

Sept. 22, 1936.

R. E. KITCHING

2,054,859

DRILL STEM

Filed Aug. 27, 1934

2 Sheets-Sheet 1

FIG. 1.

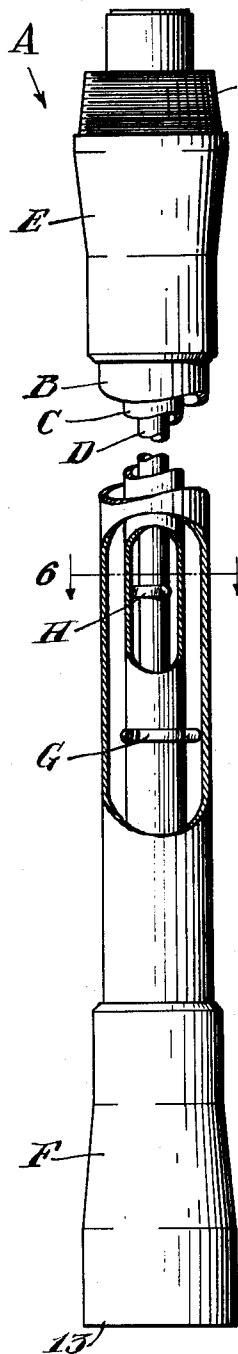


FIG. 2.

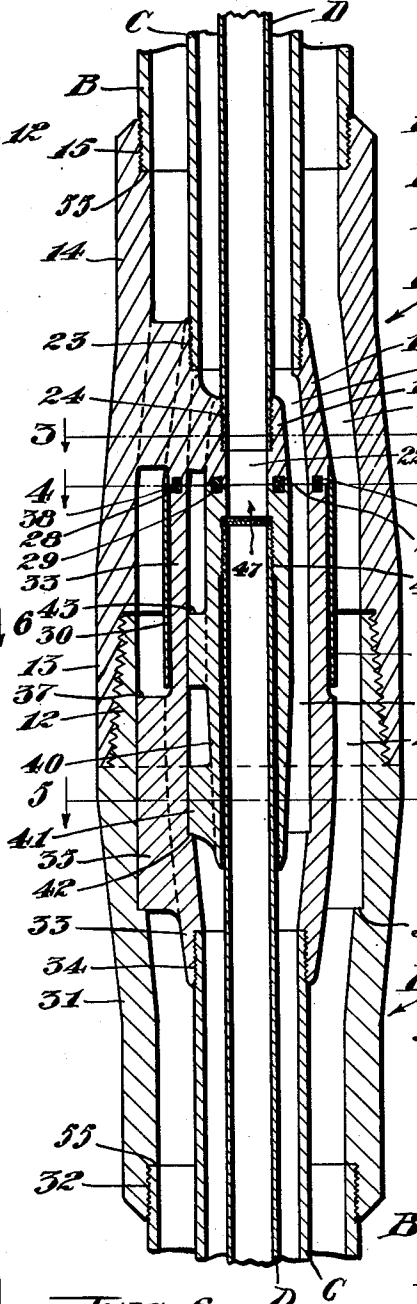


FIG. 3.

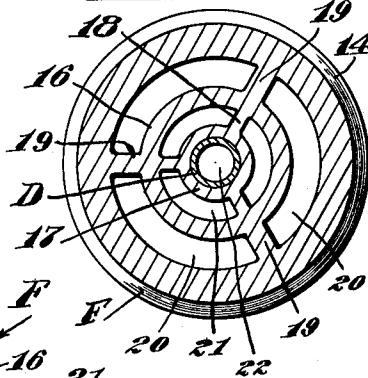


FIG. 4.

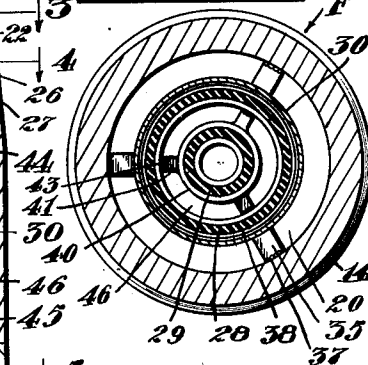


FIG. 5.

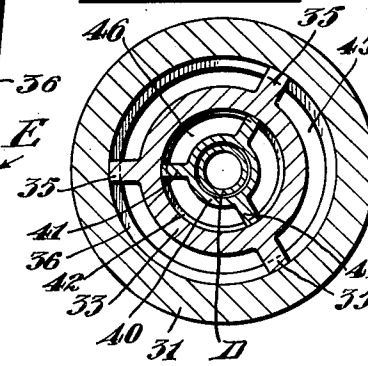
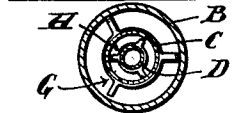


FIG. 6.



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Fig. 7.

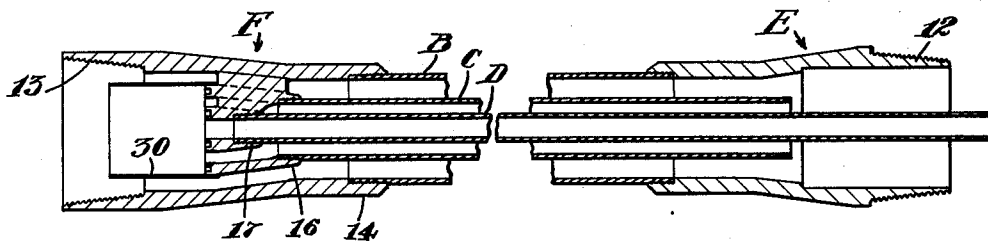


FIG. 8.

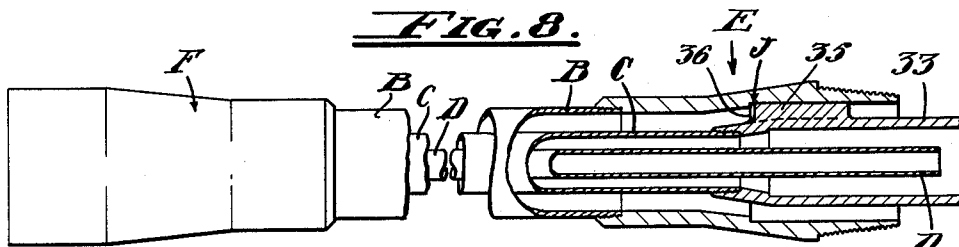


FIG. 9.

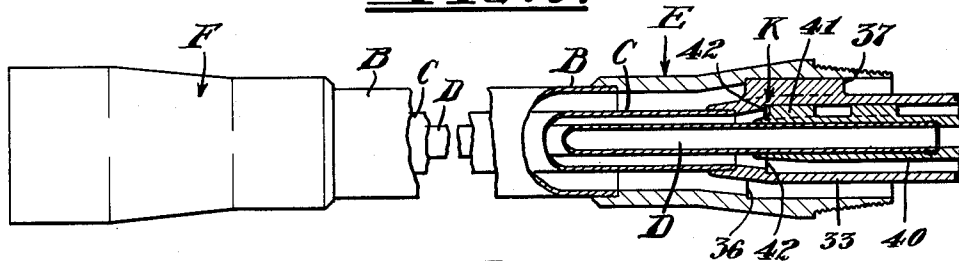


FIG. 10.

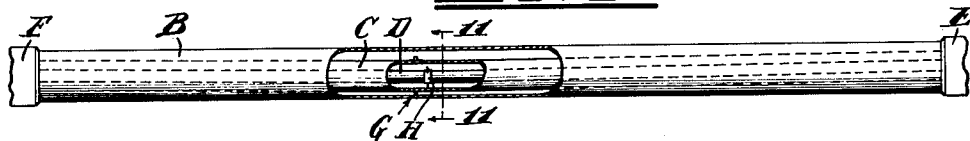
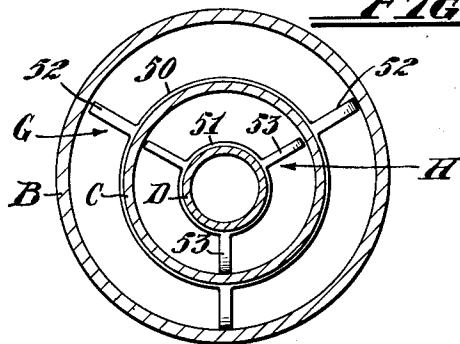


FIG. 11.



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UNITED STATES PATENT OFFICE

2,054,859

DRILL STEM

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Application August 27, 1934, Serial No. 741,564

11 Claims. (Cl. 285—22)

This invention relates to a drill stem of the character adapted to be employed in connection with a pneumatic well drill of the character set forth in an application Serial No. 741,563 of August 27, 1934, now Patent No. 2,033,527 of March 10, 1936, filed coincidentally herewith and wherein both liquid and air are delivered through the drill stem.

An object of the invention is to provide a drill stem of the above character embodying a plurality of conduits consisting of at least three telescoped lengths of tubing, the outermost of which serves as a conduit for liquid and the innermost of which serves as a conduit for air under pressure and the intermediate of which serves as a conduit for exhaust air, and in which the tubing is so assembled and arranged in forming drill stem sections that the several tubes or conduits of one section may be united with the complementary tubes or conduits of another section by a single connection.

Another object is to provide a drill stem of the above character in which interconnection and disconnection of adjacent section may be rapidly effected with the facility of a single tube assembly by a screw threaded connection of the character known as a tool-joint.

Another object is to provide an arrangement whereby on disconnecting adjacent depending sections liquid draining from the upper section may be prevented from being directed into the air conduits of the lower section.

A further object is to provide a means and method for assembling a plurality of telescoped conduits into a drill stem section in such fashion that when the sections are assembled in a depending drill stem the longitudinal strains occasioned by the load of the drill stem and a drill thereon will be carried in most part by the outer tubing so as to relieve the inner lines of tubing of such strains and whereby stretch of the drill stem will occur in the outer tubing independent at least in most part to the inner tubing so as to minimize accidental loosening of the inner tubing from their connections and consequent leakage of the air conduit.

With the foregoing objects in view together with such other objects and advantages as may subsequently appear the invention resides in the parts and in the combination, construction and arrangement of parts and also in the steps and features, hereinafter described and illustrated in the accompanying drawings in which:

Fig. 1 is a view in elevation of a section of drill stem with portions broken away and showing the parts in vertical section:

Fig. 2 is a view in vertical section of a fragmentary portion of the drill stem showing the manner of interconnecting adjacent drill stem sections:

Fig. 3 is a view in horizontal section taken on the line 3—3 of Fig. 2:

Fig. 4 is a detail in horizontal section taken on the line 4—4 of Fig. 2:

Fig. 5 is a detail in horizontal section taken on the line 5—5 of Fig. 2:

Fig. 6 is a detail in horizontal section taken on the line 6—6 of Fig. 1:

Figs. 7, 8 and 9 are diagrams illustrating the manner of assembling the elements of a drill stem section.

Fig. 10 is a view in elevation with portions broken away of a length of the drill stem section showing the manner in which a slack is formed in the inner tube sections:

Fig. 11 is a view in section taken on the line 11—11 of Fig. 10.

Referring to the drawings more specifically A indicates generally a length of drill stem section which embodies a plurality of telescoped tubes here shown as comprising an outer tube B, an intermediate tube C, and an inner tube D, which tubes are collectively carried by tool-joint members E and F constituting the upper and lower end portions of the drill stem section; the tool-joint member E embodying an externally threaded tapered outer end portion 12 and the tool-joint member F having an internally threaded outer end portion 13 adapted to receive the threaded end portion 12 of a tool-joint E on an adjacent drill stem section to effect interconnection between adjacent lengths of drill stem sections.

The tool-joint member F is in the form of a tube the walls 14 of which are circular in cross section and the threaded outer end portion 13 of which is enlarged relative to its inner end portion which latter is formed with internal threads 15 and is screwed into engagement with the outer tube B as particularly shown in Fig. 2.

Formed intermediate the ends of the member F interiorly thereof is a pair of spaced concentric annular walls 16 and 17 connected together by radial webs 18 with the wall 16 spaced concentrically from the inner periphery of the wall 14 and connected to the latter by radial webs 19 as particularly shown in Fig. 3. By this arrangement passages 20 are provided between the walls 14 and 16, passages 21 are provided between the walls 16 and 17, and a passage 22 is encircled by the wall 17.

The lower end of the intermediate tube C is screwed into engagement with the wall 16 as indicated at 23 in Fig. 2 with its interior communicating with the passages 21, and the lower end of the tube D is screwed into engagement with the wall 17 as indicated at 24 in Fig. 2 with the interior of the tube communicating with the passage 22. In this fashion a series of passages are provided through the tool-joint member F

which passages are connected independently with the interiors of the tubes B, C and D respectively.

The lower margins of the walls 16 and 17 terminate on a corresponding plane and are formed respectively with annular channels 26 and 27 on their end faces for the reception of packing rings 28 and 29; the plane of termination of the walls 16 and 17 being spaced inwardly from the threaded end portion 13 of the member F so as to be recessed relative to the outer end of the latter.

Mounted on the lower end of the wall 16 and projecting downwardly therefrom is a thin cylindrical sleeve 30 the lower end of which terminates adjacent to but spaced inwardly from the lower or outer end of the member F and which sleeve forms a continuation of the passage 20 beyond the lower ends of the passages 21 and 22.

The tool-joint member E embodies a tubular wall 31 the upper end of which terminates in the tapered threaded portion 12 and the lower end of which is formed with screw threads 32 which are screwed into engagement with the upper end of the outer tube B. The upper end of the intermediate tube C extends into the lower end portion of the member E and is screwed into engagement with the lower end of a cylinder 33, as indicated at 34, which cylinder is spaced concentric from the inner periphery of the upper portion of the member E; the cylinder 33 being formed on its exterior with a series of longitudinally extending radial webs 35 which seat on a shoulder 36 formed on the interior of the wall 31 and are affixed to the latter by a weld joint 37 as particularly shown in Fig. 2. The upper end portion of the cylinder 33 projects above the upper end of the member E and is adapted to abut against the lower end of the wall 16 of the member F and is formed with an annular groove 38 in which is mounted the packing ring 28. The cylinder 33 is adapted to extend into the sleeve 30 in telescoped relation thereto.

Arranged interiorly of the cylinder 33 concentric therewith is a cylinder 40 having longitudinally extending webs 41 on the exterior thereof certain of which seat on an annular shoulder 42 formed on the interior of the cylinder 33, and which cylinder 40 is affixed to the cylinder 33 by a weld joint connection as particularly shown in Fig. 2.

The upper end of the inner tube D extends interiorly of the cylinder 40 and is screwed into engagement with the latter as indicated at 44. The upper end of the cylinder 40 terminates on a plane with the upper end of the cylinder 33 and carries the packing ring 29.

By the provision of the cylinders 33 and 40 passages 45, 46 and 47 are formed in continuation of the tubes B, C and D respectively through the tool-joint member E, which passages will on interconnecting the tool-joint members E and F communicate with the passages 20, 21 and 22 in the latter communicating with the lower ends of the tubes B, C and D respectively of an adjacent drill stem section.

An important feature of the invention resides in the manner of assembling the tubes and connecting their end portions to the tool-joint members E and F whereby a slack will be formed in the inner tubes C and D so as to permit the stretching of the outer tube B without imposing excessive longitudinal strains on the inner tubes and whereby the load of a string of the drill

stem sections will be carried entirely by the outer tube B.

This assemblage is effected as follows: Lengths of the tubes B, C and D are telescoped relatively to each other with spacers G interposed between the tubes B and C, and spacers H interposed between tubes C and D, the inner tube D being formed of such length so arranged that its ends will protrude from the ends of the intermediate tube C, and the latter being formed of a greater length than the outer tube B and arranged so that its ends will protrude from the ends of the latter. One end of the inner tube D is then screwed into engagement with the annular wall 17 of the tool-joint member F whereupon the tube C is screwed into engagement with the wall 16 and thereafter the tube B is screwed into engagement with the wall 14. This operation is preferably effected with the parts extended horizontally as shown in Fig. 7.

After having thus assembled the tubes B, C and D on the tool-joint member F the outer ends of the tubes B, C and D will extend in off-set relation to each other as shown in Fig. 7. The tool-joint member E is then screwed into engagement with the outer end of the tube B, but may obviously be attached to the latter coincident with or prior to the attachment therewith of the tool-joint member F. On thus completing the assemblage as shown in Fig. 7 the cylinder 33 is inserted in the outer end of the member F and is screwed into engagement with the intermediate tube C, being advanced on the threaded other end of the latter until the inner ends of the webs 35 are spaced a short distance from the shoulder 36 to form a gap J between the webs and shoulder as shown in Fig. 8. The webs 35 are then forced to their seated position on the shoulder 36 by subjecting the cylinder 33 and its connected tube C to a longitudinal compression strain relative to the outer tube B thus placing a bend or slack in the tube C whereupon the cylinder 33 is affixed to the member F by the weld joint 37 as shown in Fig. 9, which weld is applied to the outer end of the webs 35. On this being accomplished the cylinder 40 is inserted in the cylinder 33 and screwed into engagement with the outer end of the tube C until the inner ends of certain of the webs 41 are brought to a position close to but spaced from the shoulder 42 to provide a gap K between the webs 41 and shoulder 42 as shown in Fig. 9. The connected cylinder 40 and tube C are then subjected to longitudinal compression strains to force the webs 41 against the shoulder 42 thus placing a slack in the tube C whereupon the weld joint 43 is applied to fasten the cylinder 40 to the cylinder 33.

The spacers G and H as here shown embody ring portions 50 and 51 respectively which encircle the tubes C and D and are affixed thereto, as by shrinking the rings thereon or by spot welding, so as to hold the rings against longitudinal movement on the tubes; the rings 50 and 51 being formed with a series of radial projections 52 and 53 respectively which are designed to abut at their outer ends against the inner peripheries of the tubes B and C.

In order to permit sagging of the tubes C and D the projections 52 and 53 on the spacers disposed intermediate the ends of the tubes are of such length as to permit the tubes C and D being positioned off-center or out of concentric relation to each other and to the outer tubes B as particularly shown in Fig. 11.

In the operation of the invention a string of the

drill stem sections A are assembled in the manner commonly employed in the assembling of drill stems in deep well drilling operations; a section A being suspended vertically with the tool-joint member E uppermost and with the latter securely held against turning as by grips on a rotatable table whereupon a section A to be attached thereto is suspended vertically with the tool-joint member F lowermost and is lowered so as to direct the sleeve 30 downwardly around the upwardly projecting end portion of the cylinder 33 and to bring the internally threaded lower end portion 13 of the upper section into engagement with the threaded upper end portion 12 of the lower section.

The tool-joint members E and F are then screwed into engagement with each other and in so doing the upper ends of the cylinders 33 and 40 of the member E are brought into abutting position against the lower ends of the walls 16 and 17 of the member F and compressing the packing rings 28 and 29 to effectively seal the joints in which they are interposed. Drill stems of any suitable length are thus formed and lowered into well bores.

By providing the slack in the inner tubes C and D any material stretch of the drill stem will occur in the outer drill stem tube B thus relieving the inner tubes C and D of longitudinal or tensile strains apart from such as are occasioned by the weight of the individual lengths of the inner tubes C and D.

In order to avoid any possibility of the tubing B being advanced on its threads relative to the tool-joints during this operation the ends of the tubes B are screwed into the tool-joint members E and F to abut tightly against shoulders 55 therein as particularly shown in Fig. 2.

In operation a liquid is forced downwardly through the drill stem B for purposes of the usual mud circulation, the liquid passing through the passages 20 and 45 of the assembled tool-joint members F and E respectively.

Compressed air is directed downwardly through the inner tube D, which air flows through the passages 22 and 47 in the connected tool-joint members and after effecting operation of pneumatic actuated drill mechanism carried by the drill stem is exhaust to atmosphere through the intermediate tube C; the exhaust air flowing upwardly around the inner tube D and flowing through the passages 46 and 21 of the tool-joint members E and F.

The drill stem thus formed is rotated in the usual manner through the medium of a rotating table equipped with grips engaging the outer tubes B in the manner common in rotary well drill operations.

In a drill stem of this character it is essential that no liquid be admitted to the interior of the tubes C and D and it therefore becomes important when disconnecting adjacent dependent lengths of the drill stem sections to prevent liquid draining from the upper section into the air conduits of the lower section. This is accomplished by the shield afforded by the sleeve 30 which is of a length exceeding the length of the threaded connection between the portions 12 and 13 of the tool-joint, so that when the connections are unscrewed to a point where the lower end of the member F is just clear of the upper end of the member E the sleeve 30 will still encircle the upper end portion of the cylinder 33 whereby liquid draining from the pipe B of the upper section will either be delivered into the pipe

E of the adjacent section or overflow outwardly from the upper end of the tool-joint member E. This arrangement permits liquid being blown from the upper section by directing forced currents of air downwardly therethrough, and thus permits thorough cleansing of the upper section before lifting it clear of the lower section.

While I have shown and described a specific embodiment of my invention I do not limit myself to the exact details of construction and arrangement shown but may employ such changes therein as occasion may require coming within the spirit and scope of the appended claims.

I claim:

1. In a drill stem, a series of at least three telescoped tubes, a pair of tool joint members between which said tubes extend and to which said tubes are connected, each of said members having separated passages leading therethrough communicating with the interiors of said tubes.

2. In a drill stem, liquid conveying tube, a pair of telescoped air conveying tubes extending longitudinally through said liquid conveying tube, a pair of tool joint members to which said tubes are connected, each of said members having passages leading longitudinally therethrough communicating with the interiors of said tubes, said telescoped air conveying tubes being formed with a longitudinal slack to permit stretching of the liquid conveying tube relative thereof and independent thereof.

3. A drill stem comprising a liquid conveying tube, a pair of telescoped air conveying tubes extending longitudinally through said liquid conveying tube, a tool joint member affixed to each end of said liquid conveying tube, connections between the ends of said air conveying tubes and said tool joint members, an externally threaded end portion on one of said tool joint members, and an internally threaded end portion on the other of each of said tool joint members, said tool joint members having separated passages leading therethrough communicating with the interiors of said tubes.

4. In a drill stem, a series of at least three telescoped tubes, a tool joint member connected to the corresponding ends of said tubes having separated passages intermediate its ends communicating with the interiors of said tubes and formed with an internally threaded outer end portion, a sleeve arranged interiorly of said threaded end portion and spaced from the inner periphery thereof, a second tool joint member connected to the other ends of said tubes having separated passages leading therethrough communicating with the interiors of said tubes and having an externally threaded outer end portion, and a cylindrical end projection on said last named tool joint member of a diameter slightly less than that of the sleeve in the other tool joint member.

5. In a drill stem, a pair of telescoped air conducting tubes, a liquid conducting tube surrounding said air conducting tubes, a tubular tool joint member having one end affixed to said liquid conveying tube, a pair of spaced annular walls intermediate the ends of said tool joint member affixed to corresponding ends of said air conveying tubes, said annular walls being arranged with their outer ends recessed relative to the outer end of said member, a second tool joint member affixed to the other end of said liquid conveying tube, and a pair of telescoped cylinders extending into the outer end of said last named tool joint member and affixed thereto to which said air conveying tubes are attached, said cylinders projecting be-

yond the outer end of said last named tool joint member.

6. In a drill stem, a pair of tool joint members having screw threaded interconnection with each other, a liquid conveying tube leading from each of said members, a pair of telescoped air conveying tubes connected to each of said members and leading through said liquid containing tubes, each of said tool joint members being formed with passages affording a communication between the liquid conveying tubes and also having separated passages affording a communication between the air conveying tubes.

7. In a drill stem, a pair of tool joint members screwed into engagement with each other, liquid conveying tubes leading from the outer ends of said members, a pair of spaced annular walls arranged intermediate the ends of one of said members, a pair of telescoped cylinders arranged in the other of said members and affixed thereto, said cylinders having their outer ends abutting against the ends of said annular walls, packing rings interposed between said cylinders and annular walls, a pair of telescoped air conveying tubes connected to said pair of annular walls, and a pair of air conducting tubes connecting with said pair of cylinders.

8. A drill stem section comprising a tubular tool joint member having an internally threaded outer end portion, a pair of spaced annular walls formed intermediate the ends of said member, a pair of telescoped air conveying tubes having screw threaded connections at their corresponding ends with said annular walls, a liquid conveying tube surrounding said pair of tubes having screw engagement with the inner end of said member, a second tubular tool joint member having screw engagement with the outer end of said liquid conveying tube formed with an externally threaded end portion, a pair of telescoped cylinders arranged in the outer end of said last named member and affixed thereto and having screw engagement with said air conveying tubes, and means rigidly connecting said cylinders together.

9. A drill stem section comprising a tubular tool joint member having an internally threaded outer end portion, a pair of spaced annular walls formed intermediate the ends of said member, a pair of telescoped air conveying tubes having

screw threaded connections at their corresponding ends with said annular walls, a liquid conveying tube surrounding said pair of tubes having screw engagement with the inner end of said member, a second tubular tool joint member having screw engagement with the outer end of said liquid conveying tube formed with an externally threaded end portion, a pair of telescoped cylinders arranged in the outer end of said last named member having screw engagement with said air conveying tubes, and means for fastening said cylinders relative to said last named tool joint member with a slack in said air conducting tubes.

10. In a drill stem, a coupling member, having a series of at least three concentrically arranged passages leading therethrough, telescoped tubes connected to said member and leading therefrom there being a tube communicating with each of said passages, a second coupling member connected to the outer end of the outermost tube, a plurality of telescoped cylinders in the last named coupling member to which the outer ends of the inner tubes are attached, spacing webs on the outermost cylinder abutting the inner periphery of said last named coupling member and connected thereto, and spacing webs on the innermost cylinder contacting the inner periphery of its surrounding cylinder and affixed thereto.

11. In a drill stem, a coupling member having a series of at least three concentrically arranged passages leading therethrough, telescoped tubes connected to said member and leading therefrom there being a tube communicating with each of said passages, a second coupling member connected to the outer end of the outermost tube, a plurality of telescoped cylinders in the last named coupling member to which the outer ends of the inner tubes are attached, spacing webs on the outermost cylinder abutting the inner periphery of said last named coupling member and connected thereto, and spacing webs on the innermost cylinder contacting the inner periphery of its surrounding cylinder and affixed thereto, internal shoulders on said last named coupling member and the outermost cylinder against which certain of said webs abut; said inner tubes being formed with a slack relative to the outer tube.

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