Nov. 6, 1928. 1,690,399

L. P. BURGESS

METHOD OF AND MEANS FOR ALIGNING PUMP LINERS WITHIN PUMP SHELLS

Filed Oct. 2, 1926

Fig. 1.

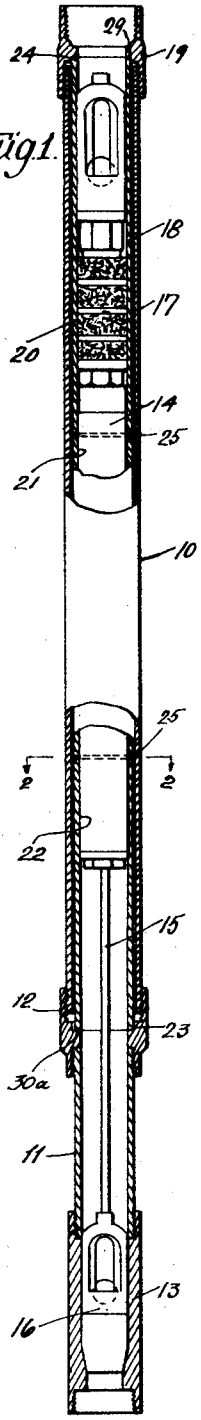


Fig. 4.

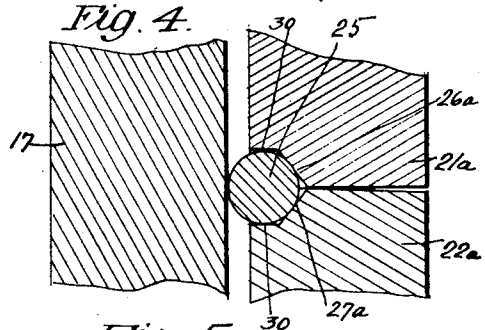


Fig. 3.

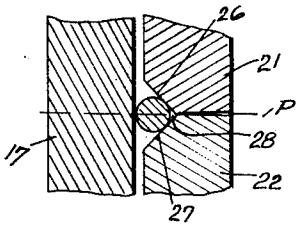


Fig. 5.

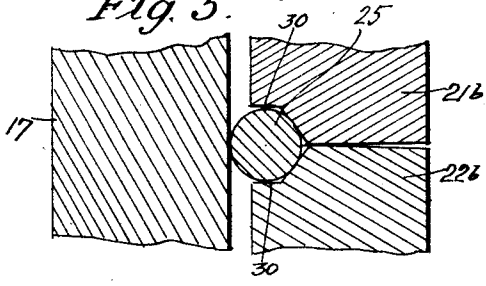


Fig. 2.

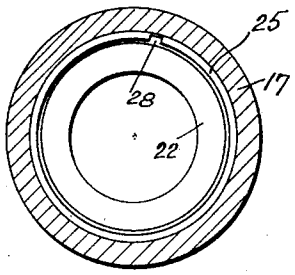


Fig 6

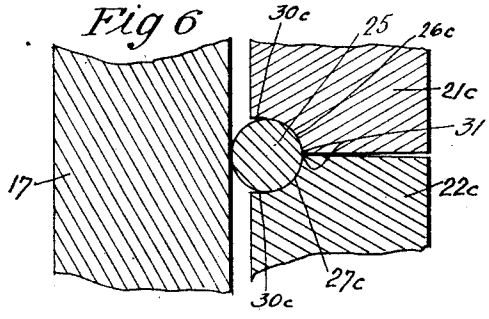


Fig. 8.

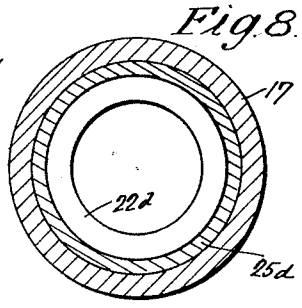
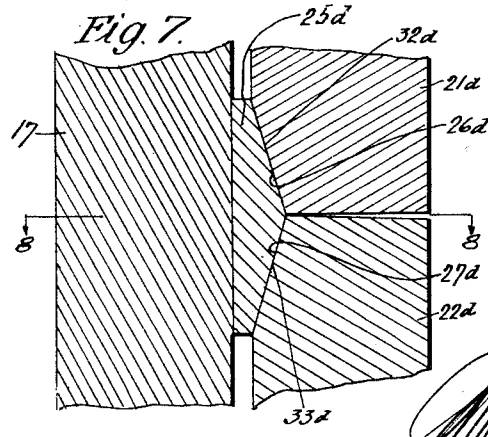


Fig. 7.



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UNITED STATES PATENT OFFICE.

LYSLE P. BURGESS, OF LOS ANGELES, CALIFORNIA, ASSIGNOR, BY MESNE ASSIGNMENTS, TO L. P. BURGESS, D. DANIELS, J. O. CLUTTER, AS TRUSTEES.

METHOD OF AND MEANS FOR ALIGNING PUMP LINERS WITHIN PUMP SHELLS.

Application filed October 2, 1926. Serial No. 139,198.

This invention has to do with a method of and means for axially aligning pipe sections within an outer pipe or shell from which said sections are to be annularly spaced.

While the invention, considered in its broader aspects, is applicable to any structure where the above conditions are to be brought about, it is particularly useful in connection with the alignment of liner sections within pump shells, and I will therefore describe such a particular embodiment. This is not to be construed, however, as limiting the invention to this particular embodiment, as the illustrative example given here will make it apparent to those skilled in the art how the invention may be applied to similar structures with advantage.

Pump barrels for deep well pumps are ordinarily made up of an outer tube or shell several feet in length within which are supported a series of liners held together in axial alignment under longitudinal compression. The reasons for making up the liners of a plurality of sections rather than of a single length of pipe are well known to those skilled in the art, and therefore need not be dwelt upon here. It will suffice to say that the liner sections are necessarily very accurately machined and ground to take the pump plunger, and it is, of course, vitally important to the efficient operation and life of the pump, both as regards the liner and plunger, that the liner sections by very accurately lined up so the joints between them are perfectly smooth.

Heretofore, many different methods and means for lining up the liner sections have been utilized, all of them requiring equipment and knowledge only found in pump factories. As a consequence, when the liners become unduly worn it has been necessary that the entire barrel be sent from the field to the factory for liner replacement, it having been found entirely unfeasible to ship the liners to the field and have the field operators attempt to insert and line up the sections.

Therefore, it is among the principal objects of my invention to provide a method and means whereby the lining up of the liner sections may be accomplished with ease and accuracy without the use of special equipment or knowledge. It therefore becomes possible to ship to or keep available at the field a supply of new liner sections, so when occasion for replacement occurs, the field operators may re-line the barrels easily and quickly. The economic advantage of this is obvious, for it saves time, labor, and expense of shipping as well as materially reducing the length of time a well must be shut down during replacement operations.

The plunger construction which permits of such easy, rapid assembly or liner replacement, embodies centering or aligning bushings used in connection with the plunger and liner sections, said bushings being located at the opposed ends of adjacent sections. These bushings are adapted to have outer peripheral engagement with the barrel and inner peripheral engagement with the adjacent sections at points near their opposed ends. With the bushing of given cross sectional characteristics used in connection with sections of given outside diameters, it will be seen that this contact of the sections and shell with opposite sides of the bushing serves accurately to center said sections within the shell and hence align them axially with one another.

As a means for guiding the sections into axial alignment, the opposed ends of the sections are shaped to have angular engagement with said bushings during relative movement therebetween. This angularity is brought about by cutting the opposed ends of the sections oppositely and preferably equally so, when the sections are in end engagement, there is formed a groove or channel about the liner at the joining point of the sections, said groove preferably being symmetrical, one-half on one section and the other half on the adjacent section. The bushing is adapted to seat within this groove and engage the inner peripheral wall of the shell. This seating of the bushing within the annular groove prevents the bushing from shifting longitudinally with respect to the sections after the latter are in place, the bushing thereby being adapted to maintain the sections in alignment.

The method of assembling the barrel is to

drop one of the sections through the shell bore from one end, then insert the bushing within that end of the bore, and follow by thrusting a second section against the bushing until the latter seats against the first section, the angular engagement of the section ends with the bushing moving said sections into axial alignment.

During the movement of the bushing longitudinally through the outer pipe, it is highly desirable that it be maintained in a plane substantially parallel to a cross section plane of the pipe, for obvious reasons, and while this result may be obtained by giving sufficient longitudinal extent to the area of engagement between bushing and pipe, the preferred form of my bushing is a wire ring of circular cross-section, the surface of contact between the ring and shell being of such little longitudinal extent that it is liable to "cock" or swing out of square. Therefore, where the bushing is of such characteristics that it has a tendency to swing out of square, with respect to the pipe bore, it is preferable that means be provided on the sections for preventing such undesired movement. This means I provide in the nature of shoulders preferably square cut which extend from the angular shoulders heretofore described, and partially defining the annular groove formed at the ends of adjacent sections.

It has heretofore been stated that the bushing is in peripheral engagement with the inner wall of the shell, and as a means for securing such engagement without calling for accurate machining of the bushing, I preferably utilize a radially expansible bushing, that is, one which may be initially radially contracted to allow its easy entry to the pipe bore and then springs outwardly into engagement with the pipe. Wire of circular cross section which has sufficient uniformity of cross-section to insure centering may be purchased on the open market, and thus forms an ideal material for the purpose. This spring wire may be readily cut to length and given ring-like formation, becoming a split-spring ring preferably so formed that it must be initially contracted radially for entry to the pipe bore and then, by reason of its inherent resiliency, spring into contact with the pipe. However, while the preferred bushing is thus in the form of spring wire of circular cross-section and is split rather than continuous, these characteristics are not essential to the bushing, considering the invention in its broader aspects, and only such claims as are drawn specifically to those features are to be considered as limited thereto.

Further objects and features of novelty of the invention will be made apparent in the following detailed specification, reference being had to the accompanying drawings in which:

Fig. 1 is a longitudinal section partly in elevation of a pump barrel embodying my invention;

Fig. 2 is an enlarged section on line 2—2 of Fig. 1;

Fig. 3 is an enlarged fragmentary section showing one form of joint between liner sections;

Fig. 4 is a view similar to Fig. 3, but showing the ends of the sections having slightly different characteristics;

Fig. 5 is a slight variation of Fig. 4;

Fig. 6 shows another variational form of the liner section ends;

Fig. 7 shows a variational form of bushing; and

Fig. 8 is a reduced section on line 8—8 of Fig. 7.

In Fig. 1 I have illustrated a pump, made up of a barrel generally indicated at 10, an extension nipple 11 connected to said barrel by lower collar 12, a standing valve shoe 13 on nipple 11, a plunger 14 adapted to be reciprocated through the valve and connected by Garbutt rod 15 to standing valve 16. Barrel 10 is made up of outer shell 17 and a sectional liner generally indicated at 18, the liner sections being annularly spaced from shell 17 and being held under longitudinal compression by collars 12 and 19 at opposite ends of the shell.

I have here shown liner 18 as made up of the three sections 20, 21, and 22, though it will be understood that, depending upon the length of the barrel, said liner may be made up of only two or more than three sections, and that the formation hereinafter ascribed to the opposed ends of two particular sections, are to be considered as typical or characteristic of the opposed ends of all the sections.

Collar 12 is provided with a counter-bore 23 which nicely takes the lower end of the lowermost liner section, establishing the position of said end in concentricity with the inner wall of shell 17. Likewise, collar 19 is formed with a counter-bore 24 adapted to take the upper end of uppermost section 20 and support said end in axial alignment with the lower end of section 22. It then only remains to axially align the opposed ends of the sections, and it is with this alignment that my invention is concerned.

I employ between the opposed ends of adjacent liners a centering or aligning bushing 25, and preferably, though not necessarily, said bushing is made in the form of a split ring of wire, said wire being of circular cross section of predetermined diameter and having resilient characteristics. The ring is so formed initially that its inherent tendency is to expand radially to a larger diameter than the bore of shell 17. Preferably, though not necessarily, the material of which bushing 25 is made is somewhat softer than of which the liner sections are made, so, if and when the bushing is considerably compressed between

the opposed ends of the liners, the bushing will be deformed to a greater extent than will be the sections.

The opposed ends of the liner sections are so shaped that they have angular engagement with the bushing when moved longitudinally with respect thereto, it following that with the bushing of predetermined cross-section and with the section diameters of given dimension at the points where they engage the bushing when the two sections are in end contact, said sections will be in axial alignment by virture of their equal annular spacing from the outer pipe.

The angular engagement of the sections with the bushing serves to guide said sections into axial alignment should they be disaligned during their approaching movement, and it will be understood this condition of dis-alignment ordinarily exists.

In Fig. 3 I have shown the opposed ends of liners 21, 22 cut angularly and oppositely equal as at 26 and 27, so, when said liners are in end engagement, shoulders 26 and 27 define an annular groove 28 of V-cross section about the liner, as a whole, the bushing 25 being seated within this V-groove and thus engaging shoulders 26 and 27 at points equally spaced from the cross section plane P, and in outer peripheral engagement with the inner wall of pipe 17.

In assembling the barrel, lowermost section 22 is first lowered into place, that is, with its lower end in centering counter-bore 23, the upper end of said section being free to move somewhat radially. Spring bushing 25 is then compressed sufficiently to allow its entry into the upper end of the bore of shell 17. Section 21 is then inserted through said one end and pushed downwardly, forcing before it the bushing 25. The resilient characteristic of bushing 25 expands it into frictional engagement with pipe 17 and holds it from dropping freely through said pipe, tending also, of course, to prevent it from swinging or becoming cocked within said pipe. As section 21 is thus pushed against the bushing, shoulder 26 engages the bushing angularly, this engagement tending to center section 21 within pipe 17. The angle of shoulder 26 is such that, with known surface characteristics of bushing 25 and said shoulder, and with a given tendency of bushing 25 to retard frictionally its bodily advance, said bushing will not be wedged between shoulder 26 and pipet 17 in a manner to prevent bodily advance of said bushing. While my invention is not limited to the provision of shoulders of any particular angle, I have found that angles between 35° and 40° are particularly effective in causing readiness of centering and having a minor tendency towards wedging the bushing against movement bodily. Of course, shoulders 27 and 26 are preferably of substantially equal degree.

As bushing 25 is forced by section 21 into engagement with shoulder 27 of section 22, the angular engagement of said shoulder with the bushing moves the upper end of said section bodily into coaxial relation with shell 17 and hence with section 21, this axial alignment of the two sections being the desideratum. The remaining bushings and sections are then assembled on top section 21 in the manner described above, the section ends coming into alignment as they are brought into end contact (Fig. 3), and cap 19 is finally screwed on the shell with the upper end of section 18 in centering counterbore 24. Cap 19 is screwed down to bring its downwardly facing annular shoulder 29 against the upper end of section 20, and, since the lower end of section 22 engages the upwardly, facing annular shoulder 30^a on collar 12, continued downward, threaded movement of collar 19 places the liner sections under longitudinal compression and thus clamps them in axial alignment.

While wire 25 is ordinarily chosen of such diameter that with sections having a given angular cut the bushing will be engaged with said shoulders and pipe 17 at such a time as the adjacent sections come into abutment, if there be any divergence from this particular cross-section dimension of the bushing it will be a slight increase, so the three point contact is assured. However, the diameter of the wire is never so great but that when the sections are placed under longitudinal compression the section ends come preferably into firm contact, the material of which the bushing is made preferably being somewhat softer than that of the sections, so if the wire be over-size, the compressive force thus acting against it will cause its slight deformation.

In utilizing a bushing of circular cross-section, such as round wire, even though said bushing be expansible and frictionally engage pipe 17, there may be some tendency for said bushing to cant or cock as it passes through the pipe, an obviously undesirable condition. To prevent such canting, I preferably provide the opposed ends of the sections with substantially square-cut shoulders 30 (Fig. 4), said shoulders leading to the angular shoulders 26^a, 27^a. It will be seen that as section 21^a is thrust downwardly against the ring or bushing, its shoulder 30 engages the upper side of the ring and tends to hold it in a plane substantially parallel to a cross section plane of the section and pipe. The opposed shoulders 30 of adjacent sections may be so spaced from the ends of their particular sections that when said sections are in end contact said shoulders just engage bushing 25, as shown in Fig. 4, it being essential, however, that said shoulders do not engage effectually until it is assured that the bushing is in aligning association with the sections and the shell.

Ordinarily, however, shoulders 30 are so spaced from the ends of their sections that there will be longitudinal clearance (Fig. 5) between bushing 25 and shoulders 30, or that the shoulders will just touch the bushings when the sections are in end contact and therefore in axial alignment, it thus being insured that said shoulders do not interfere with proper alignment.

In Fig. 6 I have shown a slight modification wherein shoulders 26^c and 27^c are arcuate or of varying angularity and merge into the substantially square cut shoulders 30^c. With this formation, it will be seen that should the sections be out of alignment, the leading edges 31 thereof have angular engagement with bushing 25, said shoulders thus acting in the same manner as shoulders 26, 27 in moving the sections into alignment and in maintaining them in alignment, it being understood, of course, that shoulders 26^c, 27^c are given predetermined degrees of curvature.

In Figs. 7 and 8 I have shown a variation wherein bushing 25^d is in the form of a collar of appreciable longitudinal extent and having oppositely inclining internal conical faces 32^d and 33^d adapted to engage angular shoulders 26^d and 27^d on the liner sections. It will be seen that the bushing shown here serves to guide the sections into and hold them in axial alignment, but that due to its extent of longitudinal engagement with pipe 17 no means is necessary to hold it from canting. This form of bushing is not ordinarily as desirable, however, as that shown in the other figures, since, to insure that it have peripheral engagement with pipe 17 at the same time that the angular shoulders are in full contact, said bushing must be quite accurately machined, whereas, in the case of the spring wire bushing it is merely necessary to cut the wire to length and give it ring formation without any particular degree of accuracy.

It will be evident from the above that proper alignment of the sections necessarily calls for the use of an outer shell having a substantially true bore. While the shell bore may be machined or ground true by any well known expedient, it is found in actual practice that pipe of the general nature of seamless, drawn tubing is sufficiently true, as it comes from the market, to insure proper alignment. Should there be slight inaccuracies of the bore at points where the bushing engages the tubing, these need not necessarily result in causing decentering of the bushings to the full extent of the inaccuracies, since the bushings preferably are capable of being unevenly deformed to an extent sufficient to compensate at least for a degree of inaccuracy.

It will be understood the drawings and description are to be considred merely as illustrative of and not restrictive on the broader claims appended hereto, for various changes in design, structure and arrangement may be made without departing from the spirit and scope of said claims.

I claim:

1. In combination with an outer pipe and a plurality of inner pipe-sections adapted to be arranged end to end within the outer pipe and to be annularly spaced therefrom, the opposed ends of adjacent sections being cut angularly and oppositely to provide an annular groove of V-cross-section between the ends of said adjacent sections, and an aligning bushing seated within said groove and engaging the inner wall of the outer pipe.

2. In combination with an outer pipe and a plurality of inner pipe-sections adapted to be arranged end to end within the outer pipe and to be annularly spaced therefrom, the opposed ends of adjacent sections being cut angularly and oppositely to provide an annular groove of V-cross-section between the ends of said adjacent sections, and a radially expansible ring seated within said groove and engaging the inner wall of the outer pipe.

3. In combination with an outer pipe and a plurality of inner pipe-sections adapted to be arranged end to end within the outer pipe and to be annularly spaced therefrom, the opposed ends of adjacent sections being cut angularly and oppositely to provide an annular groove of V-cross-section between the ends of said adjacent sections, and an aligning bushing of circular cross-section seated within said groove and engaging the inner wall of the outer pipe.

4. In combination with an outer pipe and a plurality of inner pipe-sections adapted to be arranged end to end within the outer pipe and to be annularly spaced therefrom, the opposed ends of adjacent sections being cut angularly and oppositely to provide an annular groove of V-cross-section between the ends of said adjacent sections, and a radially expansible ring of circular cross-section seated within said groove and engaging the inner wall of the outer pipe.

5. In combination with an outer pipe and a plurality of inner pipe-sections adapted to be arranged end to end within the outer pipe and to be annularly spaced therefrom, the opposed ends of adjacent sections being cut angularly and oppositely to provide an annular groove of V-cross-section between the ends of said adjacent sections, an aligning bushing of circular cross-section seated within said groove and engaging the inner wall of the outer pipe, and opposed, substantially square-cut shoulders on the ends of said adjacent sections and extending between the external peripheral faces thereof towards said angular cuts.

6. In combination with an outer pipe and a plurality of inner pipe-sections adapted to be

arranged end to end within the outer pipe and to be annularly spaced therefrom, the opposed ends of adjacent sections being cut angularly and oppositely to provide an annular groove between the ends of said adjacent sections, the groove-defining walls of said adjacent sections being in opposition, and an aligning bushing within said groove, said bushing engaging the inner wall of the outer pipe and said opposed groove-defining walls.

In witness that I claim the foregoing I have hereunto subscribed my name this 10th day of September, 1926.

LYSLE P. BURGESS.