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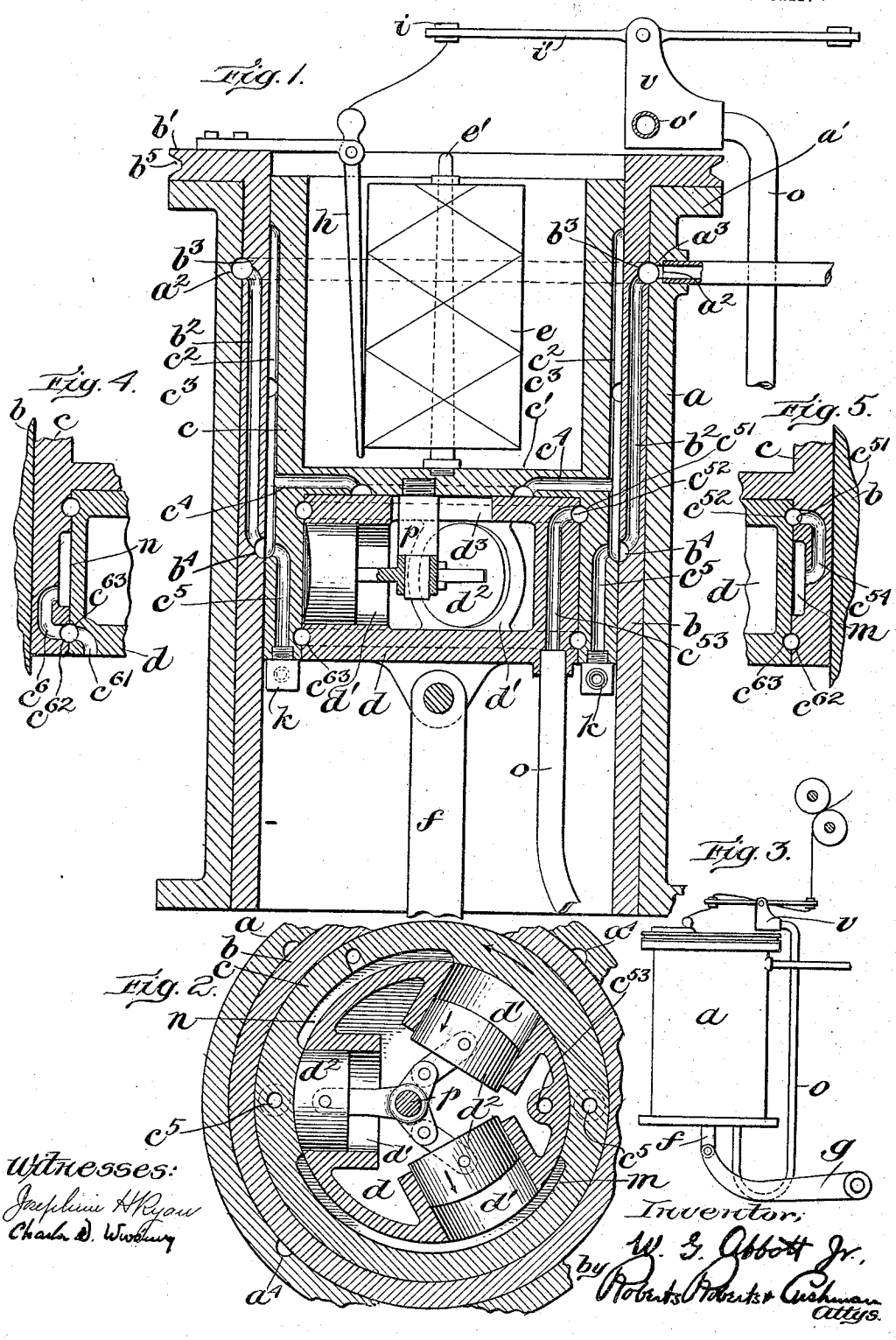
DEVICE FOR UTILIZING FLUID UNDER PRESSURE FOR LUBRICATING RELATIVELY MOVABLE ELEMENTS.

APPLICATION FILED MAR. 6, 1912.

1,185,571.

Patented May 30, 1916.

2 SHEETS—SHEET 1.



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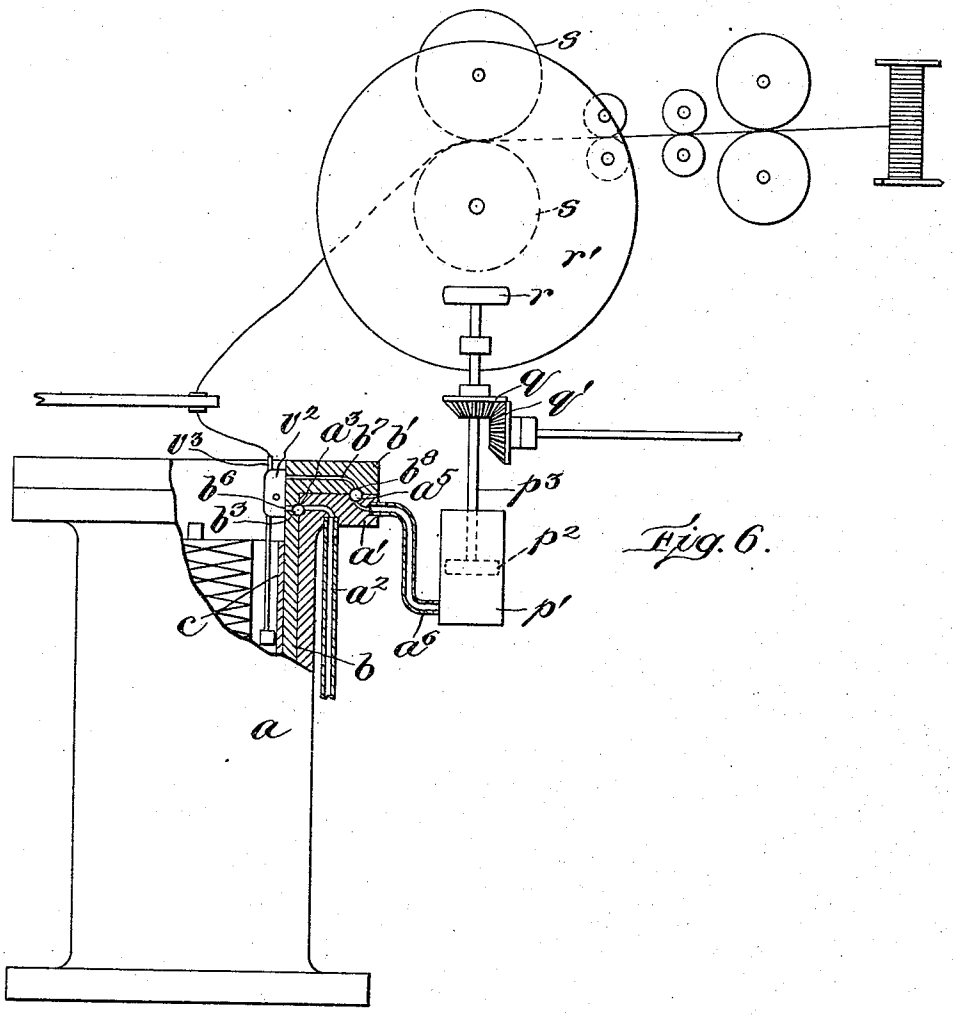


Fig. 6.

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UNITED STATES PATENT OFFICE.

WILLIAM G. ABBOTT, JR., OF WILTON, NEW HAMPSHIRE.

DEVICE FOR UTILIZING FLUID UNDER PRESSURE FOR LUBRICATING RELATIVELY MOVABLE ELEMENTS.

1,185,571. Specification of Letters Patent. **Patented May 30, 1916.**

Application filed March 6, 1912. Serial No. 681,978.

To all whom it may concern:

Be it known that I, WILLIAM G. ABBOTT, Jr., a citizen of the United States, and resident of Wilton, in the county of Hillsboro and State of New Hampshire, have invented new and useful Improvements in Devices for Utilizing Fluid Under Pressure for Lubricating Relatively Movable Elements, of which the following is a specification.

This invention relates to devices for utilizing fluid under pressure, such as compressed air, to lubricate, control or drive relatively movable elements, and for performing any one of said purposes singly or in combination with another or others of said purposes.

Thus, the invention contemplates the provision of at least two relatively movable elements closely fitted together, with a small clearance therebetween, into which clearance the fluid under pressure may be delivered equally or symmetrically between the working surfaces for the purpose of lubrication. It also contemplates the provision of a fluid transmission channel or passage communicating with said clearance to lead the fluid under pressure to another element which may be termed a working element and which may be independent of or carried by, one of said two relatively movable elements, to actuate said working element.

Other features will hereinafter be more particularly described and pointed out in the claims.

In order to explain the invention, I will use as a typical illustration a spinning mechanism, which contains the various elemental members of my invention and some of their possible modifications. It will be understood however that my invention is not restricted to spinning mechanisms but is applicable broadly to various forms of relatively movable elements for effecting a variety of motions and accomplishing a variety of purposes, and a broad application of the invention is contemplated by the claims.

In the acompanying drawings, which illustrate certain embodiments of the invention as applied to a spinning spindle, Figure 1 shows in vertical section (partly in elevation) a spinning spindle containing certain forms of the invention; Fig. 2 is a horizontal section on line 2—2 of Fig. 1, partly broken away; Fig. 3 is a side elevation of said device on a reduced scale; Figs. 4 and 5 are sectional details hereinafter described; and Fig. 6 illustrates certain modifications hereinafter described.

Referring first to Figs. 1, 2 and 3, a represents a cylinder accurately bored out, and smoothly finished on its inner surface and on the upper surface of its flange, a'. The cylinder, a, in the structure now being described, is a stationary element, and carries within it a relatively movable element in the form of a rotor, b, which is finished to fit the bore of cylinder, a, closely but with a very small clearance, and is supported on a by its upper flanged end, b'. If now a fluid, such as air, under pressure be introduced into the clearance between the surfaces of the two relatively movable elements, a and b, by means of suitable channels, grooves or ports, and is symmetrically distributed within said channel by symmetrically arranged channels, grooves or ports, the equally distributed or balanced pressure of the fluid within said clearance will support and hold the elements out of mechanical contact with each other, thereby lubricating the two relatively movable elements and reducing the friction therebetween to that between an element and the fluid. To this end a fluid admission channel, a^2, is provided, communicating with a source of fluid pressure (not shown) extending through element, a, and opening into the small clearance space between, a and b. The admission channel, a^2, communicates with the annular groove or channel, a^3, (Fig. 1) extending around and opening into the bore of element, a; and extending parallel to the axis of cylinder, a, from channel, a^3, are symmetrically arranged grooves or channels, a^4 (Fig. 2). Thus, fluid under pressure introduced through channel, a^2 enters the symmetrically arranged channels, a^3 and a^4, from which it leaks into the clearance space between the two elements, and creates a symmetrical or balanced pressure in said clearance, holding the elements out of mechanical contact and effectively lubricating them. In order further to utilize said fluid under pressure, one or more fluid transmission channels are provided communicating with said clearance space, to convey the fluid to some additional element for the purpose of lubricating, or actuating

said additional element or both. Such fluid transmission channels are illustrated at b^2, b^2, which communicate with an annular groove or channel, b^3, in the outer surface of element, b, registering with groove, a^3, and extend through element, b, opening into an annular groove or channel, b^4, on the inner surface of element, b. The third element, c, to which the fluid is transmitted by said transmission channels, is also cylindrical in form, as herein shown, and is divided by a disk or wall, c', into two parts. In the upper part, a bobbin, e, is shown set on a spindle, e', centrally fastened to the separating wall, c', the bobbin and element c being so connected as to move together as one part. Element c is fitted within element, b, with a small clearance therebetween, and b and c are lubricated by fluid under pressure in substantially the same manner as described with reference to a and b, the symmetrically disposed longitudinal channels, c^2, communicating with annular channel, b^4, and being connected with one another by annular channel c^3. Element, c, is supported by cylinder, d, fitting into the lower part of element c. A reciprocating motion can be imparted to element, c, by cylinder, d, through connecting rod, f, and crank, g. Thus, it will be seen that element c may both be rotated and reciprocated in a manner suitable to wind a thread on the bobbin, e.

From the description thus far it will be seen that simple and effective means are provided for lubricating two or more relatively movable elements by fluid under pressure, and for transferring the fluid under pressure between and through the elements, or some of them, for this purpose, by suitably disposed channels or ports, the friction between the elements being reduced to that between an element and the fluid.

In order to effect the motions necessary for the elements thus far described to perform the operation of spinning, flange b' of element b is peripherally grooved at b^5 to constitute a pulley, and is rotated at constant speed by a cord or band. A thread is delivered from the usual drafting rolls of a spinning frame, and passed through the eye, i, thence to the arm, h, which is pivoted on element b, and is so balanced that its lower end rests lightly on the surface of the bobbin at all speeds of the device, and thence on to the bobbin. As the element b is rotated and the thread is fed out by the drafting rolls a definite twist will be put in the thread. If the element c, which turns in the same direction as element b, were to turn at the same speed as b, the thread would obviously not be wound on to the bobbin. Therefore, c may be turned at a slower speed than b and the speed is decreased as the bobbin grows or increases in diameter; or the speed of c may be fixed, and the speed of b diminished with the increasing diameter of the bobbin; or the speed at which the thread is fed out could be varied, in which case both b and c could be run at constant but different speeds.

To describe now one method of rotating element a: The fluid under pressure passes from annular channel, b^4, to longitudinal channels, c^2, which are kept in communication with channel, b^4, in all positions of element, c, during its reciprocation. The fluid is then transmitted by channels, c^4, to the clearance between elements c and d to lubricate the same in the manner hereinbefore described with reference to the other elements, and from channels, c^2, by channels, c^5, to the nozzles, k. The unbalanced pressure of the fluid reacting from nozzles k can be made to drive element c, or to retard it according to the spinning requirements.

Assuming that nozzles k are used to drive element c, I provide the following means for controlling and varying the speed of rotation of element, c, as the diameter of the bobbin grows: The member d is provided with cylinders, d', the bores of which extend completely through the walls of d. Pistons, d^2, working in said cylinders, d', are connected by piston rods with wrist pin, p, which is fastened to element, c, eccentrically thereof, through a circular opening, d^3, in the top of d. The engine composed of said cylinders and pistons, acts as a pump or a motor according to the manner in which it is being operated. Under the present assumption, that is, when the nozzles, k, are used to drive c, said engine acts as a pump. c will be turning in a counter-clockwise direction, and air will be drawn in by said pistons through inlet passage, n, and forced out through passage, m. Said passage, n, communicates with the atmosphere through ports c^6 and c^{61} and registering annular grooves c^{62} and c^{63} in the members c and d, respectively, and said passage, m, is connected through port c^{54} with a pair of annular registering grooves, c^{51} and c^{52} in members, c and d, respectively. The grooves, c^{51} and c^{52} form an annular conduit that is connected by a port, c^{53} with a pipe o which is made flexible to permit reciprocation of elements, d and c. The pipe o contains a valve, v, and the arm, i', which guides the thread is pivotally mounted, and actuates the valve, v, to vary the opening thereof. As the bobbin grows and tends to take up the thread faster by reason of its greater surface speed, increased tension is put upon the thread coming from the drawing rolls, which causes arm, i', to swing thereby operating valve, v, to check the flow of air through pipe o. A greater load is thereby thrown on the engine cylinder and pistons, d', which are pumping air

through pipe, o, and the speed of rotation of element c is checked. Thus the diameter of the bobbin, through the resultant variation in tension of the thread, automatically regulates the speed of c and consequently of the bobbin, through the resultant varia- the air exhausts from valve, v, to the atmosphere, through pipe o'. If now the pipe o' is connected with a supply of air under pressure the action is reversed and air is forced in through pipe o', valve c, pipe o and passages c^{53}, c^{51}, c^{52}, c^{54} and n to the cylinders and pistons, d', d^2. The latter then become actuators for c instead of retarders and rotate c. Under these conditions the air would exhaust from d' directly to the atmosphere through passages m, c^6, c^{62}, c^{63} and c^{61}. It will be understood that whether said pistons and cylinders are acting as retarders or actuators, the inner walls of element, c, constitute the valves for controlling the cylinders thereof, and the member, d, the valve seat; that the two relatively movable elements (c and d) are supported out of mechanical contact and lubricated by the fluid under pressure in a manner similar to the other elements; and that the fluid is delivered from one to the other to perform further work, and in its transmission is suitably interrupted or controlled.

Referring now to the modification shown in Fig. 6, the fluid under pressure after being passed through the stationary member, passes between the stationary and movable member, lubricating the same, and thence passes again through the stationary member to operate a working member. a, a', b, b', and c represent the same parts as in the other figures. The fluid admission channel, a^2, also is substantially the same as before excepting that it is shown in slightly different location. Channel, a^2, communicates with an annular groove, a^3, which registers with groove, b^3, as before, and the leakage therefrom lubricates parts a and b. From groove b^3 the fluid is transmitted by channel b^6 to valve v^2 which is controlled by the tension on the thread in the same way as valve v of Fig. 1. Valve v^2 communicates with channel b^7 in element b which leads to an annular groove, b^8, registering with an annular groove, a^5, in element, a, and the channel leads thence through element, a, and pipe, a^6, to a cylinder p' in which works a piston p^2. A bevel gear q is mounted on piston rod p^3 with a feather and groove connection, so as to slide longitudinally on rod, p^3, but to rotate with it. q is driven at constant speed by bevel gear, q', which is rotated by any suitable driving means. Rod p^3 carries a wheel r which engages disk, r', and constitutes therewith a friction drive for the feed rolls or drawing rolls s, s. As wheel, r, is shifted near or farther from the center of disk, r', the drawing rolls will be driven faster or slower. The thread being twisted and delivered to the bobbin passes over arms, v^3, of valve, v^2. If the rolls, s, s, are feeding too slowly the increased tension on the thread opens the valve v^2, and admits the fluid under pressure to channel, b^7, whence it passes to cylinder, p', and raises piston, p^2, thereby shifting friction wheel, r, nearer the center of disk, r', and increasing the speed of rolls, s, s. The slackening of the tension of the thread has a reverse effect.

I claim:

1. Two relatively movable elements fitted to each other with a small clearance therebetween, a fluid admission channel communicating with said clearance adapted to distribute fluid under pressure symmetrically within said clearance, a fluid transmission channel in one of said elements also in communication with said clearance, and means to interrupt the flow of fluid through said transmission channel.

2. Two elements adapted relatively to rotate and to reciprocate, said elements fitted to each other with a small clearance therebetween, and a fluid admission channel communicating with said clearance adapted to distribute fluid under pressure symmetrically within said clearance.

Signed by me at Wilton, New Hampshire, this twenty-third day of February, 1912.

WILLIAM G. ABBOTT, JR.

Witnesses:
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H. D. CHEEVER.

Copies of this patent may be obtained for five cents each, by addressing the "Commissioner of Patents, Washington, D. C."