Feb. 24, 1931. A. L. SEGELHORST ET AL 1,793,644

SWAB FOR TAPERED TUBING

Filed Oct. 31, 1928

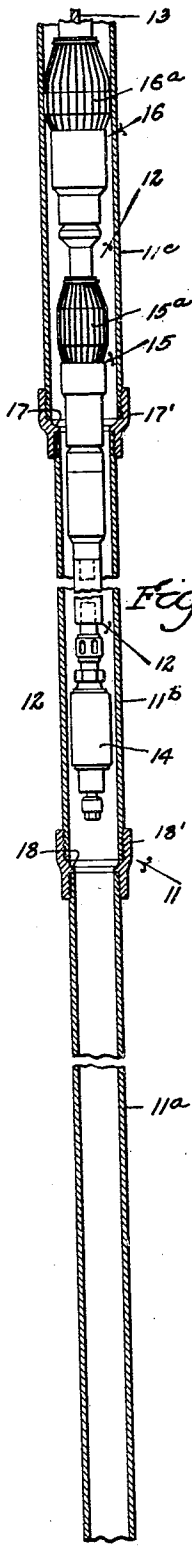


Fig. 1.

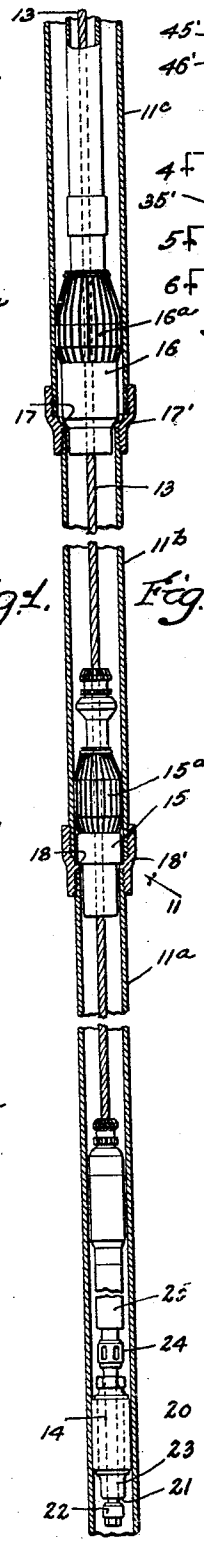


Fig. 2.

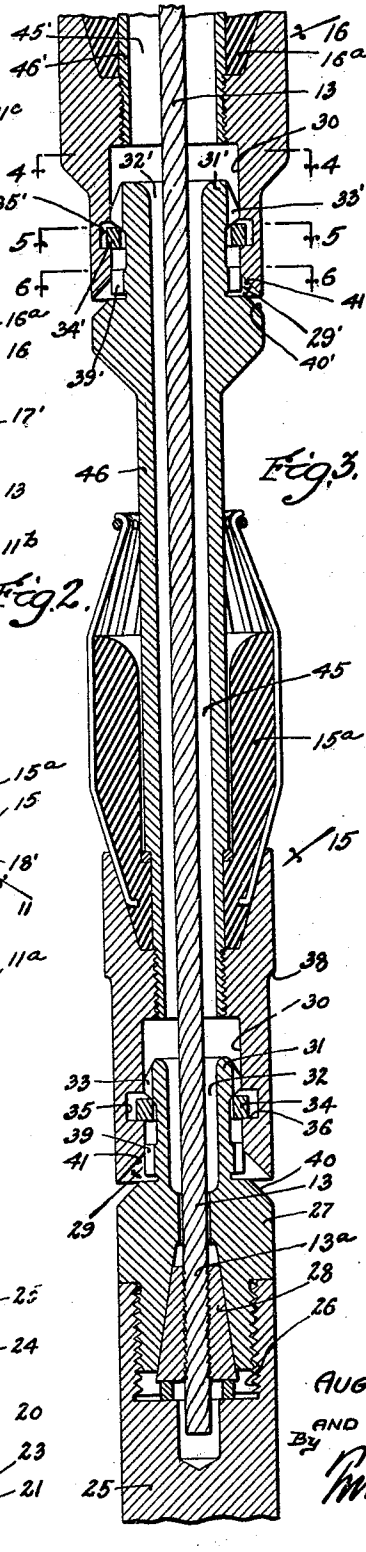


Fig. 3.

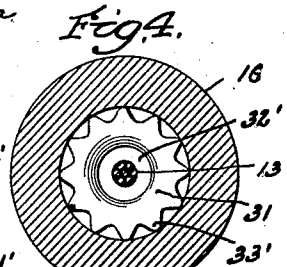


Fig. 4.

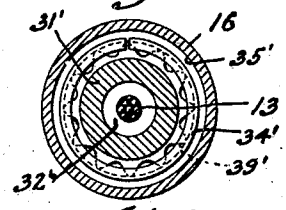


Fig. 5.

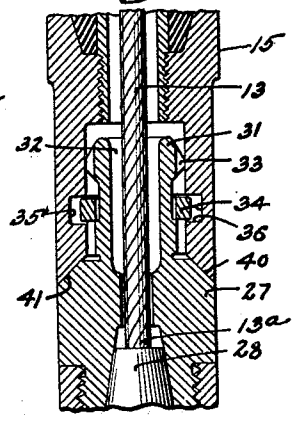


Fig. 7.

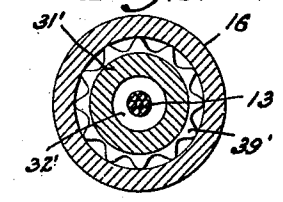


Fig. 6.

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UNITED STATES PATENT OFFICE

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SWAB FOR TAPERED TUBING

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This invention relates to an improved swabbing organization which is particularly adapted for use in connection with oil wells and has been developed especially for use in combination with a well having tapered tubing therein.

It is well known to those familiar with the petroleum industry that it is frequently necessary, in the installation of tubing through which the oil is withdrawn from the well, to place the tubing in a series of stepped or tapered sections, the tubing at the bottom of the well being, say, two inches in diameter, superposed by a tubing of, say, four inches in diameter which, in turn, supports a tubing of six inches in diameter, etc.

It is also known to those familiar with the art that it is common practice in "bringing in" a well, or in removing liquid therefrom, prior to the installation of the pump or before the well starts to flow, to employ a so-called "swab" which is nothing more or less than a plunger adapted to be lowered into the tubing by means of a cable, the plunger being in turn provided with a suitable valve or valve means which will permit the upward flow of the liquid therethrough but will prevent its return downward into the well during the withdrawal of the swab.

It is obvious that such a construction can be advantageously used only in a tube which has a uniform diameter from the point at which the swab starts on its upward movement to the top of the well. However, in view of the recent development of deep wells, necessitating the above mentioned use of the tapered tubing, it has been found necessary to produce a swab which will be effective to remove the liquid from a well in which the casing is not of substantially uniform diameter throughout.

It is therefore an object of this invention to produce a swabbing organization of the character last described which is simple of contruction and efficient in its operation.

It is a further object of the invention to develop an organization of this class which embodies a series of swab sections, each section being adapted for use in a tubing section of corresponding diameter and all of the sections being provided with co-operating interlocking means whereby each section is carried to the bottom of the respective tubing section before the same is released from the entire swabbing organization.

It is a further object of the invention to provide an organization in which the interlocking means are so formed as to provide fluid circulating passages which will permit the upward flow of the fluid through the swab while the organization is being lowered into the tubing.

It is also an object of the invention to produce an organization in which the individual members or swab units are so connected that a uniformly sealed swabbing construction is formed while the organization is being moved upwardly through the tubing. This construction is obtained by providing co-operating shoulders or valve seats upon the top and bottom ends of the adjacent members which unite to form the swabbing organization.

Other advantageous features of this invention and further objects attending its production will be better understood from the following description of the accompanying drawings which are chosen for illustrative purposes only and in which

Fig. 1 is an elevational view partly in section illustrating the swabbing organization of the character described as being lowered into a well having tapered tubing therein.

Fig. 2 is an elevational view similar to Fig. 1 but illustrating the swabbing organization as having been lowered into the well and in a position prior to the initiation of the withdrawing movement.

Fig. 3 is an enlarged elevational section illustrating the details in the construction of the novel elements of this invention.

Fig. 4 is a plan section taken substantially in the plane represented by the line 4—4 in Fig. 3.

Fig. 5 is a plan section taken substantially in the plane represented by the line 5—5 in Fig. 3.

Fig. 6 is a plan section taken substantially in the plane represented by the line 6—6 in Fig. 3; and

Fig. 7 is an elevational view illustrating

a part of that embodiment of the invention shown in Fig. 3 but showing the elements in the position which they will occupy while the swabbing organization is being withdrawn from the well.

More particularly describing the invention as herein illustrated, reference numeral 11 indicates a well tubing which is illustrated as being composed of sections 11*a*, 11*b* and 11*c* of respectively increased diameters. A swabbing organization generally indicated by reference numeral 12 is illustrated as being suspended within the tubing by means of a cable 13. The swabbing organization 12, in the form of the invention illustrated in the drawing, embodies three units or swab members indicated by reference numerals 14, 15 and 16 which are of progressively increasing diameter, the outside diameter of these units being substantially the same as the inside diameter of the respective tubings 11*a*, 11*b* and 11*c*.

It will be understood that the cup or plungers 15*a* and 16*a* on each one of the swabbing members 15 and 16 may be of any standard construction and that the novelty of this invention resides largely in a unit which embodies a series of swab members of progressively increasing diameters. These members are provided with co-operative interlocking means my means of which the upper member, during downward movement through a tubing section, is released upon engagement of this member with the upward end of the next tubing section of smaller diameter.

This feature of the invention is perhaps best illustrated in Fig. 2 in which it will be noted that the upper member 16, which is of the largest diameter, and which is adapted to engage the walls of the tubing section 11*c*, is illustrated as resting upon a shoulder 17 in the collar or coupling 17′ which connects the larger tubing member 11*c* with the intermediate tubing member 11*b*. The intermediate swabbing member 15, upon the engagement of the upper member 16 with the mentioned shoulder 17, is released in a manner which will be hereinafter described and travels down through tubing section 11*b* until it is brought into engagement with the shoulder 18 formed on the upper end 18′ of the smaller tubing section 11*a*. The lower swab member 14 then travels down through this small section of the tubing until it is desired to withdraw the same and thereby swab the well.

It will be understood that, as was heretofore mentioned, the lower swab section 14 may be of any preferred construction and in the form of the invention illustrated this member comprises a so-called plunger section, the lower end of which is provided with a valve section 21 which receives a valve member 22. The valve member 22 is provided with an upwardly extending stem 23 which passes through a cage 24 mounted upon the upper end of the plunger section 20 and is attached to the lower end of a weight 25. It will be understood that, during the downward movement of the organization through the well, the pressure of the oil upon the lower edge of the plunger 20 tends to force the plunger upward upon the stem 23, thereby forming an opening between the valve 22 and the valve seat 21 which admits the passage of fluid upward through the plunger 20 and out of the cage 24. It will also be understood from the illustration in Fig. 2 that the weight 25 is made of a diameter such that it is smaller than the plunger 20 in order that the liquid may pass thereabout and admit the downward movement of the weight through the smaller tubing 11*a*.

The detailed construction of the individual swab members which embody the swabbing unit or swabbing organization are best illustrated in Fig. 3 which shows the weight section 25 as being upwardly provided with a threaded recess 26 which receives the lower threaded end of a head member 27. The recess 26 and the head member 27 co-operate with slips 28 to engage and hold the lower end 13*a* of the supporting cable 13. It will be understood from this construction that the cable 13 comprises the sole supporting means for the whole unit. The head member 27 is upwardly provided with an interlocking head 29 which is received by a co-operating interlocking socket 30 formed upon the lower end of the intermediate swabbing section 15. This interlocking head and socket construction is carried throughout the entire swabbing organization, being provided between each set of swab members.

As is best illustrated in Fig. 3, this locking construction comprises an upwardly extending stem 31 which is provided with a central passage 32 to admit the free passage therethrough of the cable 13. The stem 31 is outwardly provided with a plurality of so-called wedge members 33 which are best illustrated in Fig. 4 as being spaced apart to admit the passage of fluid; and, as shown in Fig. 3, both the top and bottom faces of these wedge members are tapered to admit their passage by a yieldable annular member in the form of a split ring 34 which is retained within an annular groove or recess 35 formed in the inner surface of the socket 30.

The ring member 34 rests upon a shoulder 36 and, when the members are in the position shown in Fig. 3, during the normal movement of the swabbing organization in either direction, this ring acts as a lock between the two members between which it is interposed. Upon the engagement of the swab member 15 with the shoulder 18, as illustrated in Fig. 2, which is effected upon a suitable shoulder 38 formed upon the outer surface of the socket

member 30, the impact from such an engagement is sufficient to cause the wedge members 33 to force the split ring 34 out into the recess 35, thereby permitting the downward passage of the lower swabbing member 14 and its attending parts.

The impact spoken of above as resulting from the engagement between the swab member 15 and the shoulder 18 is of course effected by the downward movement of the weight 25.

In order that the head member 27 may be secured against a wobbling or oscillating movement within the socket 29, the lower section of the stem member 31 is provided with a plurality of outwardly extending lugs or guide members 39 which are spaced apart as indicated in Fig. 6 to admit the upward passage of the fluid through the swab.

It will also be noted, from the illustration shown in Fig. 3, that the head member 27 is provided with a downwardly sloping shoulder 40 which is adapted to co-operate with the oppositely formed and similarly sloping shoulder 41 upon the lower edge of the socket member 30 to form a seat or valve, and it will be seen from the illustration shown in Fig. 7 that, when the upward movement of the swabbing organization is initiated, these mentioned shoulders are brought into engagement and the downward passage of the fluid, above the swabbing member 15, is prevented.

The locking head and socket organization indicated at 29′ and 30′, respectively, between the lower end of the largest swabbing member 16 and the upper end of the intermediate swabbing member 15, is the same in form as that described in connection with the head 27 and the lower end of the intermediate swab 15. And to more clearly illustrate this construction the details of this organization are indicated by the same reference numerals used in connection with the lower construction except that in the upper organization the numbers are distinguished by the prime (′) mark.

In the operation of this invention it will be understood that the units 14, 15 and 16 are arranged in locked relation to each other as illustrated in Fig. 1 and, in this relation, it will of course be apparent that the entire organization is supported by means of cable 13 which is retained in the weight 25 by means of the slips indicated at 28.

The main advantage in having the members locked to one another, it will be understood by those familiar with the art, is to prevent the possibility of one of the members becoming lodged in the casing due to the friction of the swab or cup upon the inner surface of the casing.

As the organization shown in Fig. 1 is lowered downward into the tubing, any liquid which is in the tubing passes upward through the valve organization indicated at 21 and 22 from which it passes through the lower swab member 14 and out into the tubing above this member through the cage 24.

As the unit moves on down the liquid passes between the shoulders 40 and 41 from which it is carried upward through the passage 32 in the stem 31 and into the tubular passage 45 in a tubular connection member 46 which is interposed between the upper and lower ends of the swab member 15. This liquid of course passes from this member into the tubular passage 45′ which is formed in the tubular member 46′ in the upper swab member 16 and so on throughout the organization as far as it may be desired to carry this series of members.

As was previously explained, the engagement of the members 15 and 16 respectively, with the shoulders 17 and 18 in the upper ends of the tubing sections 11*b* and 11*a*, respectively, is effective to disengage the units supported below these members; and, in this case, each swabbing member which is retained in the bottom of the tubing section acts as a packer therein having a central passage therethrough through which liquid may be advanced by means of upward movement of the swabbing member suspended therebelow.

When the lower swabbing member, such as member 14, is carried upward to a point at which the upper end 27 is brought into engagement with the lower end of the swabbing member 15, the shoulders 40 and 41 are brought into engagement which prevents the downward passage of liquid from tubing 11*b* and this liquid is accordingly advanced upward through the swabbing member or packer 16 which is in the bottom of the tubing section 11*c*.

It will be understood that under certain circumstances the locking members may be eliminated by making the tubing members 46 and 46′ of sufficient weight to effect the downward movement of each swabbing section independently.

From the foregoing description it will be apparent that this invention embodies an organization which may be easily constructed, one which may be adapted for use in a so-called tapered stem or tubing having any number of sections of upwardly increasing diameters, and that the locking feature of the unit comprises a feature which obviates the possibility of one of the swab members becoming stuck within the section with which its outer surface is in engagement, due to friction thereon or irregularities in the tubing.

It will be understood that, while we have herein described and illustrated one specific form of the invention, it is not limited to the precise construction set forth but includes within its scope whatever changes

fairly come within the spirit of the appended claims.

We claim as our invention:

1. A well-swabbing organization embodying: a plurality of separate swab members movable relative to each other; releasable means for locking said members to each other; and means for supporting said members as a single unit.

2. A well-swabbing organization embodying: a plurality of separate swab members movable relative to each other; releasable means for locking said members to each other comprising a split ring in one of said members, and wedge means on a co-operating member adapted to engage said split ring.

3. A well-swabbing organization embodying: a plurality of separate swab members movable relative to each other; releasable means for locking said members to each other comprising a split ring in one of said members, and wedge means on a co-operating member adapted to engage said split ring, said wedge means including fluid passages.

4. A well-swabbing organization embodying: a plurality of interconnected swab members; and means for supporting said swab members as a unit, said members being releasably connected to each other by means comprising a yieldable member mounted in a recess formed in one of said members, and fixed projections formed upon an adjacent member and adapted to engage said yieldable member.

5. A well-swabbing organization embodying: a plurality of interconnected swab members; and means for supporting said swab members as a unit, said members being releasably connected to each other by means comprising a yieldable annular member mounted in a recess formed in one of said members, and fixed projections formed upon an adjacent member and adapted to engage said yieldable member, said projections being spaced apart to admit the passage of fluid.

6. A well-swabbing organization embodying: a plurality of separate swab members movable relative to each other; means for supporting said members as a single unit; and means for admitting the upward passage of fluid through said unit while said unit is moving downward into a well; and means for preventing the downward passage of fluid through said unit during the withdrawal of said unit from said well, said last mentioned means embodying annular valves formed by co-operating shoulders on the upper and lower ends of adjacent units.

7. A well-swabbing organization embodying: a plurality of separate swab members movable relative to each other, releasable means for locking said members to each other; means for supporting said members as a single unit; and means for admitting the upward passage of fluid through said unit while said unit is moving downward into a well.

8. A swabbing organization of the character described embodying the combination: co-operating swab members, one of said swab members being provided with a locking head, the other of said members being provided with a locking socket adapted to receive said head; yieldable means interposed between said head and said socket; and substantially rigid wedge means adapted to engage said yieldable means, said yieldable means being adapted to engage a fixed shoulder and to transmit pressure from said wedge means to said shoulder.

9. A swabbing organization of the character described embodying the combination: co-operating swab members, one of said swab members being provided with a locking head, the other of said members being provided with a locking socket adapted to receive said head; yieldable means interposed between said head and said socket; substantially rigid wedge means adapted to engage said yieldable means, said yieldable means being adapted to engage a fixed shoulder and to transmit pressure from said wedge means to said shoulder; and substantially rigid guide means positionally fixed relative to said wedge means for keeping said swab members in alignment.

10. A swabbing organization of the character described embodying the combination: co-operating swab members, one of said swab members being provided with a locking head, the other of said members being provided with a locking socket adapted to receive said head; yieldable means interposed between said head and said socket; substantially rigid wedge means adapted to engage said yieldable means, said yieldable means being adapted to engage a fixed shoulder and to transmit pressure from said wedge means to said shoulder; substantially rigid guide means positionally fixed relative to said wedge means for keeping said swab members in alignment; said wedge means and said guide means being provided with circulation passages.

11. A swabbing organization of the character described embodying an upper swab member; a lower swab member; a stem on the upper end of said lower swab member; a socket on the lower end of said upper swab member, said socket being provided with an annular channel; and a yieldable member mounted in said channel; wedge members formed on said stem adapted to be forced upward by said yieldable member and to be supported by said socket through engagement with the upper edge of said yieldable member.

12. A swabbing organization of the character described embodying an upper swab

member; a lower swab member; a stem on the upper end of said lower swab member; a socket on the lower end of said upper swab member, said socket being provided with an annular channel; a yieldable member mounted in said channel; wedge members formed on said stem adapted to be forced upward by said yieldable member and to be supported by said socket through engagement with an upper edge of said yieldable member, said wedge members being formed to admit their downward passage by said yieldable member upon the sudden application of a downward force to said stem.

13. A swabbing organization of the character described embodying an upper swab member; a lower swab member; a stem on the upper end of said lower swab member; a socket on the lower end of said upper swab member, said socket being provided with an annular channel; a yieldable member mounted in said channel; wedge members formed on said stem adapted to be forced upward by said yieldable member and to be supported by said socket through engagement with an upper edge of said yieldable member; and guide means on said stem in a downward spaced relation with said wedge members.

14. For use in combination with a stepped well tubing, comprising sections of downwardly decreased diameters, a swabbing organization embodying a plurality of swab members arranged one above the other and having downwardly decreased diameters to correspond with the diameters of said tubing sections; releasable interlocking means between said swabbing members; means for supporting said members as a single unit; and means for releasing said locking means comprising houlders on the outer surfaces of said members adapted to engae the upper edge of the next smaller section of tubing.

15. In a swabbing organization of the character described, a releasable unidirectional valve coupling adapted to connect two swab members, including: a tubular stem on the first of said swab members; a stem on the second of said swab members; means for releasably engaging said stem of said second swab member within the tubular stem of said first mentioned swab member; and cooperative valve means arranged between the end of said tubular stem and said second swab member to effect a unidirectional flow of liquid when said organization is reciprocated within a well.

16. In a swabbing element of the character described, a releasable unidirectional valve coupling adapted to connect two swab members, including: a tubular stem on the first of said swab members, said tubular stem having an internal annular groove therein; a stem on the second swab member adapted to enter said tubular stem, said stem having peripheral wedge-shaped projections thereon; and a split ring arranged in said annular groove to engage said projections, the lower end of said tubular stem being tapered and arranged to seat upon correspondingly tapered shoulders formed on said second swab member.

In testimony whereof, we have hereunto set our hands at Los Angeles, California, this 13th day of October, 1928.

AUGUST L. SEGELHORST.
HUGH S. BERKEY.