Nov. 17, 1953 D. M. LINNEY 2,659,576

COMBINATION JAR AND EQUALIZER

Filed Dec. 19, 1950 2 Sheets-Sheet 1

Fig. 1A

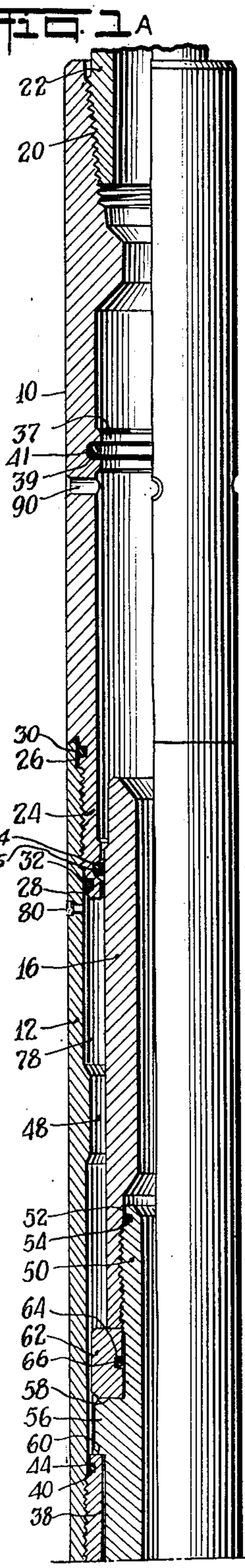

Fig. 1B

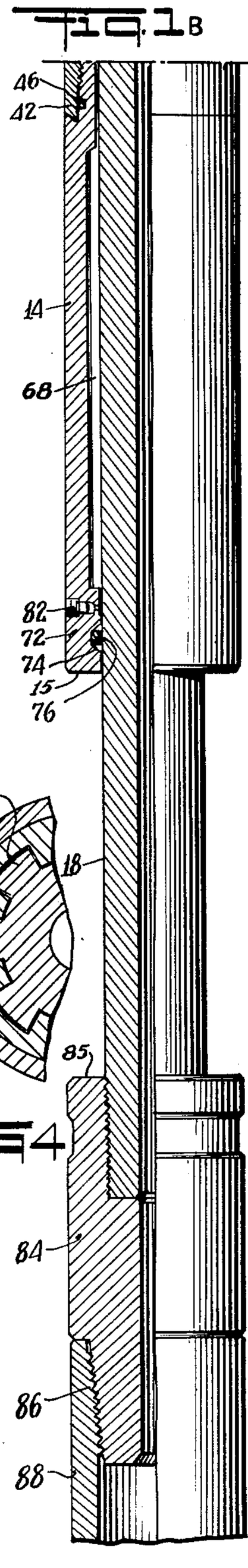

Fig. 4

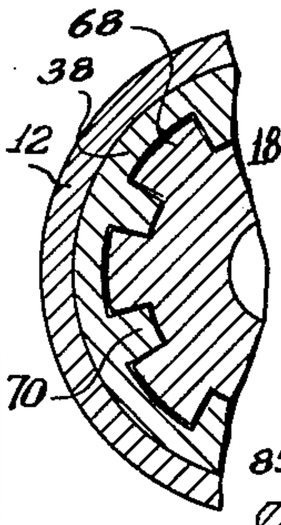

Fig. 2A

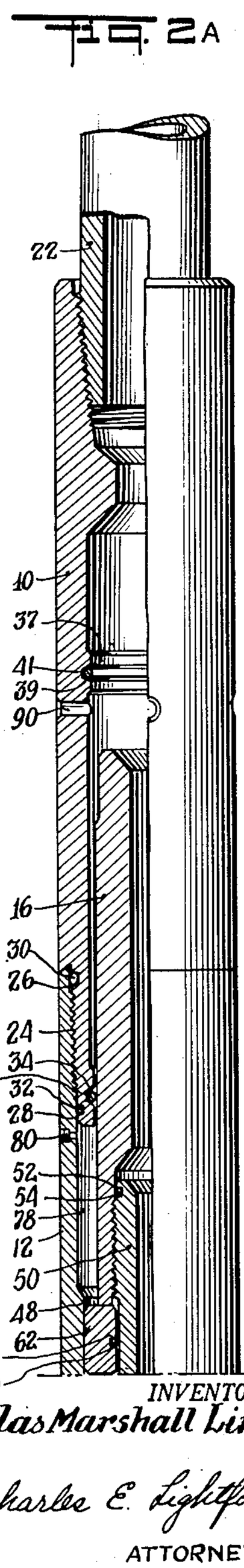

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FIG. 2B

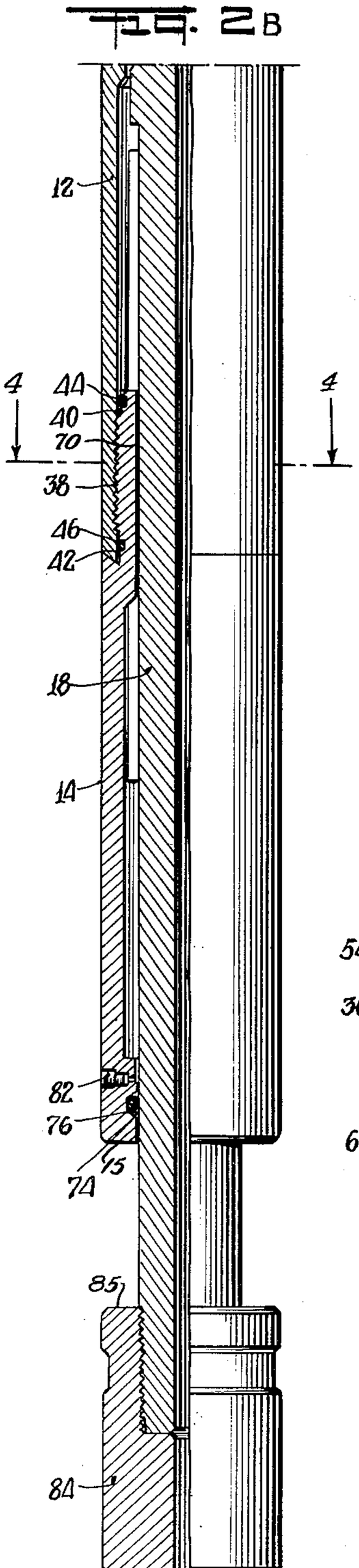


FIG. 3A

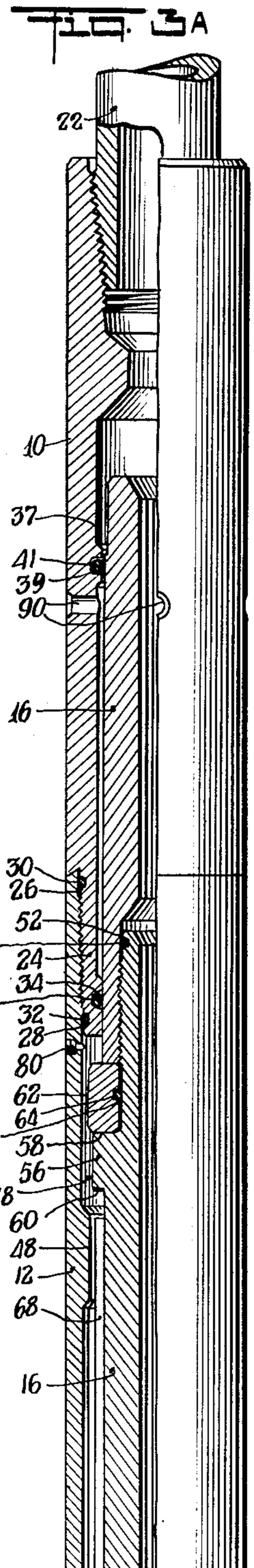
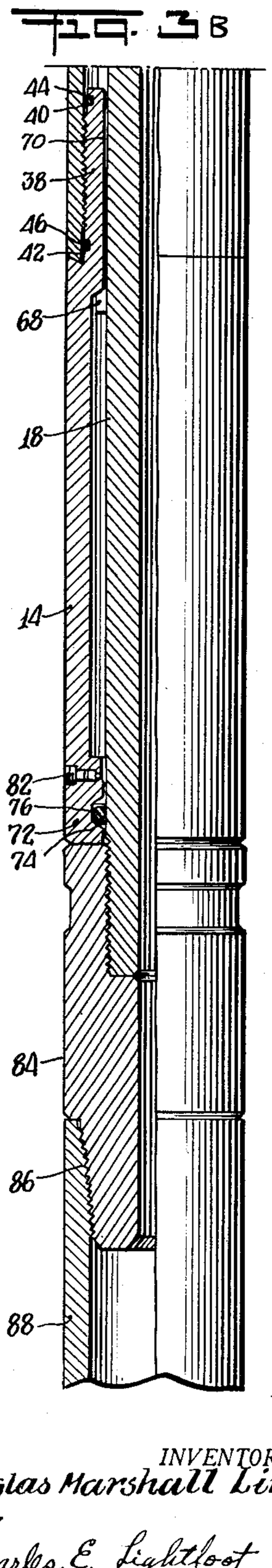


FIG. 3B



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COMBINATION JAR AND EQUALIZER

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Application December 19, 1950, Serial No. 201,668

4 Claims. (Cl. 255—27)

1

This invention relates to a combination jar and equalizer, and has for its principal object the provision of a combined jar and circulating sub for use in oil well operations.

The invention finds particular application in connection with such tools as formation testers, fishing tools, cement retainers and the like, usually employed with an operating string in a well and in which fluid is circulated, and in the employment of which an unbalanced condition of pressure may develop in the well between columns of fluid inside and outside of the string. Under such conditions it is frequently desirable to provide means under the control of the operator by which the circulating fluid may be diverted from the operating string, without interrupting the operation of the tool, as well as means for carrying out a jarring operation should this be necessary.

Heretofore, it has been customary to provide two separate tools inserted in the operating string for accomplishing the above operations, one of these tools being a circulating sub, and the other a jar.

Another object of the present invention is the provision of an equalizing jar constructed to accomplish the work of the two above mentioned tools, whereby the overall length of the string of tools may be greatly reduced.

A further object of the invention is to provide a combined jar and circulating sub, wherein the equalizing function of the device may be employed independently of its operation as a jar, so that the pressure condition of the circulating fluid may be controlled, without interference with the use of the device for carrying out jarring operations.

A still further object of the invention is the provision of an equalizing jar of simple design and rugged construction, by which the expense of operation and maintenance of the string of tools may be greatly reduced, and which is capable of withstanding the extreme conditions of hard usage and wear to which such a device is likely to be subjected.

The above and other objects and advantages of the invention will be apparent from the following detailed description, constituting a specification of the same, when considered in conjunction with the annexed drawings, wherein—

Figures 1A and 1B are fragmentary elevational views, partly in cross section, illustrating the invention in use as a jar;

Figures 2A and 2B are similar views of the invention, illustrating the use of the same as an

2

equalizer with the circulating sub in open condition;

Figures 3A and 3B are similar views of the invention, showing the use of the same as an equalizer with the circulating sub in closed condition and

Figure 4 is a cross sectional view taken along the line 4—4 of Figure 2B.

Referring now to the drawings in greater detail, wherein like numerals of reference designate the same parts throughout the several views, the invention has an outer part and an inner part, the outer part being made up of a cylindrical upper body member 10, attached to the upper end of a cylindrical middle body member 12, to the lower end of which a cylindrical lower body member 14 is secured. The inner part of the jar is made up of a wash pipe 16, carried by a mandrel 18, and the inner part so constructed is arranged for telescopic movement within the outer part.

The upper body member 10 is internally threaded at its upper end, as indicated at 20 for connection to an upper section 22 of an operating string, drill pipe or the like, and at its lower end the upper body member has a reduced portion 24, which is externally threaded for connection to the upper end of the middle body member 12. The reduced portion 24 of the upper body member may be provided with external annular grooves, 26 and 28, adapted to receive sealing means, such as the O-rings 30 and 32, respectively, to provide a fluid tight connection between the upper body member and the middle body member. An internal annular groove 34 may also be provided in the lower end of the upper body member, to receive packing means, such as the O-ring 36, adapted to form a fluid tight seal between the upper body member and the wash pipe 16. The upper body member also has an internal restricted portion 37 mediate its ends, which portion is provided with an internal annular groove 39 to receive packing means such as an O-ring 41 to form a fluid tight seal between the wash pipe and upper body member when the jar is in the position shown in Figures 3A and 3B.

A similar connection is formed between the lower end of the middle body member and the upper end of the lower body member, the upper end of the lower body member being formed with a reduced externally threaded portion 38 which is received in the internally threaded lower end of the middle body member. The reduced portion 38 of the lower body member is also formed with external annular grooves 40 and 42, adapted

to receive packing means, such as the O-rings **44** and **46**, whereby a fluid type seal is established between the middle body member and the lower body member.

Within the middle body member **12**, intermediate its end, there is a portion **48** of reduced diameter forming a restriction, for a purpose to be made apparent hereinafter.

The upper end of the mandrel **18** has a reduced portion **50**, which is externally threaded to be received in the internally threaded lower end of the wash pipe **16**, and the reduced portion **50** may be provided with an external annular groove **52**, adapted to receive packing means, such as the O-ring **54**, forming a fluid type seal between the mandrel and the wash pipe. The mandrel also has an annular enlargement **56** adjacent its upper end portion, providing an upwardly facing shoulder **58** and a downwardly facing shoulder **60**. A ring **62** is disposed on the upper end portion of the mandrel, confined between the shoulder **58** and the lower end of the wash pipe. This ring forms a piston on the inner part of the jar and is provided with an internal annular groove **64**, for the reception of packing means, such as an O-ring **66**, forming a fluid-tight seal between the ring and the mandrel. The diameter of the piston **62** is such that it may pass through the restricted portion **48** of the outer part of the jar, but in so doing, the piston nearly closes the restricted portion, thus greatly restricting the flow of fluid past the piston.

The mandrel is provided with external splines, as indicated at **68**, for a portion of its length beneath the piston **62**, which splines intermesh with complementary internal splines **70** located in the lower body member **14**, whereby relative rotation of the inner and outer parts of the jar is prevented. The lower body member has a thickened portion **72** at its lower end, which is provided with an internal annular groove **74**, for the reception of packing means, such as the O-ring **74**, forming a fluid-tight seal between the lower body member and the mandrel.

Between the inner and outer parts of the jar there is an annular chamber, indicated at **78**, extending from the lower end of the upper body member to the lower end of the lower body member, which chamber is adapted to be filled with fluid through the upper and lower filling openings **80** and **82** respectively, the opening **80** being near the upper end of the middle body member, and the opening **84** being located adjacent the lower end of the lower body member. The openings are in communication with the annular chamber and may be internally threaded for the reception of closure plugs for closing the same. A lower sub **84** is threadably connected to the lower end of the mandrel, which lower sub is externally threaded at its lower end, as indicated at **86**, for the attachment thereto of the upper end of a lower section **88** of the operating string. The lower sub **84** has an upper end surface **85**, adapted to strike the lower end surface **15** of the lower body member **14**, when the device is operated as a jar to secure an upward jarring action.

Beneath the restricted portion **37** of the upper body member the same is provided with openings **90**, which serve to permit the flow of fluid from inside the operating string to the outside of the same or vice versa, when the wash pipe moves downwardly in the jar a sufficient distance to pass below the restricted portion **37**. Upward movement of the wash pipe into the restricted portion **37** results in closing off the openings **90** from communication with the interior of the operating string, so that fluid in the string may not pass to the outside thereof at the jar, or vice versa.

It will be appreciated that the wash pipe **16** and mandrel **18** are tubular in form, so that circulation of well fluid, or the like, may take place through the jar, and such circulation may continue if desired during the jarring operation.

In making use of the invention as described above, the same is connected into the operating string at the desired point by attaching the upper section **22** of the operating string to the upper end of the upper body member, while a lower section **88** of the operating string is attached to the lower sub **84**, whereby the device may be lowered into the bore of a well with the operating string.

During the drilling or other operation which is being undertaken in the well the jar will normally be in its fully retracted condition, due to the weight of the operating string pushing downwardly on the outer part of the jar, while the lower end of the string is resting on the bottom of the hole. In this condition of the apparatus the openings or ports **90** are closed by the wash pipe, which extends through the restricted portion **37** of the upper body member, so that circulation of fluid may take place through the operating string as well as about the outside of the string. In the event that it should be desirable or necessary to equalize the fluid pressure of the columns inside and outside of the operating string, an upward pull may be taken on the operating string, resulting in upward movement of the outer part of the jar to bring the ports **90** above the upper end of the wash pipe **16**, so that fluid may flow into or out of the operating string through the ports.

Should the drill or other device attached to the operating string become stuck in the well, so that it is found necessary to carry out a jarring operation, then the jar may be operated by appropriate movement of the upper portion of the operating string, to secure a jarring action in either direction.

In order to jar upwardly a pull may be exerted on the operating string, resulting in upward movement of the outer part of the jar, until the piston **62** on the mandrel enters the restricted portion **48** in the middle body member. As soon as the piston **62** enters the restricted portion **48** the flow of fluid from one end of the chamber **78** to the other end thereof will be restricted, resulting in the development of tension in the operating string. When the piston moves out of the restricted portion **48** the tension so developed will result in sudden extension of the inner and outer parts of the jar until the shoulder **60** of the enlargement **56** on the mandrel engages the upper end of the lower body member, to cause an upward jar.

In carrying out a downward jarring action the reverse of the above described action takes place, the piston **62** moving in the chamber **78** from beneath the restricted portion **48**, through said restricted portion **48**, and into the chamber above the restriction. During such upward movement of the piston a compressive force is built up in the operating string, so that when the piston leaves the restriction the inner and outer parts of the jar are telescoped together suddenly, causing the upper end of the member

84 to suddenly engage the lower end of the lower body member, and producing a downward jarring action on the operating string.

It will be noted that the pressure equalizing function of the structure may take place entirely independently of the jarring action of the same, so that the device may be operated either as an equalizer or as a jar, thus combining in a single tool the desirable features of an equalizer and a jar, without the necessity of providing two separate tools, and effecting a great economy in material and compactness in the string of tools. Moreover, the operation of the invention is greatly simplified, and is completely under the control of the operator at all times.

The invention has been described in connection with a specific embodiment of the same, but it will be understood that this is intended by way of illustration only, and numerous modifications can be made in the construction and arrangement of the various parts without departing from the spirit of the invention, or the scope of the appended claims.

Having thus clearly shown and described the invention, what is claimed as new and desired to secure by Letters Patent is:

1. A well tool comprising inner and outer telescopically arranged tubular parts, means for connecting one of said parts to an upper section of an operating string, means connecting the other of said parts to a lower section of said string, an annular fluid chamber formed between the inner tubular part and the outer tubular part, a piston on the inner tubular part, sealing means at the ends of said chamber, said outer part being in communication with said string beyond said chamber, said chamber having a restricted internal diameter intermediate its ends forming a cylinder coacting with said piston to permit of the latter moving in said cylinder in either direction upon relative longitudinal movement of said inner and outer parts, said cylinder and piston coacting to permit of fluid flow from one side of said piston to the other side thereof as the piston moves in the cylinder, coacting impact faces on the inner and outer parts arranged to contact when the parts reach the limit of their movement relative to each other in either direction, said outer part having an opening in communication with the inside and outside of the outer part beyond said chamber, and said inner part being cooperable with said outer part upon relative longitudinal movement of the parts to establish and cut off communication between the inside and outside of the string through said opening.

2. A well tool comprising inner and outer telescopically arranged tubular parts, means for connecting one of said parts to an upper section of an operating string, means for connecting the other of said parts to a lower section of said string, an annular fluid chamber formed between the inner tubular part and the outer tubular part, a piston on the inner tubular part, sealing means at the ends of said chamber, said outer part being in communication with said string beyond said chamber, said chamber having a restricted internal diameter intermediate its ends forming a cylinder coacting with said piston to permit of the latter moving in the cylinder in either direction upon relative longitudinal movement of said inner and outer parts, the annulus of said piston being spaced from said cylinder to permit of fluid flow around said piston from one side to the other side thereof as the piston moves in the cylinder, coacting impact faces on the inner and outer parts arranged to contact when the parts reach the limit of their movement relative to each other in either direction, said outer part having an opening therethrough in communication with the inside and outside of said outer part beyond said chamber, and means on said inner part cooperable with said outer part to establish and cut off communication between the inside and outside of the string through said opening.

3. A well tool comprising inner and outer telescopically arranged tubular parts movable longitudinally relative to each other, said inner part including a mandrel and a wash pipe connected to the mandrel, means for connecting one of said parts to an upper section of an operating string, means for connecting the other of said parts to a lower section of said string, an annular fluid chamber formed between the inner tubular part and the outer tubular part, a piston on the inner tubular part, sealing means at the ends of said chamber, said chamber having a restricted internal diameter intermediate its ends forming a cylinder coacting with said piston to permit of the latter moving in said cylinder in either direction upon relative longitudinal movement of said inner and outer parts, said cylinder and piston coacting to permit of fluid flow from one side of said piston to the other side thereof as the piston moves in the cylinder, coacting impact faces on the inner and outer parts arranged to contact when the parts reach the limit of their movement relative to each other in either direction, said outer part having an opening beyond said chamber in communication with the inside and outside of the string, and said wash pipe being cooperable with the outer part to establish and cut off communication between the inside and outside of the string through said opening.

4. A well tool comprising inner and outer telescopically arranged tubular parts movable longitudinally relative to each other, means for connecting one of said parts to an upper section of an operating string, means for connecting the other of said parts to a lower section of said string, coacting impact faces on the inner and outer parts arranged to contact when the parts reach the limit of their movement relative to each other in either direction, said outer part having an opening in communication with the inside and outside of the string and a portion of restricted internal diameter beyond said opening, sealing means in said restricted portion, said inner part being adapted to move into said restricted portion and cooperate with said sealing means upon relative movement of said parts in one direction to shut off communication between the inside and outside of the string through said opening, and to move out of said restricted portion upon relative movement of said parts in the other direction to establish communication between the inside and outside of the string through said opening.

DOUGLAS MARSHALL LINNEY.

References Cited in the file of this patent

UNITED STATES PATENTS

Number	Name	Date
1,835,392	Hardies et al.	Dec. 8, 1931
2,245,786	Johnson	June 17, 1941
2,499,695	Storm	Mar. 7, 1950
2,538,690	Johnston	Jan. 16, 1951
2,551,868	Brady	May 8, 1951