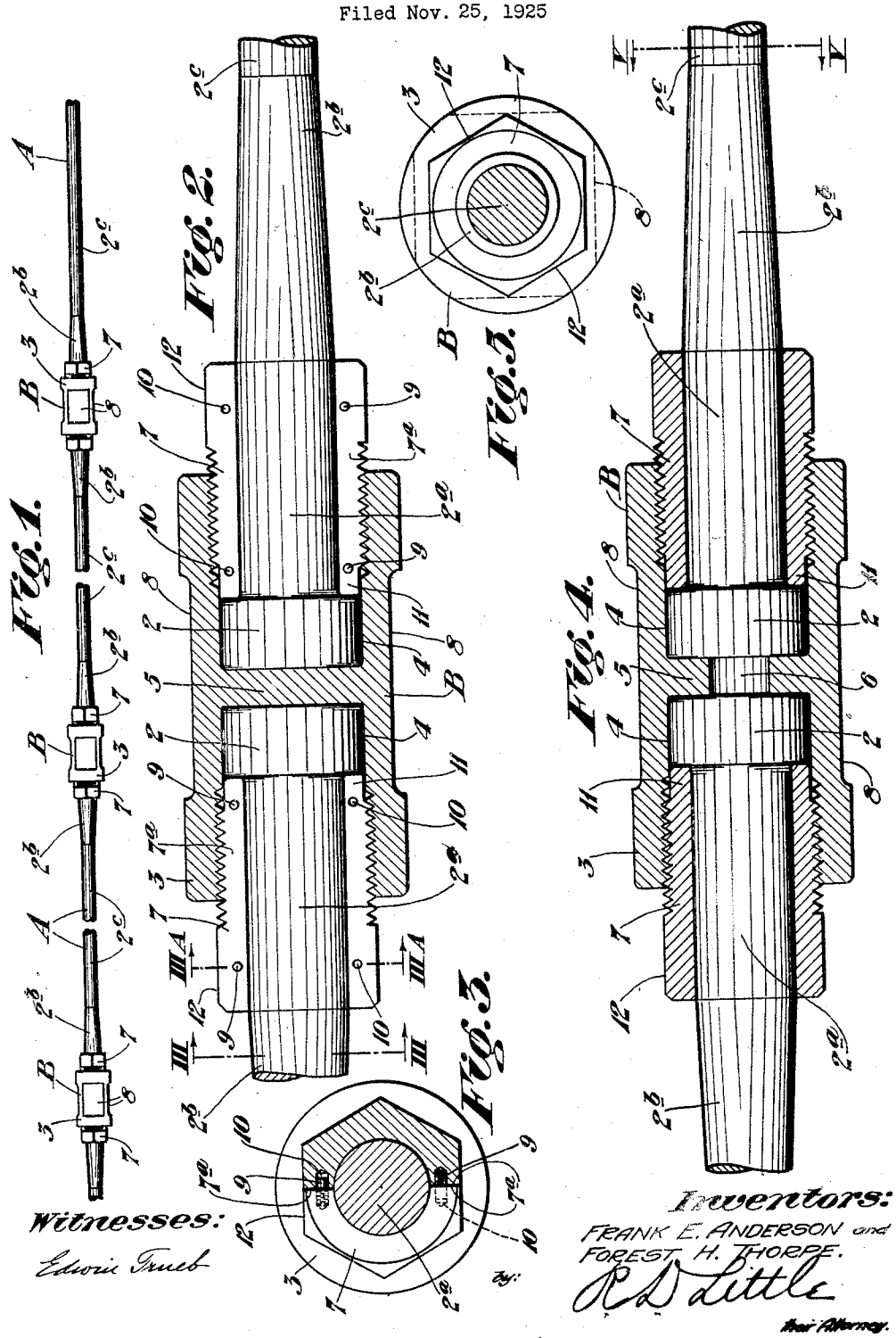
Nov. 6, 1928. 1,690,612

F. E. ANDERSON ET AL

METHOD OF MAKING SUCKER RODS

Filed Nov. 25, 1925



Patented Nov. 6, 1928. 1,690,612

UNITED STATES PATENT OFFICE.

FRANK E. ANDERSON AND FOREST H. THORPE, OF COLUMBUS, OHIO, ASSIGNORS TO THE COLUMBUS SUCKER ROD COMPANY, OF COLUMBUS, OHIO, A CORPORATION OF OHIO.

METHOD OF MAKING SUCKER RODS.

Application filed November 25, 1925. Serial No. 71,340.

Our invention relates to sucker rods of which a "string" is used in pumping deep wells such as oil wells. The depth of such wells is constantly being increased, now being drilled as much as five thousand feet deep. On account of the greatly increased depth of the wells, the strings of sucker rods used in pumping the wells frequently break because of the great length and increased weight of such strings.

The size or internal diameter of the casing used in the wells limits the transverse dimensions of the couplings for the sucker rods and the sucker rods, which makes any material increase in such dimensions practically impossible. Breakage of a rod in a string of sucker rods is a frequent cause of long and expensive delays in the well pumping operations. Sucker rods as made heretofore generally fail by breaking at or closely adjacent to the point where the head on the ends of each sucker rod joins the body portion of the rods. Another factor in the cost of pumping wells is because the heads on the ends of the rod sections become upset by long use, such upsetting making it difficult to disconnect the sucker rod couplings as is done when removing a string from a well, and as is necessary from time to time in order to clean the well, and to enable repairs being made to the pump cylinder on the lower end of the well casing at the bottom of the well and for various other reasons.

One object of our invention is the provision of a novel method of making sucker rods resulting in a sucker rod and rod coupling of improved construction whereby the strength and durability of a string of the rods is materially increased without material increase in the weight of the string and with little or no reduction in the clearance between the string and the inner surface of the well casing in which the string is suspended when in use.

Another object of the invention is the provision of a novel method of making the sucker rods and rod couplings whereby the increased strength and durability of the rods and rod couplings are attained in a rapid, cheap and economical manner.

Still further objects of the invention will be made apparent hereinafter in the detailed description of the invention.

The invention consists in the novel constructions and arrangement of parts forming the assembled string of sucker rods, in the way the ends of the rods are enlarged and provided with heads, and in the improved series of steps used in making the rods.

Referring now to the drawings forming part of this specification, Figure 1 is a plan showing part of a string of sucker rods made in accordance with our invention, as assembled for use in pumping.

Figure 2 is a longitudinal section, on a larger scale, showing a preferred construction of sucker rod and rod coupling made in accordance with our invention.

Figure 3 is a transverse section of the construction shown in Figure 2, the left-hand half of Figure 3 being taken on the line III—III, and the right-hand half on the line III^{A}—III^{A} of Figure 2.

Figure 4 is a longitudinal section similar to Figure 2, showing a modified form of coupling embodying certain features of our invention.

Figure 5 is a transverse section on the line V—V of Figure 4.

In the accompanying drawings, the letter A designates the sucker rods of the series used in forming a "string", and B the couplings by which the adjoining ends of the rods are fastened to one another when assembled into the string.

Each of the rods A which, as shown, are of circular cross-section, has a circular head 2 on each end, the heads 2 being formed integral on the enlarged end portions 2^{a} of the rods and the end portions 2^{a} preferably being connected by a tapering portion 2^{b} to the body portion 2^{c} of the rods A. The enlarged portions 2^{a} and 2^{b} and the heads 2 are formed by upsetting the ends of the rods or in any other approved manner, and the heads 2 and enlarged portions 2^{a} preferably will be machined or turned to the required sizes, although in some cases smooth forging the rods may be found to be sufficient.

The couplings B are formed of a sleeve 3 having a cavity or recess 4 in each end, the opposite faces of the septum 5 in the sleeves forming the bottoms of the recesses which engage with the end faces of the heads on the rods. A hole 6 may be provided in the septum, as shown in Figure 4, when considered desirable or necessary. The outer end of each recess 4 has internal screw-threads adapted to receive the externally

threaded glands 7 by which the ends of the sucker rods A are secured within the recesses of the sleeves B.

In the construction shown in Figures 2 and 3, the enlarged ends or heads 2 of the sucker rods are of a diameter slightly smaller than that of the recesses 4 in which the heads are seated when assembled into a string. In the construction of Figures 4 and 5 the enlarged ends or heads of the rods are made of a diameter to neatly fit within the unthreaded portion of the recess 4.

The sleeves B, as shown, have parallel flattened faces 8 on opposite sides of their longitudinal axis to provide means for engagement by a wrench so as to prevent turning of the sleeves when the glands 7 are being screwed into or out of the recesses 4. The sleeves may be of polygonal cross-section when desired, instead of circular, as shown.

In the construction shown in Figures 2 and 3, the glands 7 are split axially into two halves and in such case the contacting faces 7^a of the half glands are provided with registering dowel pins 9 and holes 10 adapted to maintain the two parts of each gland in alinement and prevent movement of one relative to the other, when inserting or removing the glands.

In the construction shown in Figures 4 and 5, the sleeve is the same as in that of Figure 2, except that the hole 6 is omitted from the septum 5, and the glands 7 are the same except that they are made of one piece and are not split lengthwise.

When the glands 7 of Figures 4 and 5 are used, two of them will be properly positioned on the cylindrical rods A before the second one of the two upset ends or heads 2 is formed on the rod. The glands and the enlarged portions 2^a of the sucker rods are machined to a diameter to form a sliding fit on the enlarged ends 2^a of the rods A so as to enable the glands to turn, when being screwed into the sleeves, into holding engagement with the enlarged rod end or head 2 positioned within the recess 6 in the sleeve B.

The inner end, or end of the glands which engages with the head 2 of the rods A has a cylindrical portion 11 of a diameter to neatly fit into the unthreaded portion of the recesses 4 in the sleeves B, as is shown in Figures 2 and 4. Hexagonal outer ends 12 on the glands provide means for using a wrench when screwing the glands into and out of the sleeves, and the glands of Figure 2, for a purpose to be described, preferably are split lengthwise.

The enlarged body portions 2^a on the ends of the rods A will be made of a diameter to have a relatively close sliding fit within the glands 7 so that when the glands are tightly screwed into place in the sleeves or couplings B the ends of the rods will be rigidly held within the recesses 4 of the couplings and any flexure of the rods in an assembled string will be at points in the length of each rod between the opposite taper portions 2^b of each rod.

In order to increase the physical properties of the string of sucker rods, each rod A will be carefully heat treated after the enlarged portions 2^a and heads 2 have been formed thereon. In carrying out this heat treatment, the rods will be uniformly heated to above the upper critical point, and then quenched. After the quenching operation the rods will again be heated to below the critical point, and then allowed to cool slowly in air. By heat treating carbon steel sucker rods in this way, the tensile strength of the rods is materially increased, and the heads 2 on their ends are hardened so as to prevent the undesirable enlargement caused by the heads gradually becoming upset by long continued use, a result heretofore obtained with such rods as made heretofore. The physical properties of the rods may be further increased by using an alloy steel instead of a carbon steel in making the rods.

In heat treating rods with integrally formed glands 7 positioned thereon, some difficulty may be experienced in making the heat treatment of the rod uniform, because of the influence of the body of metal forming the gland in the heating and cooling steps of the heat treatment. For that reason the split glands 7 of Figure 2 preferably will be used, as such glands are not positioned on the rods until the rods are being assembled into a string. The split glands also are peculiarly well adapted for use in making repairs to a broken string of sucker rods.

In forming a string the rods A are successively lowered into the well casing. The upper end of the uppermost rod within the well is then connected by a coupling B to the lowermost end of a rod A suspended above the well. This rod is then lowered into the well and another rod is connected by its lower end to the upper end of the rod now uppermost within the well. These operations are continued until the required number of rods are connected into a string, the assembled part of the string gradually increasing in length until the string extends downwardly within the well for the desired distance.

In removing the string from the well, as is found necessary from time to time, it is lifted until one or more of the rods A project above the upper end of the well casing. The projecting rod or rods is then unfastened from the string by unscrewing the glands in the coupling B, and laid to one side. These operations are then repeated until the entire string has been removed from the well.

The advantages of our invention will be apparent to those skilled in the art.

Modifications in the construction and arrangement of the parts may be made with-

out departing from our invention as defined in the claims. Various alloy steels may be employed as well as a plain carbon steel in making the rods and couplings. The rods may be made of tubes instead of solid bars, as shown. The cross-section of the rods may vary and the shape of the enlarged heads on the rods may be changed and other modifications may be made within the scope of the appended claims.

We claim:

1. The method of making sucker rods which consists in enlarging each end of the rod by upsetting, forging integral heads on the upset ends and then heat treating the so-formed rod to thereby increase its physical properties.

2. The method of making sucker rods which consists in enlarging the ends of a rod by upsetting, enlarging the upset ends to form heads thereon, positioning a pair of hollow screw threaded glands on the rod before forming at least one of said heads, and then heat treating the rod to thereby increase its physical properties.

3. The method of making sucker rods which consists in enlarging each end of the rod by upsetting, forging integral heads on the upset ends, then uniformly heating said rods above the upper critical point, and quenching said rods, then heating said rods to a point below the critical point, and allowing said rods to cool slowly in air.

In testimony whereof, we have hereunto set our hands.

FRANK E. ANDERSON.
FOREST H. THORPE.