J. HAHN.

PUMPING APPARATUS.

APPLICATION FILED JAN. 10, 1911.

Patented July 2, 1912.

1,031,643.

Fig. 1

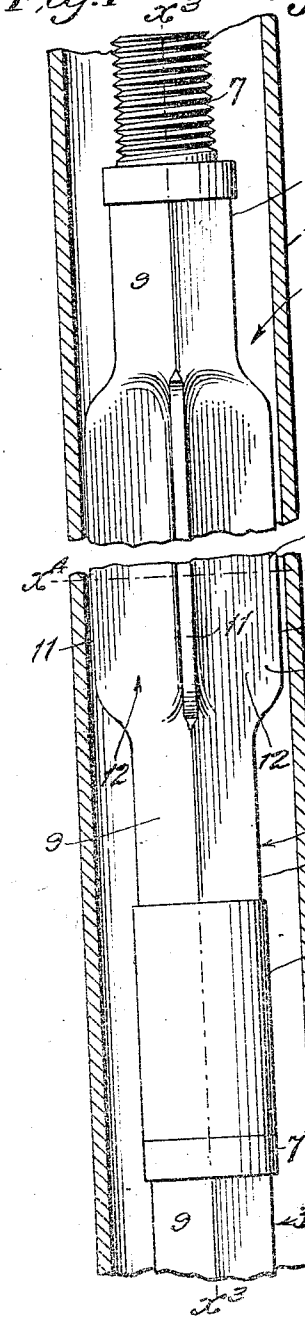


Fig. 2

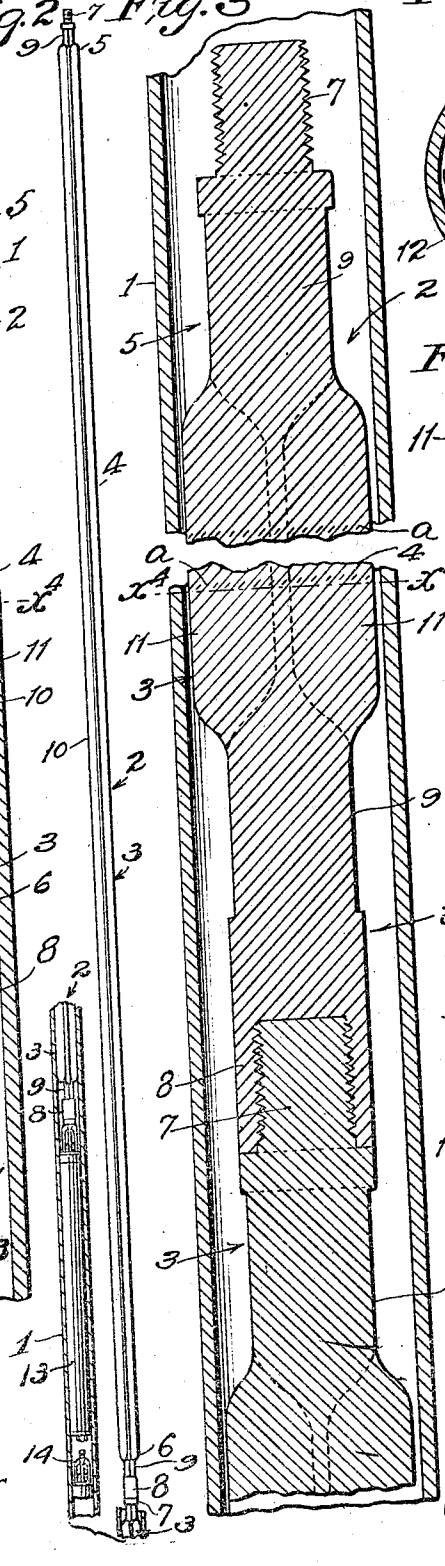


Fig. 3

Fig. 4

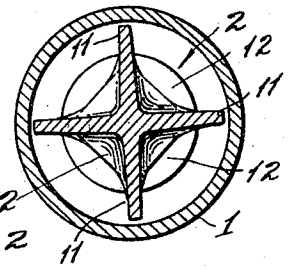


Fig. 5

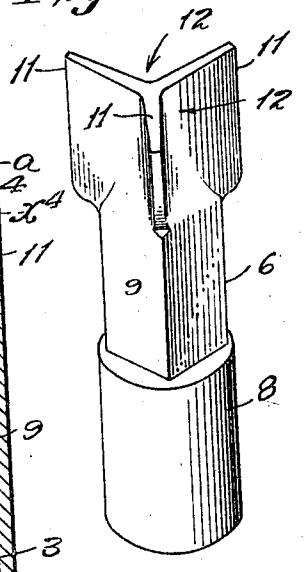
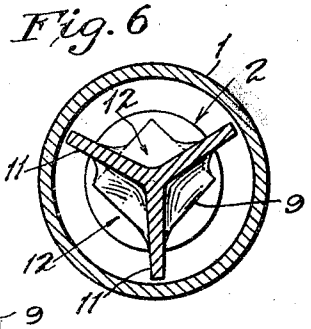


Fig. 6



Witnesses
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UNITED STATES PATENT OFFICE.

JOHN HAHN, OF LOS ANGELES, CALIFORNIA.

PUMPING APPARATUS.

1,031,643. Specification of Letters Patent. Patented July 2, 1912.

Original application filed April 7, 1910, Serial No. 554,063. Divided and this application filed January 10, 1911. Serial No. 601,878.

To all whom it may concern:

Be it known that I, JOHN HAHN, a citizen of the United States, residing at Los Angeles, in the county of Los Angeles and State of California, have invented new and useful Improvements in Pumping Apparatus, of which the following is a specification.

This invention relates to the construction of the sucker rod and also to the combination with the pump tubing of a sucker rod of novel construction.

This invention includes the sucker rod shown in my application Serial Number 554,063, filed April 7, 1910, for pumping apparatus, of which this application is a division.

Specific claims to the sucker rod, *per se*, as herein shown have been divided out of this application and are included in my copending application for sucker rod, Serial No. 672,003, filed Jan. 18, 1912.

In deep well pumps were the sucker rods are one thousand feet in length and over it is found to be impossible to operate the pump piston effectively, with sucker rods of the construction heretofore known, excepting at very low speed, for the reason that the pump tubing must be of small diameter on account of the great depth and the tremendous pressure to the square inch upon the pump piston; and that consequently, the sucker rod must be of small cross sectional area in order to afford a passage inside the tubing for the liquid to be pumped.

With the present construction of sucker rods capable of practical use and in practical use for such deep wells, the sucker rods bend or buckle on the down stroke so that the transmission of motion to the pump piston is very ineffective and the stroke of said piston resulting from a 24-inch stroke of the walking beam may be reduced to only four or five inches.

It has been proposed in some instances to provide rings at intervals around the sucker rod to hold the rod from buckling and to provide the rod with concave grooves to allow the liquid to pass the rings. But such rings increase the friction and such sucker rods are not capable of practical use in deep wells.

With the sucker rods heretofore in use in the field the most effective operation of the pump is secured with from twelve to fifteen strokes per minute. The said strokes above mentioned do not discharge the amount of oil which would be discharged were the piston stroke equal to that of the top end of the sucker rod. Furthermore the buckling and bending of the sucker rods crystallizes the metal and causes breakage to occur at the pins and boxes. Furthermore whenever the sucker rods are buckled or bent on the down stroke so as to strike the pump tubing, said tubing and the pin and the boxes wear, so that the life of the tube and the sucker rod is greatly reduced.

The sections of sucker rods heretofore in use are liable to relatively turn so as to unscrew at the joints, thus often causing a fishing job with much delay and expense.

I have discovered that the principal difficulty to be overcome in pumping deep oil wells arises from the following conditions: There is usually a pressure of gas or compressed air in such wells and the escaping gas or air seeks and tends to move along the surfaces bounding the column of oil which is being pumped and tends to carry upward along such surfaces the lighter and more fluid material; and consequently the heavier material, as sand and the thicker oil, gravitates to the center of the column.

In hydromechanics it is known that the particles of fluid flowing through a pipe have movements varying in speed from center to periphery of the column, the central particles moving at maximum rate and the peripheral particles at minimum rate. In consequence of this difference of speed the heavier particles in a column carrying fluid of different densities gravitate to the center of such column, and when such center of the column coincides with the center of the pump tubing it is clear that sucker rods in use up to the present time and those that have been proposed must be operated under adverse conditions since such sucker rods are located in the position of maximum flow and maximum density. It is known that in handling crude oil that such oil loses a high percentage of its more volatile and valuable constituents, as gasolene, such losses doubtless being due to the presence of air or other gases in and about the oil.

I have discovered in pumping crude oil that the less the oil is agitated and churned the smaller will be the losses of the volatile oils.

Heretofore the main body of the sucker rod has been located at the center of the column of fluid matter being pumped and con-

sequently the sand and thick fluid, which gravitate toward the center, settle against the sucker rod; and when the sucker rod moves down through the column its movement is obstructed by the friction of the heavy matter against the sucker rod. In consequence of this excessive friction the tendency of the sucker rod to buckle is increased and the pressure increasing from top to bottom in the pump tubing around the sucker rod causes the lower portion thereof to float while the upper portion is buckled by the friction of the fluid material, and consequently when the sucker rod makes above ten strokes per minute the friction on the lower portion of the sucker rod and on the pump piston of the working barrel retards those parts on the down stroke, so that the stroke of the lower portion of the sucker rod is not finished before the up stroke occurs, thus producing inefficient pumping action and causing crystallization, breaking and parting of the sucker rod and wearing of the pump tubing.

It is evident from the foregoing that in order to obtain maximum output of crude oil from a well with minimum loss of volatile oils it is necessary to get the sucker rod away from the dense fluid in the center of the column.

An object of my invention is to avoid these difficulties. This I do by practically dividing the liquid material being pumped into a plurality of columns, the perimeters of which are adjacent the sucker rod as well as adjacent the pump tubing and to surround the same with an unbroken gas-way extending entirely around the sucker-rod from top to bottom of the pump-tubing so that during the pumping operation there may be a constant upflow of gas and liquid in a series of practically straight columns extending from bottom to top of the tubing, with a minimum deflection of the fluids from a straight course at any point, and to minimize the number of places where such slight deflections of the fluid may occur. And such straight columns of liquid passing upward in a straight course hold the sucker-rod in the center of the pump tubing against vibration, rotation, buckling and bending and from contact with the pump tubing. By thus dividing the oil that is being pumped into a plurality of columns, the heavy material in each of the columns gravitates to the center of its column and away from the sucker rod and from the pump tubing so that the gas and lighter liquid material contact with the sucker rod on the down stroke, as well as with the pump tubing on the up stroke, and the friction is done away with and the consequent tendency to buckle and break is avoided, thus permitting the pump to be run at a higher speed with greater output.

A further object of this invention is to provide a reinforced sucker rod which can be manufactured at minimum weight and cost, and by which all of the difficulties heretofore enumerated will be avoided.

Further objects and advantages may appear in the subjoined detail description.

The accompanying drawings illustrate the invention.

Figure 1 is a fragmentary elevation of the invention showing two sections of a ribbed sucker rod coupled together and in place in a pump tubing, fragments of which are shown in section. Fig. 2 is a fragmentary elevation of the invention on a reduced scale. The pump piston and standing valve are shown intact inside the pump tubing, a portion of which is omitted to avoid confusion. Fig. 3 is an axial sectional elevation on line a^3, Fig. 1. Fig. 4 is a cross section on line a^4, Figs. 1 and 3. Fig. 5 is a perspective view of a welding member having a different form of welding shank than that shown in Figs. 1, 2 and 3. Fig. 6 is a cross section of a ribbed sucker rod having a body fitting the welding member shown in Fig. 5, and in place in a pump tubing.

The pumping apparatus comprises pump tubing 1 of the usual construction provided internally with a sucker rod 2 preferably constructed of separable sections 3; each of which is formed of three members, a ribbed or bladed member or body 4, of comparatively great length, as for instance, twenty feet, more or less, and of slightly less diameter than the pump tubing; and welding end members 5, 6, that are each composed of a male or female threaded coupling 7 or 8, respectively, of less diameter than the body 4, and intermediate wrench seats 9 preferably of square cross section, and ribbed or bladed welding shanks 10 that correspond with and are fastened to the body 4 by suitable means as the electric weld *a*; so that the sucker rod is practically of uniform ribbed cross section throughout its entire length.

The ribbed body 4 and ribbed shanks 10 are practically Y or X-shaped according as their radial blades, forming longitudinal partitions 11 in the pump tubing, are three or four in number, but it is understood that the number of such partitions may be more or less as desired.

The partitions 11 stiffen the sucker rod lengthwise and at the same time practically divide the pump tubing into a plurality of pumping chambers, channels or passages 12, each of which is of greater cross-sectional area that the bladed body 4 so as to form between each two adjacent partitions during the pumping operation, independent columns of liquid material, not shown; and the partitions further provide a seat for a wrench such as shown, described and claimed in my co-pending application for pump

fitting, filed June 20, 1910, Serial Number 568,033, and in which oppositely arranged wrench jaws are provided with slots to engage a ribbed sucker rod.

The lower end of the sucker rod 2 is provided with a suitable piston 13 of any desired construction and the pump tubing 1 may be provided internally below the piston 13 with a standing valve 14 of any desired form.

In practice, the diameter of the sucker rod is substantially the same as but less than the diameter of the pump tubing, the sucker rod and the pump tubing being preferably of such relative proportions that there is but slight clearance between the walls of the tubing and the edges of the partitions, so that the partitions will not touch the walls of the tubing and yet the space is minimized through which liquid may pass from one longitudinal passage to another and such clearance space is free from any sucker rod parts along the entire length of the sucker rod, so that the action of the sucker rod will not be interfered with and the sucker-rod will not agitate and turn the fluid. The purpose of this combination of the ribbed sucker rod with the pump tubing to form longitudinal pumping chambers disposed about the sucker-rod and extending unobstructedly from end to end of the tubing above the piston or sucker, is two-fold: it serves to hold the oil or other liquid with such stability as to brace the sucker rod against bending or buckling; and it applies the inertia of the oil in the pipe to minimize the tendency of the rod or the sections thereof to relatively rotate and such rotation can only be effected by practically rotating the entire column of oil or other material surrounding the portion of the rod that tends to turn. The advantages of this construction and arrangement in this respect are maximized in the case of thick and heavy crude oil carrying sand or other solids, and the tendency to unscrew at the joints is minimized.

In the form shown in Figs. 1 to 4, inclusive, there are four, and in Figs. 5 and 6, there are three straight radially disposed longitudinal partitions, ribs or blades which have no radial projections to impinge against the oil and which extend nearly but not quite to the walls of the pump tubing, thus forming four or three divisions of the tubing, as the case may be, to confine the liquid in a plurality of straight angular columns that are parallel with the axis of the tubing, thus tending to hold the sucker rod against vibration as well as against buckling and rotation, and furthermore, the strength, rigidity and channel space are maximized, and the weight and the frictional resistance against the material to be pumped are minimized.

It is thus seen that I have provided in a pumping apparatus, the combination with the pump tubing of means to divide the interior of the pump tubing into a plurality of pumping chambers extending lengthwise of the rod between the joints thereof, and that the cross-sectional area of each joint is minimized so that the liquid may flow freely along the tubing; that the couplings at the joints cannot come into contact with the tubing or become worn thereby; and that the friction of the liquid on the rod and tubing is minimized.

It is thus seen that the pump tubing and piston rod form walls respectively adapted to conjointly inclose a plurality of columns, the perimeters of which are adjacent the piston rod and the pump tubing and the wearing action of solids in the material being pumped is minimized and churning and lost motion is avoided.

I claim:—

1. A pumping apparatus comprising pump tubing, a valved piston and a longitudinally bladed sucker rod in the pump tubing, said pump tubing and bladed sucker rod forming walls respectively adapted to conjointly inclose a plurality of columns of which the perimeters are adjacent the piston operating means and the pump tubing, there being a clearance between the respective walls.

2. A pumping apparatus comprising a valved piston, pump tubing and a bladed sucker rod forming longitudinal walls of the tubing and the sucker rod blades respectively to conjointly inclose a plurality of columns of which the perimeters are adjacent the sucker rod and the pump tubing; there being an unobstructed clearance between the respective walls.

3. A pumping apparatus comprising a valved piston, pump tubing, a sucker rod attached to the piston, and having male and female couplings on the respective ends of the rod of less diameter than the pump tubing and having longitudinal partition blades of greater diameter than the couplings and of substantially the same but of less diameter than the inside of the pump tubing, said pump tubing and sucker rod blades together forming a plurality of pumping chambers for the purpose set forth.

4. A pumping apparatus comprising a valved piston, pump tubing, and a sucker rod connected to the piston and composed of separable sections, each of which is constructed of a bladed member of comparatively great length and of substantially the same but of less diameter than the pump tubing and adapted conjointly with the pump tubing to inclose a plurality of columns of which the perimeters are adjacent the bladed member and the pump tubing; and each of which is constructed of welding

end members that are each composed of a coupling member of less diameter than the bladed member and comprise intermediate wrench seats of square cross section; and each of which is constructed of bladed welding shanks that correspond with and are fastened to said bladed member.

5. In a pumping apparatus, pump tubing, and a sucker rod having a bladed body forming partitions to practically divide the pump tubing into a plurality of pumping chambers, each of which is of greater cross-sectional area than the bladed body.

6. A pumping apparatus comprising pump tubing, a piston in the pump tubing and a longitudinally bladed sucker rod to operate the piston and to practically divide the pump tubing into a plurality of pumping chambers.

7. A pumping apparatus comprising pump tubing, a piston in the pump tubing, a standing valve in the tubing below the piston and a longitudinally bladed sucker rod to operate the piston and to practically divide the pump tubing into a plurality of pumping chambers.

8. A pumping apparatus comprising a sucker and tubing and a sucker rod constructed and arranged to form longitudinal pumping chambers extending unobstructedly through the tubing above the sucker there being some clearance between the tubing and sucker rod, substantially as and for the purpose set forth.

9. A pumping apparatus comprising a sucker, and tubing and a sucker rod constructed and arranged to form longitudinal pumping chambers symmetrically disposed about the rod and extending unobstructedly through the tubing above the sucker there being some clearance between the tubing and sucker rod, substantially as and for the purpose set forth.

In testimony whereof, I have hereunto set my hand at Los Angeles California this 4th day of January 1911.

JOHN HAHN.

In presence of—
GEORGE H. HILES,
JAMES R. TOWNSEND,
L. BELLE RICE.