No. 683,353. Patented Sept. 24, 1901.

J. C. SWAN.

ROPE SOCKET.

(Application filed Dec. 17, 1900.)

(No Model.)

Fig. 1.

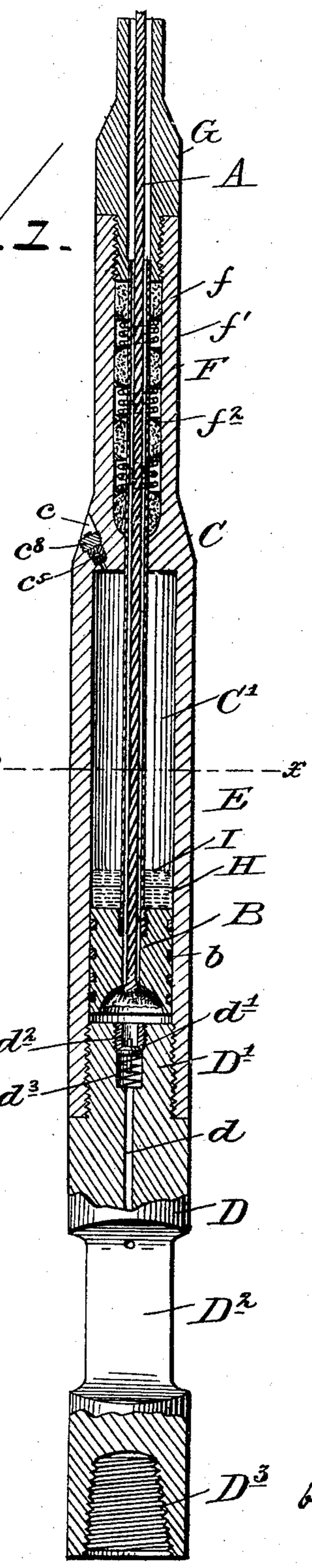


Fig. 2.

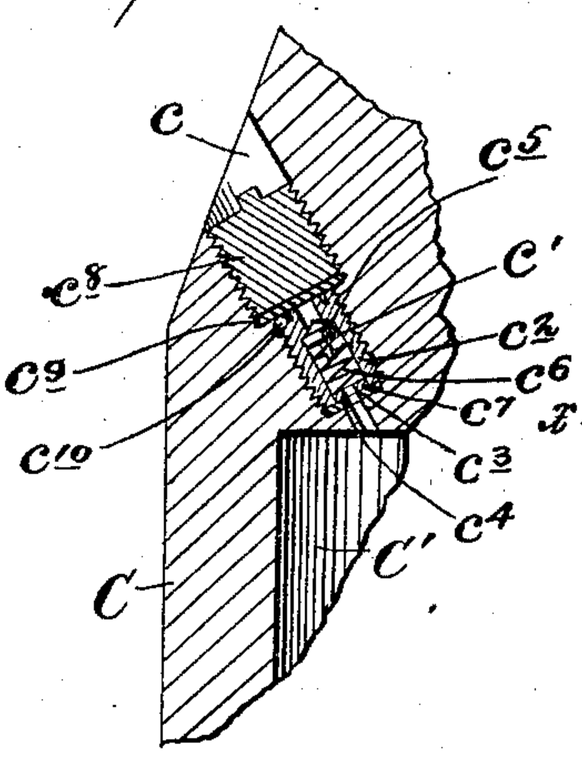
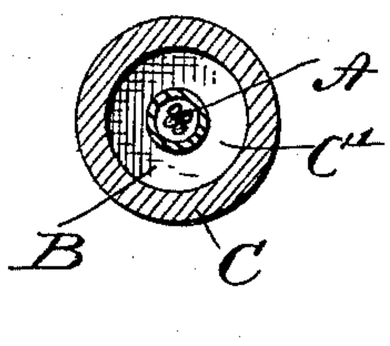


Fig. 3.



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UNITED STATES PATENT OFFICE.

JOHN C. SWAN, OF MARIETTA, OHIO, ASSIGNOR TO SWAN MACHINE & TOOL COMPANY, OF SAME PLACE.

ROPE-SOCKET.

SPECIFICATION forming part of Letters Patent No. 683,353, dated September 24, 1901.

Application filed December 17, 1900. Serial No. 40,212. (No model.)

To all whom it may concern:

Be it known that I, JOHN C. SWAN, a citizen of the United States, residing at Marietta, in the county of Washington, State of Ohio, have invented certain new and useful Improvements in Rope-Sockets, of which the following is a description, reference being had to the accompanying drawings and to the letters of reference marked thereon.

My invention relates to apparatus for drilling wells; and it consists in the improvements in rope-sockets for use in oil and Artesian well drilling hereinafter described, whereby it is made possible to utilize wire rope for carrying the drilling-tools.

In drilling wells it is found necessary to give a certain amount of elasticity to the means by which the tools are supported. Manila rope is usually employed for this purpose on account of its elasticity. It has long been recognized as desirable to substitute wire rope for the Manila rope commonly used on account of its cheapness as compared with Manila rope, as well as because of its smaller bulk in proportion to its strength. It has been found impossible to use wire rope for this purpose on account of its lack of elasticity. Attempts have been made to supply the necessary elasticity by interposing at some point between the drilling-tool and the mechanism by which it is lifted springs or other elastic devices. None of these devices have, so far as I am aware, been found to be practically operative. The device of my present invention supplies the necessary elasticity without the use of springs by utilizing the resistance to compression and the expansive force of highly-compressed gases.

In the drawings, Figure 1 is a view, partly in section, of a portion of a drilling-tool embodying my invention. Fig. 2 is a detail view of the inlet-valve of the cylinder, and Fig. 3 is a cross-sectional view on line X X of Fig. 1.

A in the drawings is a wire rope. The end of this rope is secured to a piston B, arranged to be movable within a cylinder C′, formed in the rope-socket C. The lower end of the cylinder is closed by a screw-plug D′ on the upper end of the substitute D, commonly known in the art as "sub," which is provided with the usual tool-square D^2 and in its lower end with the usual box D^3, in which the upper end of the auger-stem or jars of the drilling-tool is secured. Through the plug D′ is formed a passage *d*, preferably leading to the tool-square D^2 and open at its lower end. At its upper end this passage is provided with a downwardly-opening valve *d*′. The valve is preferably seated against a ring d^2, screwed into the enlarged upper end of the passage and normally held to its seat by a spring d^3. The piston B fits snugly in the cylinder, and in order to prevent leakage is preferably provided with packing rings or cups *b*. The connection between the wire rope A and the piston should be made by babbitting or other means, so as to be water and sediment tight.

To the piston B is secured a hollow piston-rod E. This piston-rod may be secured by screw-threading, as shown, or may be made in one piece with the piston, through which the rope A passes. The piston-rod extends upward through a packing-box F at the upper end of the cylinder. The packing preferably consists of alternate bodies of packing *f* and coiled springs *f*′, held firmly compressed by the gland G, which screws into the upper end of the packing-box. Between the bodies of packing *f* and the springs *f*′ followers f^2 are preferably employed. These followers are preferably conical on the side toward the bodies of packing. By interposing the springs *f*′ between the bodies of packing material the packing material is more firmly compressed against the piston-rod than would be the case if they were not used. The conical faces of the followers act to force the packing material against the piston-rod. It will be understood that the lowermost of the bodies of packing—viz., that immediately above the head of the cylinder—is the packing mainly depended on to prevent the escape of gas from the cylinder. Those above the lowermost body of packing will act to check leakage should any gas pass that body; but their main purpose, other than that of transmitting the compressive force of the gland G to the lowermost body of packing, is

to prevent the sediment from passing down about the piston-rod to cut the packing, and thus cause leakage. It will be understood that the whole device will in operation be more or less constantly submerged in water which is loaded with sediment, and without special means to prevent it this sediment would rapidly destroy the packing. The upper bodies of packing thus have for their most important function to preserve the integrity of the lowermost packing, which in turn has for its main function to prevent leakage of gas from the cylinder.

The springs afford ample space for lubricant, and the spaces between their coils, as well as any other spaces in or between the bodies of packing material, should be filled with lubricant, preferably a mixture of oil and plumbago.

While I prefer to use the packing shown, it will be understood that any form of packing which will effectually prevent leakage about the hollow piston-rod may be employed.

The internal diameter of the gland G is sufficiently large to receive the hollow piston-rod E and permit it to slide freely through it. The gland is made of sufficient length to afford protection to the piston-rod throughout its movement. The upper end of the gland is preferably made of reduced diameter to permit it to be grasped by the usual fishing-tools employed to recover tools from wells.

Above the piston B the cylinder C is filled with highly-compressed gas, which, by its resistance to compression, will normally hold the piston B at the lower end of the cylinder, as shown in Fig. 1. I prefer to use for this purpose carbon dioxid, commonly known as "carbonic-acid gas," (CO_2;) but any highly-compressed gas may be used. The gas within the cylinder is preferably compressed to such a degree that a portion of it will remain within the cylinder in a liquid state. In order that the gas be maintained under such pressure (one thousand pounds or more to the square inch) it is necessary that the most efficient means possible be employed to guard against leakage. The packing in the packing-box F, above described, is designed to prevent leakage about the piston-rod. This packing will in operation be highly compressed, and as the piston-rod will have movement only under strains sufficient to overcome the resistance of the gas within the cylinder the friction on the piston-rod may be practically disregarded and a high degree of compression placed on the packing.

In order to guard against leakage about the piston, I use, in addition to the packing rings or cups *b*, a layer H of heavy oil or semisolid lubricant, such as cosmoline, placed on the upper surface of the piston. This will serve as a lubricant for the piston and will seal the joint between the piston and cylinder, as well as the joint between the piston-rod E and the piston in case they are not made in one piece. The lubricant used should be of greater specific gravity than liquid carbonic-acid gas.

Whatever oil or gas escapes about the piston will collect in the space below it and will pass out through the outlet-passage *d*, the valve *d'* in the passage permitting this material to pass outward and at the same time preventing the entrance of sediment or water or other liquid from the well. As the valve *d'* keeps the space below the piston closed, a partial vacuum will be formed as the piston is drawn up, so that there will be no resistance to the return of the piston under the force of the compressed gas above it.

For the purpose of introducing the compressed gas the cylinder C' is provided with an inlet-opening *c*, preferably located, as shown in Fig. 1, in the shoulder formed above the upper end of the cylinder by reducing the upper portion of the rope-socket to form the packing-box F. This inlet-opening is provided with an inwardly-opening valve *c'*, which may be of any desired construction. This valve is preferably formed in a hollow screw-threaded plug c^2, which is screwed into the opening until its inner end is pressed firmly against a washer c^3, preferably of lead, which rests on a flange c^4, formed at the inner end of the opening *c*. In this hollow plug is a valve-seat c^5, against which the valve *c'* is seated by a spring c^6, the inner end of the spring resting against a ring c^7. Exterior to the hollow plug c^2 is placed a screw-threaded protecting-plug c^8, which serves to prevent injury to the valve by the entrance of sediment from the well as well as to prevent injury or displacement of the valve by jarring action incident to the drilling operation and to prevent leakage in case of displacement of the valve from its seat from any cause. This plug is preferably of larger diameter, as shown, and seats against a washer c^9 on the shoulder c^{10}.

By locating the inlet-opening in the shoulder, as shown, it is made possible to use a valve-plug and a protecting-plug of greater length than would be possible if the opening were made in the side wall of the cylinder. I do not, however, limit myself to such location of the valve-opening, nor do I limit my invention to the means shown for closing the inlet-opening or to any particular means for this purpose. Any convenient means by which the inlet may be closed and held closed may be used.

A portion of the highly-compressed gas introduced into the cylinder will remain, as above stated, in a liquid state. The liquid gas will lie in a layer I above the layer H of oil and possibly aids in preventing leakage about the piston. So long as this layer of liquid gas remains it will by evaporation maintain a substantially constant pressure of gas in the cylinder. As soon as the pressure through unavoidable leakage decreases the

cylinder may be recharged through the inlet-opening.

In operation as the wire rope is drawn upward after the string of tools has been dropped to strike its blow the upward pull will be transmitted to the tool through the action of the piston upon the compressed gas in the cylinder. The gas being highly elastic the direct inelastic pull of the wire rope is transmitted to the tool as a yielding pull, such as would be secured by the use of Manila rope. In the same way when the string of tools reaches, as where soft formation is encountered of drilling through a stratum of hard rock, the force of the drop is transmitted elastically to the clamp by which the drill-rope is held in the lifting mechanism.

While I prefer to arrange the device as shown, with the cylinder secured to the string of tools and the piston secured to the wire rope, it should be understood that this arrangement may be reversed and that other changes in construction and arrangement may be made without departing from my invention, the essential feature of which is the use of compressed gas confined between relatively movable parts secured, respectively, to the rope and the tools as a means for giving the elasticity necessary in the use of wire rope for drilling purposes.

Having thus described my invention, what I claim, and desire to secure by Letters Patent, is—

1. A rope-socket for use in drilling wells, provided with means for securing it to the drilling-tools and having a cylinder formed therein in combination with a piston within the cylinder constructed to be secured to the rope by which the tools are supported, and means for maintaining a body of compressed gas within the cylinder above the piston; substantially as described.

2. The combination of a rope-socket for use in drilling wells, provided with means for securing it to the drilling-tools and having a cylinder formed therein, a piston within the cylinder constructed to be secured to the rope by which the tools are supported, and means for maintaining a body of compressed gas within the cylinder above the piston, the cylinder being provided with a valve-controlled inlet above the piston whereby said body of compressed gas may be introduced into the cylinder; substantially as described.

3. The combination of a rope-socket for use in drilling wells, provided with means for securing it to the drilling-tools and having a cylinder formed therein, a piston within the cylinder constructed to be secured to the rope by which the tools are supported, means for maintaining a body of compressed gas within the cylinder above the piston, means for closing the lower end of the cylinder and a valve-controlled outlet below the piston; substantially as described.

4. The combination of a rope-socket for use in drilling wells, provided with means for securing it to the drilling-tools and having a cylinder formed therein, a piston within the cylinder constructed to be secured to the rope by which the tools are supported, means for introducing and maintaining a body of compressed gas within the cylinder above the piston comprising a valve-controlled inlet above the piston, and means for closing the lower end of the cylinder and a valve-controlled outlet below the piston; substantially as described.

5. The combination of a rope-socket for use in drilling wells, provided with means for securing it to the drilling-tools and having a cylinder formed therein, a piston within the cylinder constructed to be secured to the rope by which the tools are supported, and a hollow piston-rod secured to the piston and extending through the upper end of the cylinder, through which the rope extends, the cylinder being provided with a valve-controlled inlet above the piston substantially as described.

6. The combination of a rope-socket for use in drilling wells, provided with means for securing it to the drilling-tools and having a cylinder and packing-box formed therein, a piston within the cylinder constructed to be secured to the rope by which the tools are supported, means for maintaining a body of compressed gas within the cylinder above the piston, and a layer of lubricant above the piston; substantially as described.

7. The combination of a rope-socket for use in drilling wells, provided with means for securing it to the drilling-tools and having a cylinder and packing-box formed therein, a piston within the cylinder constructed to be secured to the rope by which the tools are supported, a layer of lubricant above the piston and a layer of liquefied gas above the lubricant; substantially as described.

8. The combination of a rope-socket for use in drilling wells, provided with means for securing it to the drilling-tools, and having a cylinder and packing-box formed therein, a piston within the cylinder constructed to be secured to the rope by which the tools are supported, a layer of lubricant above the piston, and a layer of liquefied gas above the lubricant, the lubricant being of greater specific gravity than the liquefied gas; substantially as described.

9. The combination of a rope-socket for use in drilling wells, provided with means for securing it to the drilling-tools and having a cylinder and packing-box formed therein, a piston within the cylinder constructed to be secured to the rope by which the tools are supported, a layer of lubricant above the piston, a layer of liquefied gas above the lubricant, and an inlet leading into the cylinder above the piston and means for closing the inlet; substantially as described.

10. In well-drilling apparatus, the combination of drilling-tools, a substantially ine-

lastic rope for supporting the tools and elastic means interposed between the rope and tools comprising relatively movable parts secured respectively to the rope and tools and means for confining a body of compressed gas between said movable parts; substantially as described.

In testimony whereof I affix my signature in presence of two witnesses.

JOHN C. SWAN.

Witnesses:
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