Jan. 16, 1951 J. L. JOHNSTON 2,538,690

COMBINATION SAFETY JOINT, BUMPER SUB, AND EQUALIZING VALVE

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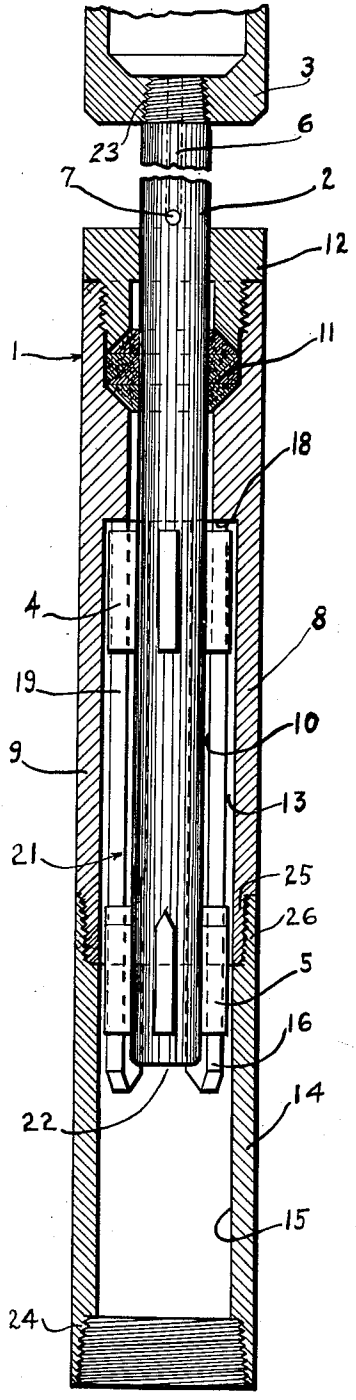


Fig. 1.

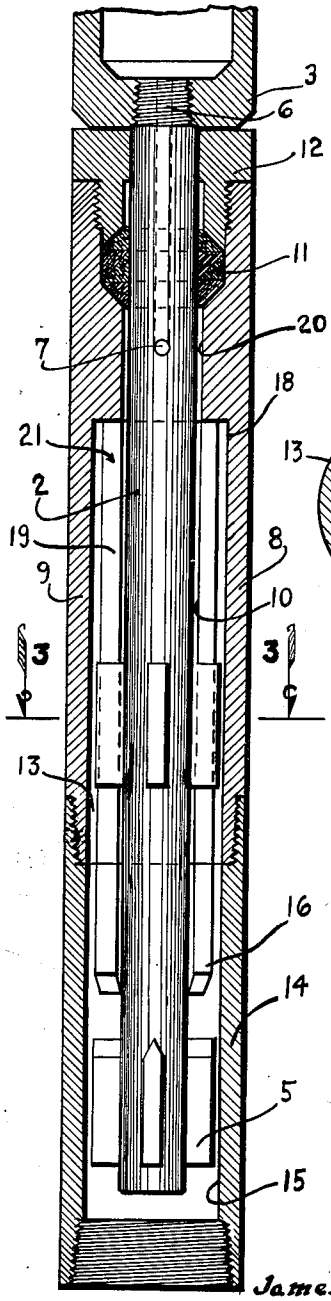


Fig. 2.

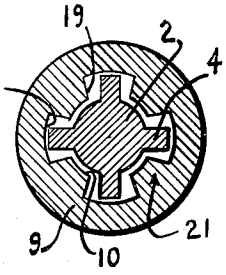


Fig. 3.

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COMBINATION SAFETY JOINT, BUMPER SUB, AND EQUALIZING VALVE

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4 Claims. (Cl. 255—27)

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This invention relates to a combination safety joint, jar or bumper sub, and equalizing valve for use in wells, especially in fishing tools, testing assemblies, and in other drill pipe assemblies in oil wells.

It is an object of this invention to provide a sub having a splined mandrel operable in a body comprising a tube and a lower section in which an upper set of splines serve to bump upwardly against the tube, and also serves to unthread the tube from the lower section so that the upper section of the sub and the pipe above it may be withdrawn from the well.

It is a further object of this invention to provide a joint of the class described in which a lower set of splines may ride in grooves in both tube and sub so as to rotate both these elements together when the drill string is rotated.

It is still a further object of this invention to provide a sub having a passage in the upper portion of the mandrel connecting with the periphery thereof so that the fluid pressures within, above, and around the body of the sub, and within elements above the sub and attached thereto, may be equalized.

It is also an object of this invention to provide a sub of the class described in which the body of the sub has a packing seal and gland in the upper end thereof through which the mandrel may slide.

It is also an object of this invention to provide a sub of the class described which is provided with an equalizing valve adapted to divert drilling fluid being pumped down the drill string outwardly into the well bore above the body of the sub to soften and to force formations which may be restricting the drill string.

Other and further objects of the invention will be readily apparent when the following description is considered in connection with the accompanying drawings wherein:

Fig. 1 is a sectional elevation showing the sub in jarring and/or rotating position.

Fig. 2 is a sectional elevation showing the sub in position so that the body may be unthreaded from the lower section.

Fig. 3 is a horizontal plan of the sub showing splines and grooves thereof taken along line 3—3 of Fig. 2.

The sub 1 comprises a mandrel 2 and the body 8. The mandrel 2 is adapted at the upper end 23 to be threaded into a drill string 3 and the body 8 at the lower end 24 is adapted to receive a fishing tool, a drill collar, or the lower end of a drill string, not shown. The upper end of the

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mandrel has an axial hole 6 therein which is connected to the periphery of the mandrel by means of a radial hole 7. The body 8 of the sub comprises a tube 9 which has a counterbored section 10 in one end thereof and which is counterbored, countersunk and threaded at the other end thereof to receive a packing seal 11 and a gland 12. The counterbored section 10 has grooves 13 cut along the whole length of the counterbore. The tube 9 is adapted at 25 to be threaded into the upper end 26 of the lower section 14 of the sub body 8.

The lower section 14 has a bore 15 therethrough and also has internal splines or lands 16 in the upper end thereof. In assembly the tube 9 and the lower section 14 are shown as being left-hand threaded to a tolerance designed to assure that when the elements are inter-threaded to full tightness the internal splines 16 of the lower section 14 are in alignment with the lands 21 in the tube 9, and the interspaces or grooves 22 between the internal splines or lands 16 are in alignment with the grooves or interspaces 13 of the tube 9.

It is pointed out that in construction the internal splines 16 can as well be lands formed by grooving the lower section 14, or that the lands 21 of the tube 9 can as well be splines formed or welded therein.

In operation in a well it often happens that the lower section of a drill pipe, to which the lower section 14 of the sub body 8 is connected, may become stuck in the bore of the well and it then becomes necessary to loosen this stuck section of pipe so that drilling may continue or in order that the pipe may be pulled out of the well. When this occurs an upward strain is exerted at the top of the well so that the upper set of splines 4 on the mandrel are brought into jarring contact with the shoulder 18 at the termination of the counterbore 10 in the tube 9. When the mandrel 2 is in this position with relation to the body 8, the lower set of splines 5 on the mandrel 2 are partially in the grooves 13 of the tube 9 and are partially in the interspaces 22 between the internal splines 16 of the lower section 14.

When in this position, rotation from the top of the well will force the lower set of splines 5 against the internal splines 16 and the walls 19 of the lands 21 so that both the tube 9 and the lower section 14 will rotate together, consequently rotation from the top of the well will be imparted to the sub body 8 and to the pipe or fishing tool section which is connected below.

It should be noticed that while jarring is be-

ing carried out to loosen stuck pipe or while the string or fishing tool is being rotated, then the hole 7 is above the top of the gland 12 and in this position the fluid pressure in the sealed off portion of the well below the point of sticking is different than the pressures above this point. At this time, however, the pressures in the portion of the well above the point of sticking and the pressures inside the drill pipe above the gland 12 can be equalized with the pressures outside thereof by means of the passage created by the hole 7 and the hole 6.

In order to better carry out the jarring operation and for other purposes, it is often found necessary to equalize the pressures which exist in the sealed off portion of the well and within the sub body 8 and the pressures existing within the drill pipe or in any tool above the sub body. This is accomplished by slackening off from the top of the well to lower the mandrel inside of the body 8 until the hole 7 is in position below the seal 11 and in communication with the open annular space 20. In this manner the passage formed by the holes 7 and 6 will permit such equalization of pressures.

It often happens that the jarring operation will not loosen the pipe that is stuck in the well and in this case is becomes expedient to withdraw from the well the elements above the sub and as much of the sub as can be recovered. This is accomplished by slackening off from the top of the well until the set of splines 5 are in position in the bore 15 of the lower section 14 and are out of contact with the internal splines 16. Then the drill string to which the mandrel 2 is attached may be rotated from the top of the well in a direction to unthread the tube 9 from the lower section 14 so that the only part of the sub which has to be left in the well is the lower section thereof.

Although the use of the device described is best adapted for connection above a fishing tool assembly or for connection in a testing or drill string, this is not the only application of this device and it can be inserted in any type of assembly where it may be necessary to equalize pressures within the body 8 and within the elements thereabove or wherein it might be necessary to equalize pressures externally of elements above the mandrel with those pressures internally thereof. The device also has a general application for use in any assembly wherein it may be necessary to jar upwardly the elements which may be attached below the lower section 14.

It should be pointed out that this invention has especial usage in a testing assembly similar to that shown in United States Patents No. 1,842,270 and 1,901,813 to M. O. Johnston in which the device is adaptable to be inserted below the tester, not shown, and above the packer, not shown, which seals off the rat hole of a well bore from the bore thereabove.

In such an application, the positioning of the hole 7 of the mandrel 2 in communication with the annular space 20 within the tube 9 permits intercommunication between the rat hole fluids, the fluids in the testing bomb and via the testing bomb with the fluids in the well bore above the rat hole with the result that pressures are equalized between these areas. And it is particularly beneficial to use this invention when the equalization of rat hole pressures with pressures thereabove results in releasing the expanded packer which seals off the rat hole.

It is also pointed out that the equalizing feature of this invention can have an application in cases where operations are conducted in well casings, as well as in uncased well bores.

The device has further application wherever it might be necessary to separate the body 8 and the elements thereabove from the lower section 14 in cases where the jarring operation may have been conducted to either a successful or unsuccessful termination.

A feature of this device also permits the pumping of fluid down the bore of the drill string 3 through the holes 6 and 7 of the mandrel, with the mandrel in the position shown in Fig. 1, and out into the well bore to soften and to force any formations which may be restricting any part of the drill string assembly.

This invention contemplates broadly the provision of a combination jarring device, safety or releasing joint, and equalizing valve and has a general application in all fields wherein the general structures described herein are serviceable.

What is claimed is:

1. In a combination safety joint, bumper and equalizing valve sub adapted for connection at its upper end to a drill string, the combination of a mandrel, upper and lower sets of splines on said mandrel therebelow, a body comprising an upper section having a grooved counterbore extending upwardly from its lower end and a partially internally splined lower section into which said upper section is threaded, said mandrel being upwardly slidable in said body to bring the upper set of splines between said grooves into jarring contact with the counterbore shoulder, said lower set of splines being spaced from said upper set to engage with the splines of said lower section as well as said grooves when said upper set is in upper portion adjacent said shoulder so that rotation of said drill string and mandrel may rotate both sections, said mandrel being downwardly slidable to position said lower set in the unsplined portion of said lower section so that the mandrel may be rotated to unthread the sections, and an axial passage in said mandrel from the upper end thereof connecting with a radial passage to the mandrel exterior so that fluid pressures surrounding said drill string may be equalized with pressures within said drill string when said mandrel is in upper position; said radial passage communicating with said body interior when said mandrel is in lower position so that pressures in said drill string and said body may be equalized.

2. In a combination safety joint, bumper, and equalizing valve sub the combination of a mandrel adapted at its upper end for connection to a drill string, upper and lower sets of splines on said mandrel therebelow, a body comprising an upwardly counterbored, grooved upper section and a partially splined lower section, said mandrel being slidable in said body to bring said upper set of splines into jarring impact with the counterbore shoulder and to position said lower set of splines in said upper section and in said lower section splines so that the rotation of said mandrel may rotate both sections, and a passage in said mandrel between said drill string interior and said mandrel exterior below said connection to communicate with said body interior when said mandrel is in lowered position so that fluid pressures within said drill string and within said body may be equalized.

3. A sub for wells comprising a mandrel adapted at its upper end for connection to drill

string and operable within an upwardly counterbored body, spline means constituting hammer means on said mandrel within said body to be brought in jarring contact with the shoulder of said counterbore when said string and said mandrel are raised, and a passage in said mandrel extending axially from said upper end and outwardly to said mandrel exterior therebelow so that fluid pressures within said drill string and externally thereof may be equalized when said mandrel is raised, and so that pressures within said drill string and said body interior may be equalized when said mandrel is lowered.

4. A sub for wells comprising a mandrel operable in an upwardly counterbored body, spline means constituting hammer means on said mandrel within said body to be brought in jarring contact with the shoulder of said counterbore, the top of said mandrel extending above said body and being adapted for connection to a drill string, and a passage in said mandrel extending from said drill string interior to said mandrel exterior

below said connection for connecting said drill string with the surrounding well bore so that fluids may be pumped down said string and through said passage to soften and force restrictive well bore formations.

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REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
1,842,270	Johnston	Jan. 19, 1932
1,889,283	Francis	Nov. 29, 1932
1,901,813	Johnston	Mar. 14, 1933
2,026,931	Burns et al.	Jan. 7, 1936
2,049,289	Burns et al.	July 28, 1936
2,049,290	Burns et al.	July 28, 1936
2,214,238	Stovall	Sept. 10, 1940
2,302,856	Hamon	Nov. 24, 1942
2,321,215	Lee	June 8, 1943