May 12, 1931. W. H. MAXWELL 1,804,700

JARRING TOOL

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Fig. 1.

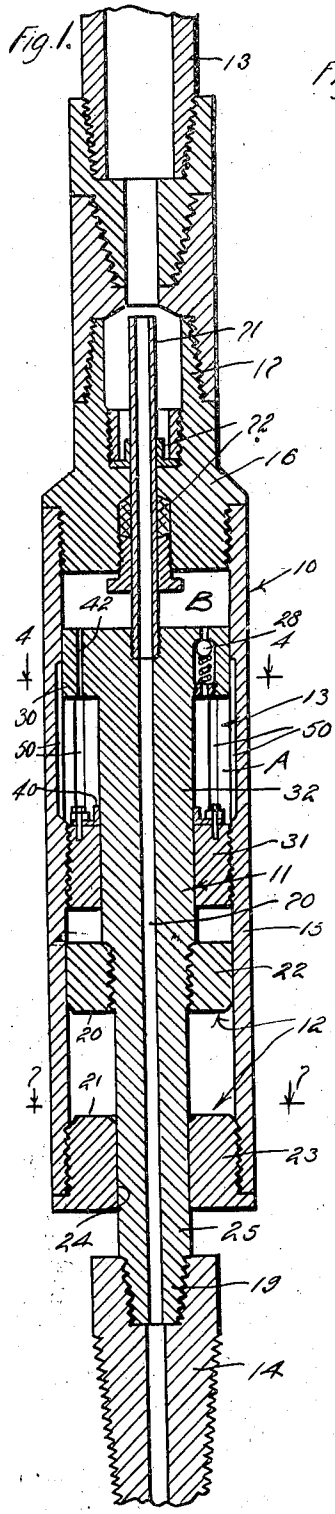


Fig. 2.

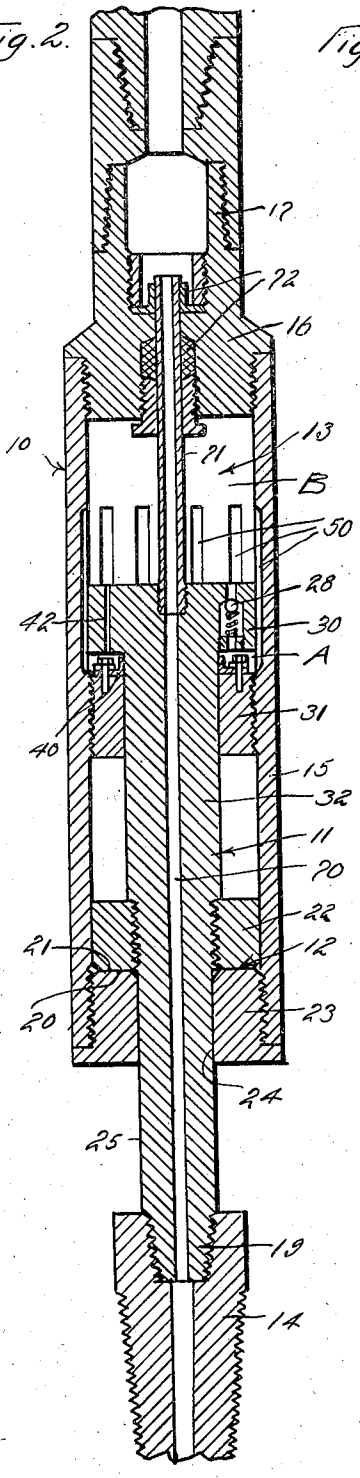
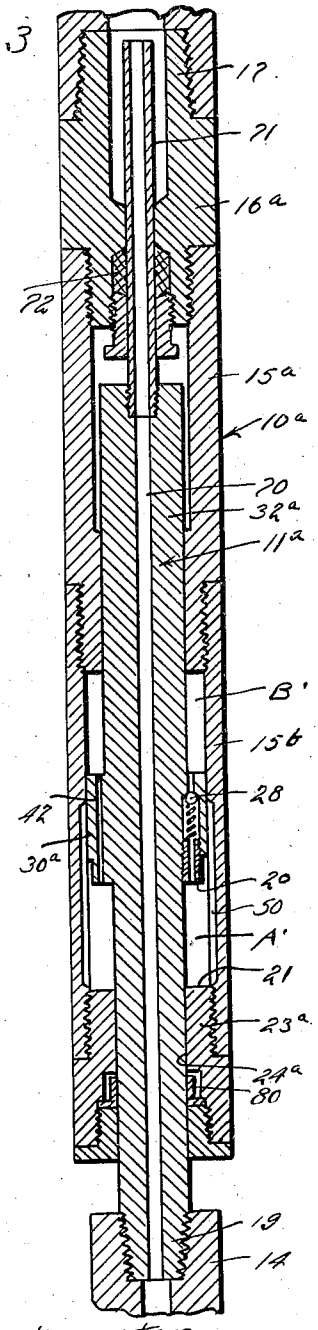


Fig. 3



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Fig. 4.

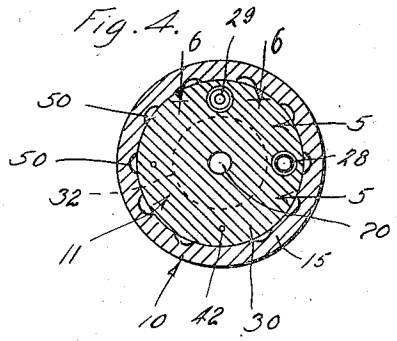


Fig. 5.

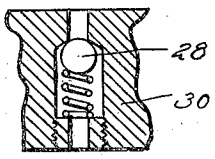


Fig. 6.

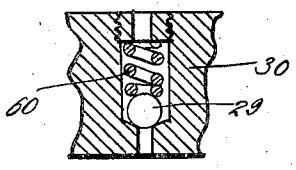
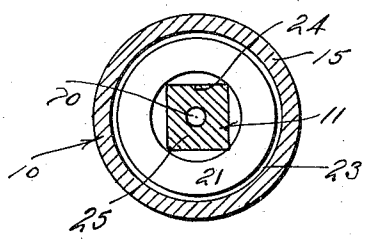


Fig. 7.



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Patented May 12, 1931 1,804,700

UNITED STATES PATENT OFFICE

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JARRING TOOL

Application filed April 5, 1927. Serial No. 181,060.

This invention has to do with a tool for use in wells and has particular reference to a jarring tool particularly useful in connection with rotary drilling tools.

Jarring tools of various kinds have, from time to time, been proposed and developed for use in connection with well drilling tools and, particularly, for use in connection with tools employed to fish parts from wells.

Jars or jarring tools are employed or desirable under various conditions during the drilling of wells. For example, when a part is lost in a well, it is often desirable, and in some cases necessary, to jar it before it can be removed. For practical use, a jarring tool should satisfy various conditions; for instance, it should be strong in construction, reliable in operation, capable of being operated repeatedly under severe conditions, simple and quick to operate, and effective in giving a heavy jar or hammer action.

It is a general object of my invention to provide a jar for use in or in connection with well drilling tools operable to jar repeatedly without failure or excessive wear.

It is another object of my invention to provide a jar of the character mentioned in which liquid is employed as a medium whereby the jarring action is controlled.

It is another object of the invention to provide a jar of the type mentioned which can be fully operated by longitudinal movement of the operating pipe or line to which the tool is connected.

Another object of my invention is to provide a jar of the type mentioned in which the operating or wear receiving parts are protected and fully lubricated.

It is a further object of this invention to provide a hydraulic jar in which the liquid employed is separated from the liquid present in the well and is used over and over again upon repeated operation of the tool.

It is another object of my invention to provide a jarring tool of the character mentioned in which the jarring parts, which are subject to wear, are removed from the liquid handling parts so that repeated operation of the tool does not impair its efficiency.

It is a further object of this invention to provide a hydraulic jar with a pressure relief whereby the parts are protected against being subjected to excessive pressures.

It is another object of my invention to provide various novel and improved details of construction for tools of the type mentioned.

The various objects and features of my invention will be best and more fully understood from the following detailed description of typical forms and applications of the invention, throughout which description reference is had to the accompanying drawings, in which:

Fig. 1 is a vertical or longitudinal detailed sectional view of a tool embodying my invention, showing it connected with typical well drilling tools; for instance, with a fishing tool and a string of drill pipe and showing the tool in position ready for operation;

Fig. 2 is a view similar to Fig. 1, showing the tool in operated position;

Fig. 3 is a view similar to Fig. 1, showing another form of construction;

Fig. 4 is a transverse, sectional view, taken as indicated by line 4—4 on Fig. 1;

Fig. 5 is an enlarged, detailed, sectional view of the return valve, being a view taken as indicated by line 5—5 on Fig. 4;

Fig. 6 is an enlarged, detailed, sectional view of the safety valve, being a view taken as indicated by line 6—6 on Fig. 4; and

Fig. 7 is a detailed, transverse, sectional view, taken as indicated by line 7—7 on Fig. 1.

The tool provided by my invention is capable of operation either with standard drilling apparatus or with rotary apparatus. The tool is particularly useful in connection with rotary drilling apparatus so, therefore, I will make particular reference to it as applied to this type of drilling equipment. It is to be understood that the principles provided by my invention may be incorporated in, or carried out with, various constructions and that the features and details of construction may be varied, depending upon the conditions or manner in which the tool is to be used. To illustrate the manner in which the invention may be modified or varied, I have set forth two different embodiments of the invention

suitable for use with rotary drilling equipment.

I will describe first the form of my invention illustrated in Figs. 1, 2, 4, 5, 6, and 7 of the drawings.

The tool provided by my invention includes, generally, two sections 10 and 11 slidably connected for relative longitudinal movement, means 12 for limiting the relative movement between the sections whereby one section can be jarred from the other, and hydraulic control means 13 for governing or controlling the relative movement between the sections. In the drawings, I have illustrated the tool in combination with typical rotary drilling equipment and have shown the tool arranged as a connection between adjacent parts of the drilling equipment. The tool may be used as a connection between the drilling parts; for instance, it may be arranged in a string of drill pipe, or the like; it may be arranged in or in connection with a tool to be operated by or from a drill pipe, or the like; or it may be arranged between the drill pipe and the tool to be operated thereby. In the drawings, I have shown the last mentioned arrangement; that is, I have shown the tool connected between a string of drill pipe 13 and a fishing tool 14. To facilitate an understanding of my invention, the drill pipe 13 may be considered an operating member while the fishing tool 14 may be considered a device to be operated by or from the operating member. When I refer to the tool provided by my invention as connected between the operating member and the device to be operated by the operating member, I mean to include any arrangement such as I have mentioned above and do not limit myself to a direct connection of the tool between the operating member 13 and the device 14, as illustrated in the drawings.

In the particular arrangement illustrated, the section 10 of the tool, which is the outer section, is adapted to be connected with the operating member 13 while the section 11, which is the inner section, is adapted to be connected with the device 14. The section 10 includes, generally, a cylindrical body 15 and a cap or top 16 at the upper end of the body 15 serving to close the upper end of the body and as a means of connecting the body with the operating member 13. In practice, the top 16 may be formed separate from the body 15, in which case it may be screwthreaded to the body in the manner shown in the drawings. I have shown the top provided with an upwardly extending screwthreaded part 17 to receive a usual tool joint connection on the lower end of the string of drill pipe. It is to be understood, of course, that any suitable arrangement may be provided for connecting the top of the section 10 with the operating member.

The section 11 in this particular arrangement is adapted to connect to or to carry the device 14 either directly or through any suitable construction that may be provided between them. The section 11 may be in the form of a mandrel or stem which extends upwardly into the body 15 of the section 11. In the drawings, I have illustrated the lower end of the section 11 provided with a screwthreaded part 19 by which the device 14 may be connected with the section 11. As above stated, I have shown the device 14 applied directly to the screw-threaded part 19.

The means 12, provided for limiting relative longitudinal movement between the sections whereby one of the sections can be jarred from the other, includes a shoulder 20 on the section 11 and a shoulder 21 on the section 10 to co-operate with the shoulder 20. In this particular case, the section 11 is adapted to be jarred in an upwardly direction from the section 10; therefore, the shoulder 20 on the section 11 faces downwardly while the shoulder 21 on the section 10 is below the shoulder 20 and faces upwardly. In the construction illustrated in the drawings, the shoulder 20 is formed on the lower side of a jar collar 22 on the section 11, while the shoulder 21 is formed on the upper side of a jar member 23 screwthreaded to the lower end of the body 15. I have shown the jar collar 22 screwthreaded onto the mandrel or section 11 and I have shown the jar member 23 screwthreaded into the lower end of the body 15. The construction just described may also be employed to guide the section 11 within the body 15 of the section 10, in which case the jar collar 22 may be made to slidably fit in the body 15 while the jar member 23 may be provided with an opening 24 which slidably passes the lower end portion 25 of the section 11. It is desirable that the sections 10 and 11 be held against relative rotation and, in practice, it is convenient to thus set the sections by making the lower portion 25 of the section 11 and the opening 24 in the jar member 23 such that the portion 25 cannot rotate in the jar member. For instance, in practice I may make the portion 25 polygonal, say substantially square, in cross sectional configuration and I may correspondingly shape the opening 24 in the jar member 23. With this arrangement, the sections of the tool are set against relative rotation, but are allowed free relative movement longitudinally.

The hydraulic control provided by my present invention operates to retard relative movement between the sections of the tool and then suddenly release them for free relative movement upon force being applied to the section 10 tending to move it upwardly to bring the jarring shoulders together. The retarding action which I obtain allows the operator to apply the desired amount of force

or strain to the member 10 before the sections operate to jar. The hydraulic control means includes primarily a compression chamber A normally filled with fluid such as oil, or the like, means for allowing the fluid to slowly escape from the chamber when operating strain is placed upon the tool, and means which allows the fluid to quickly escape from the chamber after the sections have been allowed to move to a predetermined position by the slow escape of fluid. In the preferred form of my invention, the hydraulic means includes, in addition to the elements just named, a receiving chamber B which receives the fluid from the chamber A when the device is being operated, a return valve 28 which allows the fluid to return from the receiving chamber B to the compression chamber A upon the tool being returned from the operating position to the normal position, and a safety valve 29 which prevents the tool being put under strain sufficient to cause dangerous pressure to develop in the compression chamber A. In the construction under consideration, the compression chamber A is formed between a head 30 provided on the upper end portion of the section 11 to slidably fit the body 15 and a partition or division member 31 which projects inwardly in the body 15 at a point below the head 30 and slidably passes the upper portion 32 of the section 11. With this arrangement, the receiving chamber B is formed between the top 16 of the section 10 and the head 30 of the section 11. In the preferred construction, the division member 31 is stationary or fixed in the body 15 and closely fits the upper portion 32 of the section 11. The fit between the division member 31 and portion 32 is made to allow sliding movement without allowing the passage of fluid. In practice, I provide packing means 40 between the member 31 and the portion 32 so that fluid cannot escape from the compression chamber between these parts. Further, the portion 32 is preferably round in cross sectional configuration.

The means provided for allowing fluid to slowly escape from the compression chamber A to the receiving chamber B when operating strain is put upon the parts may include one or more small openings 42 extending through the head 30 of the member 11 to connect the two chambers, or it may constitute sufficient looseness in the fit between the head 30 and the body 15 to allow the desired amount of fluid to escape past the head. It is desirable in practice, however, to make the head 30 fit the body 15 as closely as possible and to employ openings 42 for the slow escape of fluid.

The means provided for allowing the rapid escape of fluid from the chamber A to the chamber B after the sections have been operated slowly to a predetermined position through the slow escape of fluid, may include a by-pass means between the chambers A and B which is uncovered or is put in operation upon the parts reaching the said predetermined position. In the form of construction illustrated in the drawings, I have provided a plurality of by-pass openings 50 in the form of grooves extending longitudinally in the wall of the body 15. The grooves are formed in the body 15 at the compression chamber A and extend upwardly to a point in the wall 15 where they are below the upper end of the head 30 when the sections are in the normal unactuated position and remain below the upper end of the sections 30 until the sections reach the said predetermined position. In practice, I may provide a plurality of by-pass grooves 50 in the body 15 and make the grooves comparatively large so that the fluid can escape very quickly from the chamber A upon the grooves being opened to the chamber B.

The return valve 28 is provided between the chambers A and B; for instance, in the head 30, to allow free and quick return of the fluid from the chamber B to the chamber A as the parts of the tool are being returned to their normal unactuated position. The return valve 28 may be in the form of a check valve which allows free flow of fluid downwardly through the head 30, but checks flow upwardly through the head. The safety valve 29 is provided between the chambers A and B, preferably in the head 30, and is designed to allow fluid to escape from the chamber A to the chamber B when the pressure in the chamber A becomes excessive regardless of the relative positioning of the parts of the tool. The safety valve may be in the form of a ball valve normally held closed by a heavy spring 60 and adapted to open only when the pressure in the chamber A becomes sufficient to compress the spring.

It is desirable to construct the tool so that circulating fluid can be passed from the operating member 13 to the device 14 without interfering with the action or parts of the tool. To this end, an opening 70 may be provided longitudinally through the section 11 to connect with the circulating opening in the device 14 and a tubular extension 71 may be provided on the upper end of the section 11 to extend upwardly through the top 16 of the section 10 to receive circulating fluid through the operating member 13. Suitable packing means 72 may be provided between the top 16 and the extension 71 where the extension passes through the top to prevent circulating fluid from entering the receiving chamber B and to prevent the fluid in the tool from escaping from the chamber B.

From the foregoing description, it is believed that the operation of the tool will be

obvious. When it is desired to jar the device 14, or the part to which the device 14 may be connected, and up strain or pull is put upon the operating member 13, thus putting the fluid in the chamber A under compression, causing it to escape slowly from the chamber A to the chamber B through the openings 42. This escape of fluid from the chamber A allows the section 10 to move up slowly relative to the section 11 until the by-pass openings 50 reach and are uncovered by the upper end of the head 30, whereupon the fluid in the chamber A is allowed to quickly escape from the chamber A to the chamber B, thus allowing the section 10 to move freely up relative to the section 11 so that the jarring shoulder 21 engages the shoulder 20 with a jarring action. The tool can then be returned to its normal position by allowing the section 10 to lower relative to the section 11. During this return of the tool, the fluid returns from the chamber B to the chamber A through the by-pass openings 50 and the return valve 28. The tool is shown in the unactuated position in Fig. 1 and is shown actuated or in the jarring position in Fig. 2. At all times during the operation of the tool, circulation may be maintained between the operating member 13 and the device 14. It will be apparent that the operator may put any desired strain or up-pull on the member 13 and that the tool can be operated repeatedly and at frequent intervals. The operation of the tool is very simple as it involves mere vertical movement of the operating member 13 and the construction made possible by my invention is strong and durable. The tool involves no latches, catches or other devices subject to excessive wear or to damage through operation of the tool. It is also to be noted that the fluid employed in the tool to control the movement of the parts is confined in the tool separate from the fluid in the well and, therefore, can be clean fluid of the desired character and will remain clean, keeping the operating parts of the tool in good operating condition.

In the form of the invention illustrated in Fig. 3 of the drawings, I show a somewhat different arrangement of parts. In this case, the outer section 10*a* includes a body made in two sections 15*a* and 15*b*, and a top 16*a* applied to the upper end of the upper body section 15*a*. The inner section 11*a* extends into the section 10*a* through its lower end. The compression chamber A′ is formed between a head 30*a* on the inner section 11*a* and the jar member 23*a* applied to the lower end of the outer section 10*a*. In this case, the lower portion 25*a* of the inner section is round in cross section and slidably fits a round opening 24*a* in the jar member 23*a*. Suitable packing means 80 is provided between the portion 25*a* and the jar member 23*a*. In this case, the jar shoulder 20 on the section 11*a* is formed directly on the lower end of the head 30*a*, while the jar shoulder 21 on the section 10*a* is on the upper end of the jar member 23*a*. The receiving chamber B′ is formed between the upper side of the head 30*a* and a division part 31 in the section 10*a* which slidably fits the upper portion 32*a* of the inner section 11*a*. In this case, the upper portion 32*a* of the inner section is made substantially square in cross section, and the opening in the division part 31 is made to correspond to the section 32*a*. This provides against relative rotation between the sections 10*a* and 11*a*. The openings 42, return valve 28 and safety valve 29 may be provided in the head 30*a* of the section 11*a*, the same as they are provided in the head 30 in the form of the invention above described. It will be obvious that this form of the invention is substantially the same in operation as that above described.

Two forms of the invention have been set forth merely to illustrate the fact that the invention can be carried out with various arrangements and details of construction. In view of the fact that the invention is thus capable of modification and variation, I do not wish to limit myself to the particular details set forth, but wish to reserve to myself any changes or variations that may appear to those skilled in the art or fall within the scope of the following claims.

Having described my invention, I claim:

1. A well tool of the character described including two sections having co-operating parts forming a closed compression chamber and a closed receiving chamber, means for admitting fluid freely from the receiving chamber to the compression chamber, and means for freely passing fluid from the compression chamber after the fluid in the compression chamber has operated to retard movement between the sections, there being a fluid circulation opening through the tool.

2. A well tool of the character described including two sections having openings through them to pass fluid through the tool and having co-operating parts forming a compression chamber and a receiving chamber, the chambers being independent of the openings, a check valve for admitting fluid freely from the receiving chamber to the compression chamber, and means for passing fluid freely from the compression chamber after the fluid in the compression chamber has operated to retard movement between the sections.

3. A well tool of the character described including, two sections having openings through them to pass fluid through the tool and having cooperating parts forming a closed compression chamber and a closed receiving chamber, the said chambers being independent of the said openings, the sections being related for relative longitudinal movement, and means for controlling rela-

tive movement of the sections including, means for passing fluid slowly from the compression chamber to the receiving chamber upon a tensile strain being exerted on the sections, and means for passing fluid freely from the compression chamber to the receiving chamber upon the sections reaching a predetermined relative position to release the sections for free relative movement, said last-mentioned means including openings in one of the sections to communicate with both chambers upon the sections reaching said position.

In witness that I claim the foregoing I have hereunto subscribed my name this 28th day of March, 1927.

WILLIAM H. MAXWELL.