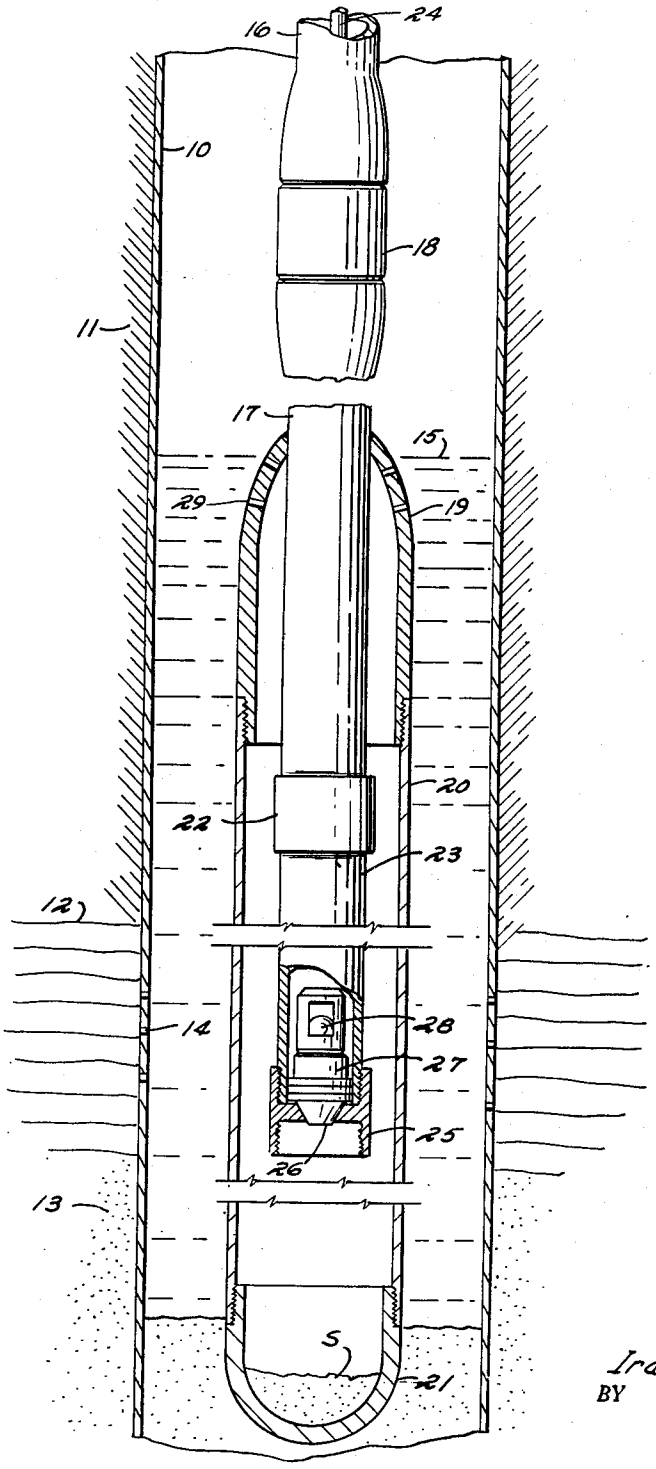
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GAS AND SAND SEPARATOR

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GAS AND SAND SEPARATOR

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My invention relates to oil wells generally, but more in particular to a gas and sand separator used in connection with pumping the well to prevent sand from entering the pump and also exclude a greater portion of gas which normally becomes mixed with the oil as it enters the pump to be drawn to the surface.

Prior art mechanisms have all disclosed elaborate assemblies having several sections of nested tubes or pipes forming pockets through which the oil must flow before finally being drawn into the working barrel and pumped to the surface. Escape holes are usually provided at the upper ends of these several tubes to permit the gas to escape into the area between the tubing and the casing of the well. The cost of manufacture of most of the assemblies mentioned above has been so great that their actual use has been prohibitive. While the closely nested tubes have allowed the gas to separate from the fluid, quantities of sand, instead of being excluded from the enclosed pockets, tend to accumulate therein and present a difficult operation when the device is withdrawn from the well for cleaning. Several other types of these devices are made of sections threadedly joined by an outside collar which, when wedged by sand at the bottom of the well hole, makes it extremely difficult to remove. The length of travel of the oil through the several tubes and passageways of former devices, together with the necessary bends, increases the friction in the normal flow to a considerable extent and produces an undue stress on the pump. The several types of devices mentioned usually contain component parts which conform to special diameters and threads which further add to their cost of manufacture.

It is an object, therefore, of the present invention, to provide a gas and sand separator which can be manufactured inexpensively from common pipe presently being used in oil field work.

Another object of the invention is to provide a gas and sand separator in which the working barrel and pump mechanism are enclosed by an outer jacket and wherein the fluid must travel downwardly for a considerable distance before being drawn through the lower standing valve of the working barrel, the gases mixed with the fluid being allowed to float to the fluid surface and escape between the tubing and casing.

Another object of the invention is to provide a separator of the character described having a construction which is streamlined through its entire length, without any projections or abrupt obstructions by which the same might be wedged in the bottom of a well hole by the accumulation of sand.

A further object of the invention is to provide a device of the character described which may be readily disassembled for cleaning and threadedly joined in such a manner as to permit easy access to the working barrel and pump mechanism.

Another object is to provide such a structure as described wherein the component parts of the device are made from standard oil field pipe and fittings and wherein the same may be assembled with any conventional pump and working barrel without the necessity of special tools.

Further objects and advantages of the invention will become apparent in the course of the following detailed description when viewed together with the accompanying drawing in which the single figure shown illustrates a broken cross-sectional view of a device made in accordance with the teaching of the present invention in a gas and sand separator for oil wells.

In the drawing, numeral **10** designates a well casing which is lowered into the earth formation **11**. The actual producing formation is designated by the numeral **12** with other oil sand **13** beneath it. The casing **10** is provided with perforations **14** positioned adjacent the oil producing strata **12** to permit the oil to flow into the inner area of the casing and rise upwardly to a fluid level as indicated at **15**.

My invention is attached to the lower end of a string of tubing **16** and lowered into the fluid as shown in the drawing. The device consists in a hollow central tube **17**, made from a portion of conventional tubing material having its upper end adapted for threaded engagement with the lower end of the tubing string **16**. It will be noted that the joints **18** thus formed are of the external upset type so that no abrupt shoulders will be left.

Positioned beneath the upper end of the central tube **17** is a cone-shaped jacket head **19** which is also made from a conventional oil field pipe of substantially twice the diameter as that of the tubing size. The upper end of the jacket head **19** is properly split and drawn together as shown, and finally welded to the circumferential surface of the central tube **17**. The length of the jacket is preferably some two or three feet, with the lower end of the central tube **17** extending slightly below it. The lower end of the jacket head **19** is provided with threads matching those of another standard size pipe which constitutes an outer jacket **20**. This jacket is shown as broken in the drawing, but may actually be the full length of a joint of pipe. The lower end of the jacket **20** is closed by means of a round-nosed plug **21** which is screwed into the jacket **20**.

Since the central tube **17** is made from a portion of conventional tubing material, it is only necessary to apply a threaded collar **22** at the lower end thereof for the attachment of any standard working barrel **23** which encloses a pump (not shown) adapted to be operated by a string of sucker rods **24**. In the present instance the working barrel **23** is provided with the common standing valve arrangement consisting of a collar **25** threadedly engaging external threads provided on the lower end of the working barrel and having an internally formed tapered seat **26** adapted to receive the lower end of a ball cage **27** carrying the conventional ball check valve **28**. Any standard practice of mounting the standing valve may be followed.

At the upper end of the device, on the jacket head **19**, I have provided perforations **29** for the entry of fluid from the casing area into the jacket **20**. Since the depth of the producing strata **12** and the actual fluid level is known by previous calculations, the entire device may be lowered into the casing until the fluid level is even with, or slightly above, the top perforations **29**. It will be remembered that the outer jacket **20** of the device is made from a full length of standard pipe which may be from 20 to 30 feet. With the addition of the standard working barrel **23**, it is readily apparent that the gaseous fluid passing through the perforations **29** must flow downwardly for a considerable distance before being finally drawn into the working barrel through the lower standing valve mechanism. Since the standing valve mechanism is positioned well below the jacket head perforations **29**, the fluid in the jacket **20** itself serves as a seal tending to prevent even the entrance of gas.

It is also seen that there is considerable space between the lower end of the working barrel and the bottom plug **21**, which defines a chamber for the collection of sand S or other heavy foreign matter which might enter the upper perforations **29** with the oil. This area is sufficient to collect all such matter until such time as the pump must be removed from the well for repairs, at which time the entire device is disassembled and cleaned.

A brief resume of the installation and operation of the device will follow. With the invention attached to the lower end of a string of tubing as described, and with the working barrel and pump mechanism installed, the device is lowered into a well hole to a depth where the fluid level covers the perforations **29** in the upper jacket head

19. The string of pipe may be supported directly on the lower plug 21 which rests on a cement plug (not shown), or upon the bottom of the hole, or even be suspended from conventional equipment at the surface. The gaseous fluid coming from the producing formation 12 enters the casing perforations 14 and rises toward the perforations 29 located in the jacket head 19. Any gas bubbles in this flow will escape into the area defined between the tubing 16 and the casing 10 as soon as they reach the fluid level 15. Should any gas attempt to enter the perforations 29, it is checked by the constant fluid seal provided by the standing fluid in the jacket 20. Should any gas attempt to pass this fluid seal, it cannot possibly be drawn downwardly for a distance of 12 to 15 feet to the lower end of the working barrel, but will rise between pump strokes and escape through the perforations 29. Any sand or other heavy sediment entering the upper jacket head 19 will be drawn by the force of the fluid flow to the bottom of the jacket closed by the plug 21, its own weight then preventing it from being drawn upwardly into the pump mechanism.

In an actual test made using the present inevntion in a well which formerly pumped considerable quantities of gas and wherein the pump cups had to be replaced at approximate intervals of 10 to 12 days, it was found that all gas in the tubing was eliminated and the wear of the sand flow in the working barrel was reduced to such an extent that changing of the pump cups was only required after a pumping period of 54 days, and the actual increase of oil pumped was upwards of 200 barrels. When the device was removed from the well, no additional force was needed to raise the pipe string beyond the weight of the string itself due to the smooth joints. Formerly the sand at the well bottom would pack around a collar or coupling and wedge the entire string with such force that occasionally even the tubing parted in an effort to dislodge the same from the well bottom.

The device is simple in its arrangement and requires only a minimum of standard fittings and pipe for its construction. While the drawing discloses a 2½ inch tubing and working barrel with a jacket made from a 4 inch pipe, it is to be understood that any of these sizes might be exchanged without departing from the spirit and scope of the invention as defined by the following claims.

I claim:

1. In a device of the class described, a hollow central tube having an upper end arranged for attachment to a string of pipe for supporting the device in a well, said tube having a lower end arranged for the attachment of a working barrel enclosing a pump and lower standing valve mechanism, a jacket head of substantially twice the diameter of said hollow central tube and having an upper end drawn down along a smooth curve and welded to the outer circumferential surface of said central tube above said pump and lower standing valve mechanism, said jacket head extending downwardly around said central tube and having a lower end positioned slightly above the lower end of said central tube, said jacket head being provided at its upper end with a plurality of perforations for the entry of fluid into the space provided between said jacket head and said central tube above said pump and lower standing valve mechanism, an outer jacket threadedly engaging the lower end of said jacket head, said outer jacket extending downwardly and terminating in an end, and a round-nosed plug closing said last mentioned end to form a chamber below the end of said working barrel for the collection of heavy foreign matter, said jacket head being supported only on said central tube, said outer jacket being supported only on said jacket head, said plug being supported only on said outer jacket, said jacket head and said outer jacket and said plug cooperating to form a casing surrounding said pump and providing an unrestricted passage about and below said pump for the unrestricted flow of fluid from said space into the lower end of said working barrel.

2. In a device of the class described, a hollow central tube having an upper end arranged for attachment to a string of pipe for supporting the device in a well, said tube having a lower end arranged for the attachment of a working barrel enclosing a pump and lower standing valve mechanism, a jacket head of substantially twice the diameter of said hollow central tube and having an upper end drawn down along a smooth curve and welded to the outer circumferential surface of said central tube above said pump and lower standing valve mechanism, said

jacket head extending downwardly around said central tube and having a lower end positioned slightly above the lower end of said central tube, said jacket head being provided at its upper end with a plurality of perforations for the entry of fluid into the space provided between said jacket head and said central tube above said pump and lower standing valve mechanism, an outer jacket threadedly engaging the lower end of said jacket head, said outer jacket extending downwardly beyond the end of said working barrel and terminating in an end, and a round-nosed plug closing said last mentioned end to form a chamber for the collection of heavy foreign matter, said jacket head being supported only on said central tube, said outer jacket being supported only on said jacket head, said plug being supported only on said outer jacket, said jacket head and said outer jacket and said plug cooperating to form a casing surrounding said pump and poviding an unrestricted passage about and below said pump for the unrestricted flow of fluid from said space into the lower end of said working barrel.

3. In a device of the class described, a hollow central tube having an upper end arranged for attachment to a string of pipe for supporting the device in a well, said tube having a lower end arranged for the attachment of a working barrel enclosing a pump and lower standing valve mechanism, a jacket head of substantially twice the diameter of said hollow central tube and having an upper end drawn down along a smooth curve and welded to the outer circumferential surface of said central tube above said pump and lower standing valve mechanism, said jacket head extending downwardly around said central tube and having a lower end positioned slightly above the lower end of said central tube, said jacket head being provided at its upper end with a plurality of perforations for the entry of fluid into the space provided between said jacket head and said central tube above said pump and lower standing valve mechanism, an outer jacket threadedly engaging the lower end of said jacket head in a manner to form a joint having a smooth outer surface, said outer jacket extending downwardly beyond the end of said working barrel and terminating in an end, and a round-nosed plug closing said last mentioned end to form a chamber for the collection of heavy foreign matter, said plug being threadedly attached to said outer jacket in such manner as to form a joint having a smooth outer surface, said jacket head being supported only on said central tube, said outer jacket being supported only on said jacket head, said plug being supported only on said outer jacket, said jacket head and said outer jacket and said plug cooperating to form a casing surrounding said pump and providing an unrestricted passage about and below said pump for the unrestricted flow of fluid from said space into the lower end of said working barrel.

4. In a device of the class described, a hollow central tube having an upper end provided with an external upset joint for attachment to a string of pipe for supporting the device in a well, said tube having a lower end arranged for the attachment of a working barrel enclosing a pump and lower standing valve mechanism, a jacket head of substantially twice the diameter of said hollow central tube and having an upper end drawn down along a smooth curve and welded to the outer circumferential surface of said central tube above said pump and lower standing valve mechanism, said jacket head extending downwardly around said central tube and having a lower end positioned slightly above the lower end of said central tube, said jacket head being provided at its upper end with a plurality of perforations for the entry of fluid into the space provided between said jacket head and said central tube above said pump and lower standing valve mechanism, an outer jacket threadedly engaging the lower end of said jacket head in a manner to form a joint having a smooth outer surface, said outer jacket extending downwardly beyond the end of said working barrel and terminating in an end, and a round-nosed plug closing said last mentioned end to form a chamber for the collection of heavy foreign matter, said plug being threadedly attached to said outer jacket in such manner as to form a joint having a smooth outer surface, said jacket head being supported only on said central tube, said outer jacket being supported only on said jacket head, said plug being supported only on said outer jacket, said jacket head and said outer jacket and said plug cooperating to form a casing surrounding said pump and providing an unrestricted passage about and below said pump for the unrestricted

flow of fluid from said space into the lower end of said working barrel.

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