

C. M. HEETER.

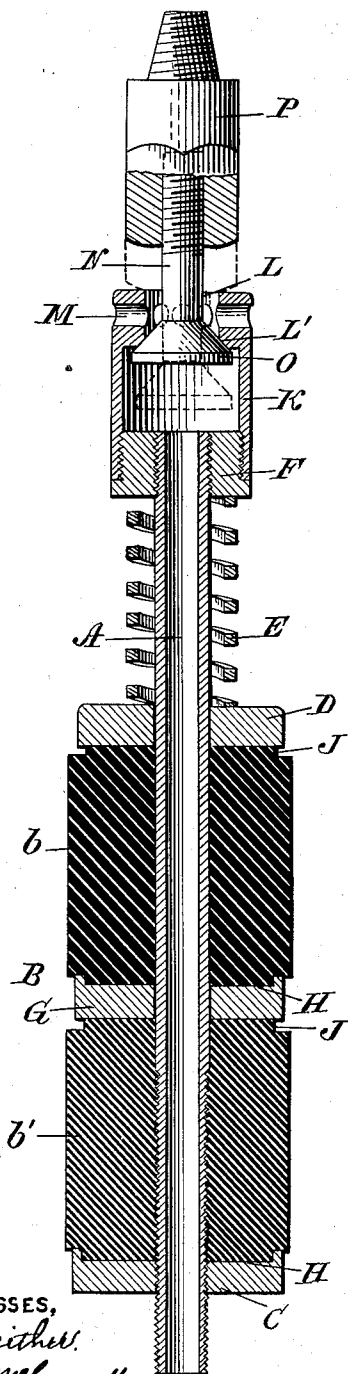
SWAB.

APPLICATION FILED JAN. 28, 1910.

1,021,600.

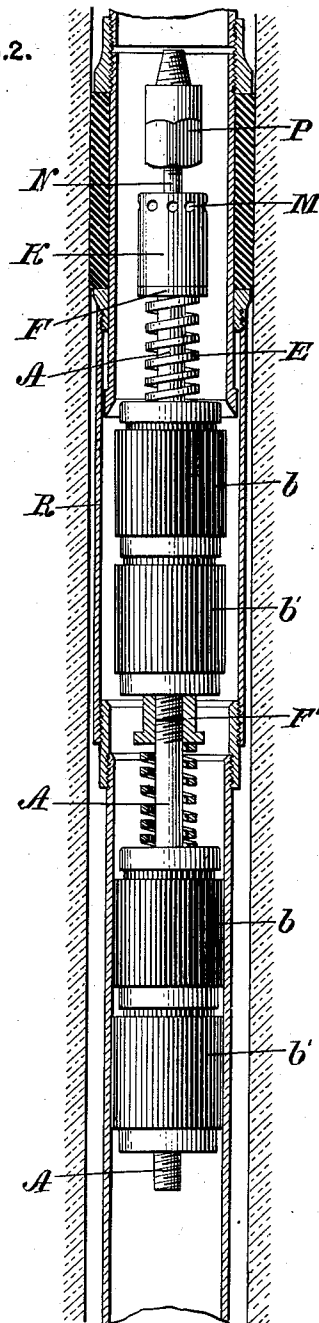
Patented Mar. 26, 1912.

FIG. 1.



WITNESSES,
H. E. Gaither.
Ella M. Cornell.

FIG. 2.



INVENTOR,
Charles M. Heeter,
By John H. Smith
Attorney

UNITED STATES PATENT OFFICE.

CHARLES M. HEETER, OF BUTLER, PENNSYLVANIA.

SWAB.

1,021,600.

Specification of Letters Patent.

Patented Mar. 26, 1912.

Application filed January 28, 1910. Serial No. 540,602.

To all whom it may concern:

Be it known that I, CHARLES M. HEETER, a resident of Butler, in the county of Butler and State of Pennsylvania, have invented certain new and useful Improvements in Swabs, of which the following is a specification.

Swabs as now constructed for lifting water or oil from oil, gas and other deep wells are constructed with a single one-section rubber sleeve which wears rapidly and must be frequently renewed, the greatest wear being at and adjacent the lower end of the sleeve.

One purpose of this invention is to protect this part of the sleeve to such an extent as to materially reduce the wear; also to provide for reversing the sleeve and thereby practically double its period of service.

A further purpose of the invention is to increase the efficiency of the sleeve by forming its upper part of softer rubber than the lower part, as I have found that a rubber of this character packs much more effectively in the casing than one of uniform resiliency throughout. Furthermore, the efficiency is increased by forming the sleeve in sections, two such sections being here shown, with the upper section of softer rubber than the lower section, and both preferably so arranged that each may be turned end for end as the lower ends become worn.

A further characteristic of the invention is the provision of a yielding top abutment for the sleeve with a spring for opposing upward movement of the abutment and exerting such downward pressure as to aid materially in effectively spreading the rubber within the casing. While the use of this movable top abutment and spring are not necessarily confined to a rubber softer at its upper end than its lower end, nor to a sleeve formed in sections, the same when used in connection with these features provides a very efficient swab.

An objection to swabs as now constructed is that the upwardly opening check valve, which permits upward flow of water or oil as the swab is lowered and closes when the swab is lifted, is frequently raised from its seat during the upward movement by gas

under high pressure within the well, and when thus raised and opened the fluid flows back through the swab, thereby defeating the very purpose for which the swab is used. This objection is overcome with the present invention by providing valve means of such construction that the greater the pressure from beneath the more tightly the valve is held closed. In the present embodiment, an upwardly closing valve is employed which is arranged in connection with the swab operating stem in such manner as to open during the downward movement and close during the upward movement, the whole weight of the swab being in fact on the valve during such upward movement, and with the arrangement such that any upward gas pressure will tend to increase the seating pressure of the valve.

In the accompanying drawings, Figure 1 is a vertical section of a swab constructed in accordance with the invention, and Fig. 2 illustrates the improved swab in double form and within a well.

Referring to the drawings, A designates the tubular stem of the swab which provides an upward passage for water, oil and gas as the swab is lowered into a well. Arranged on stem A is the swab rubber B having the ring-like bottom abutment C adjustably secured to the threaded lower portion of the stem and a disk-like top abutment D movable on the stem, and with a stout spring E embracing the stem between abutment D and the stop-forming head F secured to the upper end of the stem, spring E opposing upward movement of abutment D and exerting downward pressure thereon.

As before stated, a characteristic of the invention is a swab rubber having its upper portion of softer rubber than its lower portion, as thereby a more effective packing within the casing is secured, particularly when used with a movable spring-held top abutment. In the embodiment here shown, the rubber sleeve is in two sections *b* and *b'*, with the upper section *b* of softer rubber than the lower section. An abutment G may be loosely arranged on stem A intermediate the sleeve sections.

The sleeve wears or cuts away more

rapidly at and adjacent its lower end, and I have found that when the sleeve is in sections, each section is subject to this wear. But such wear is materially reduced by so
 5 confining the lower end of the rubber as to retard spreading, and this I accomplish by cupping the upper faces of abutments C and G, as indicated at H, with the extremities
 10 of the sleeve sections circumferentially notched or reduced, as at J, to enter the cups. And by notching both ends of each sleeve section, the latter may be reversed and full wear obtained from each, practically double the service secured from the non-reversible
 15 rubber now commonly used.

With the bottom abutment C adjustable, the rubber may be tightened up from time to time as it becomes worn and until no further efficiency can be secured by contracting
 20 it longitudinally. Spring E coöperates with this function of the adjustable bottom abutment, with the result that the rubber is at all times maintained in condition for effective fitting or packing within
 25 the casing. At the same time, the spring permits the rubber to so yield in upward direction during the downward movement of the swab as to prevent excessive friction, rendering such movement comparatively
 30 easy and at the same time relieving the rubber of much wear which such friction would cause.

It is a common practice in casing wells to use heavier casing for the lower portion of
 35 the well than for the upper portion, the lighter casing being used for say a depth of from 2,000 to 2,500 feet and the heavier casing the remainder of the depth. Both weights of casing are of the same external
 40 diameter, but there is usually an eighth of an inch difference in gage between the metals of the two weights, which makes the lighter casing a quarter of an inch larger inside the diameter than the heavier casing.
 45 With the swab rubber arranged between the two fixed abutments as heretofore and of a size to closely fit the lighter casing, the rubber is subjected to great strain and wear when forced into the smaller diameter
 50 of the lower and heavier casing, and is frequently so torn and mutilated as to be absolutely useless. With the construction here shown, the rubber, while fitting the larger diameter, yields upwardly in such
 55 manner as to enter the smaller casing without injury. The reverse action occurs when the swab emerges from the casing of smaller diameter, the sleeve spreading readily and filling the larger diameter, whereas in the
 60 former construction after the rubber has once been forced into the casing of smaller diameter it does not pack efficiently in the larger diameter and unavoidable back-flow around the swab results.

65 As here embodied, a chambered head K

is secured to the stop-forming head F with stem A open thereto. A passage L is formed through the thick upper end of head K, and the lower end of this passage is reamed to form the valve seat L', with
 70 lateral ports or outlets M above the seat. The operating stem N, smaller than passage L, extends therethrough and at its lower end carries the beveled valve-forming head O which fits seat L' and closes head K
 75 when the swab is lifted by means of the operating connection P to which stem N is secured. As the swab is lowered in the casing, stem N and its valve head are in lowered position, as in dotted lines in Fig. 1,
 80 thereby providing a free outlet through ports M for the fluid flowing upwardly through stem A, but immediately closing such outlet when the movement is reversed, the position then being as in full lines in
 85 Fig. 1. With this construction it is obvious that upward pressure of gas through the stem cannot displace the valve, as with the upwardly opening check valve now commonly used, but rather increases the pres-
 90 sure of valve O on its seat, so that such excessive gas pressure cannot operate as heretofore to release the fluid being raised.

In wells of great depth, and where very large columns of fluid must be removed, it may be desirable to provide a swab of double construction, as shown in Fig. 2, which is accomplished by using two swabs constructed as above described, omitting the
 100 chambered head and valve from the lower swab, and substituting a coupling head F' for head F which serves to unite the tubular stems of the two swabs. Obviously, a swab of practically double capacity is thereby
 105 secured, i. e., a swab having such casing-packing efficiency as to sustain the enormous weight of a large column of fluid which might be too great to be effectively held by a single swab. A further advantage
 110 of this double construction is that the column of fluid is effectively held when passing an offset formed by the sleeve and wall packer, such as R, Fig. 2. Such a sleeve is usually about three-fourths of an inch
 115 larger inside diameter than the casing, and it is clear that a considerable volume will flow back around the swab while the latter is passing through, particularly when the space of larger diameter is longer than the
 120 swab. With the double swab the whole length is such that the upper swab will fully pass such an offset before the lower swab fully enters the same, and no back flow can result.

By the terms "rubber sleeve" and "swab rubber" I refer to the full length of the rubber element irrespective of the sections in which the same is or may be formed, and the claims are to be read with this un-
 125 understanding. 130

I claim:

1. In a swab, the combination of a tubular stem, a sleeve of compressible rubber confined on the stem and compressed longitudinally by the weight of a column of fluid lifted thereby, the upper portion of the compressible rubber being softer than the lower portion.

2. In a swab, the combination of a tubular stem, a sleeve of longitudinally compressible rubber confined on the stem, the sleeve fully filling the space between the tubular stem and the well casing and compressed longitudinally by the weight of a column of fluid, the upper portion of the sleeve being of softer rubber than the lower portion.

3. In a swab, the combination of a tubular stem, a rubber sleeve confined on the stem and arranged in sections one above the other, both sections being longitudinally compressible under the weight of a column of fluid with the upper section yielding to greater compression than the lower section.

4. In a swab, the combination of a tubular stem, a longitudinally compressible rubber sleeve confined on the stem, the sleeve arranged in sections one above and closely adjacent to the other, an abutment movable on the tubular stem for the upper end of the sleeve, and a coiled spring encircling the tubular stem and normally exerting downward pressure on said abutment.

5. A swab rubber of uniform transverse thickness from end to end with its upper portion softer than its lower portion.

6. A swab rubber having a passage there-through for a tubular stem and of uniform cross-sectional area from end to end with its upper portion of softer rubber than its lower portion.

7. A swab rubber formed in sections of uniform transverse thickness from end to end with the upper portion softer than the lower portion.

8. In a swab, a tubular stem, a rubber sleeve fitting the stem and of uniform cross-sectional area from end to end, an abutment on the stem for the lower end of the rubber, an abutment movable on the stem for the upper end of the rubber, and a coiled spring encircling the tubular stem and exerting constant downward pressure on the upper abutment.

9. In a swab, a tubular stem, a rubber sleeve thereon having its upper portion formed of softer rubber than its lower portion, and abutments for the upper and lower ends of the sleeve.

10. In a swab, a tubular stem, a rubber sleeve thereon formed in sections arranged one above the other with the upper section of softer rubber than the lower section, and abutments for the sleeve.

11. In a swab, a tubular stem, a rubber sleeve thereon formed in sections arranged

one above the other with the upper section of softer rubber than the lower section, an abutment between the sections, and abutments for the upper and lower ends of the sleeve.

12. In a swab, a tubular stem, a rubber sleeve thereon formed in sections arranged one above the other, the upper section of softer rubber than the lower section, an abutment secured to the stem for the lower end of the sleeve, a movable abutment for the upper end of the sleeve, and a spring for opposing upward movement of the upper abutment.

13. In a swab, a tubular stem, a rubber sleeve on the stem, an abutment secured to the stem for the lower end of the sleeve, a movable abutment for the upper end of the sleeve, a stop device secured to the stem above the upper abutment, and a spring coiled around the tubular stem between the stop device and the upper abutment for opposing upward movement of the latter.

14. A swab having a fluid passage there-through, a chambered head at the upper end of the passage with an opening through the upper end of the head, the head formed with lateral outlets intersecting said opening above the lower end of the latter, an operating stem extending into the head, and a valve-forming head at the lower end of the stem closing the top opening when lifting the swab.

15. In a swab, the combination of a tubular stem, two swab rubbers arranged on the stem one above the other to form an elongated swab for the purpose described, an abutment fixed to the stem for the lower end of the lower rubber, movable abutments for the upper ends of the rubbers, and a spring for opposing upward movement of said movable abutments.

16. In a swab, a tubular stem, a rubber sleeve on the stem formed in sections one above the other, means fixed to the stem and engaged by the lower end of the rubber sleeve, and a coiled spring encircling the tubular stem and exerting constant downward pressure on the upper end of the sleeve.

17. A swab having a fluid passage there-through, a chambered head at the upper end of the passage with an opening through the upper end of the head, the under side of the upper end of the head forming a valve seat, the chamber having lateral outlets above the valve seat, an operating stem adapted to bear against the upper end of the chambered head and closing the opening therethrough when lowering the swab in a well, a valve stem projecting downwardly from the operating stem and through the top opening in the chambered head, and a valve-forming head at the lower end of the

valve stem adapted to engage said valve seat when the operating stem is lifted for elevating the swab.

18. In a swab, the combination of a tubular stem, and two longitudinally compressible swab rubbers arranged on the stem one
5 above the other and spaced apart, the space between the rubbers receiving fluid which

exerts compressing pressure on the lower rubber.

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

CHARLES M. HEETER.

Witnesses:

JAMES O. CAMPBELL,

GRACE E. HARKLESS.