No. 798,449. PATENTED AUG. 29, 1905.

C. F. RIGBY.

WELL DRILLING APPARATUS.

APPLICATION FILED OCT. 8, 1903.

3 SHEETS—SHEET 1.

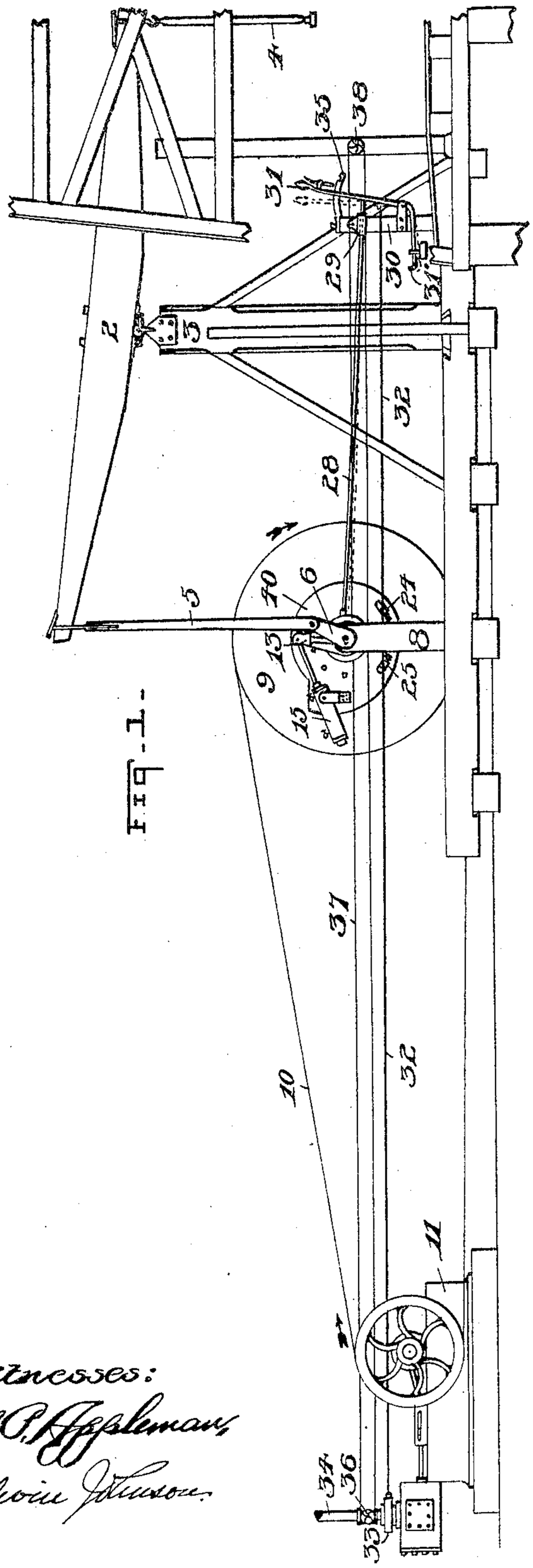

Fig. 1.

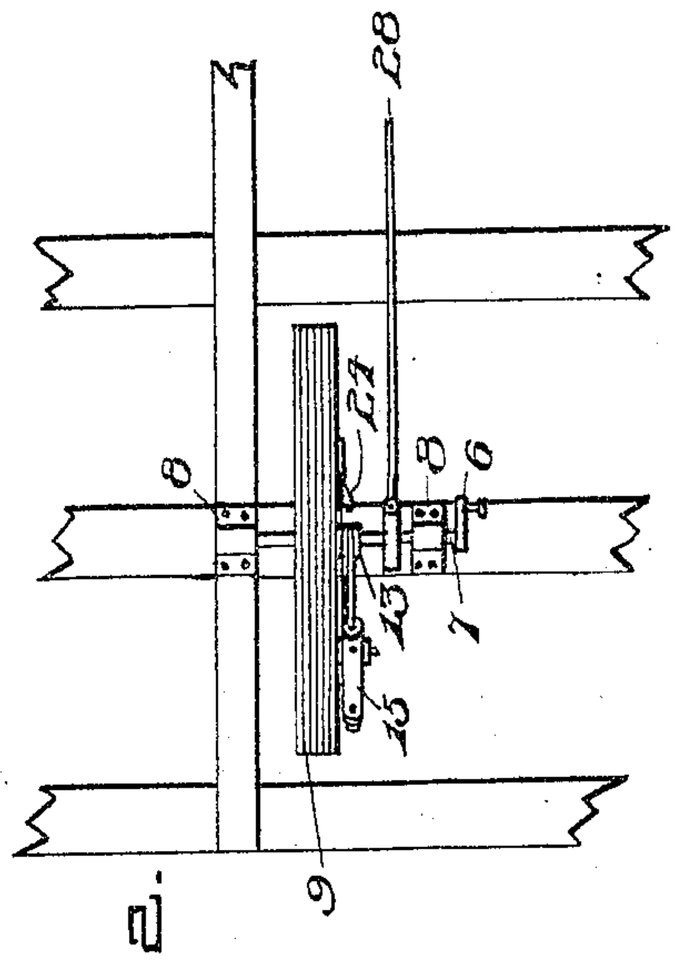

Fig. 2.

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3 SHEETS—SHEET 2.

Fig. 4.

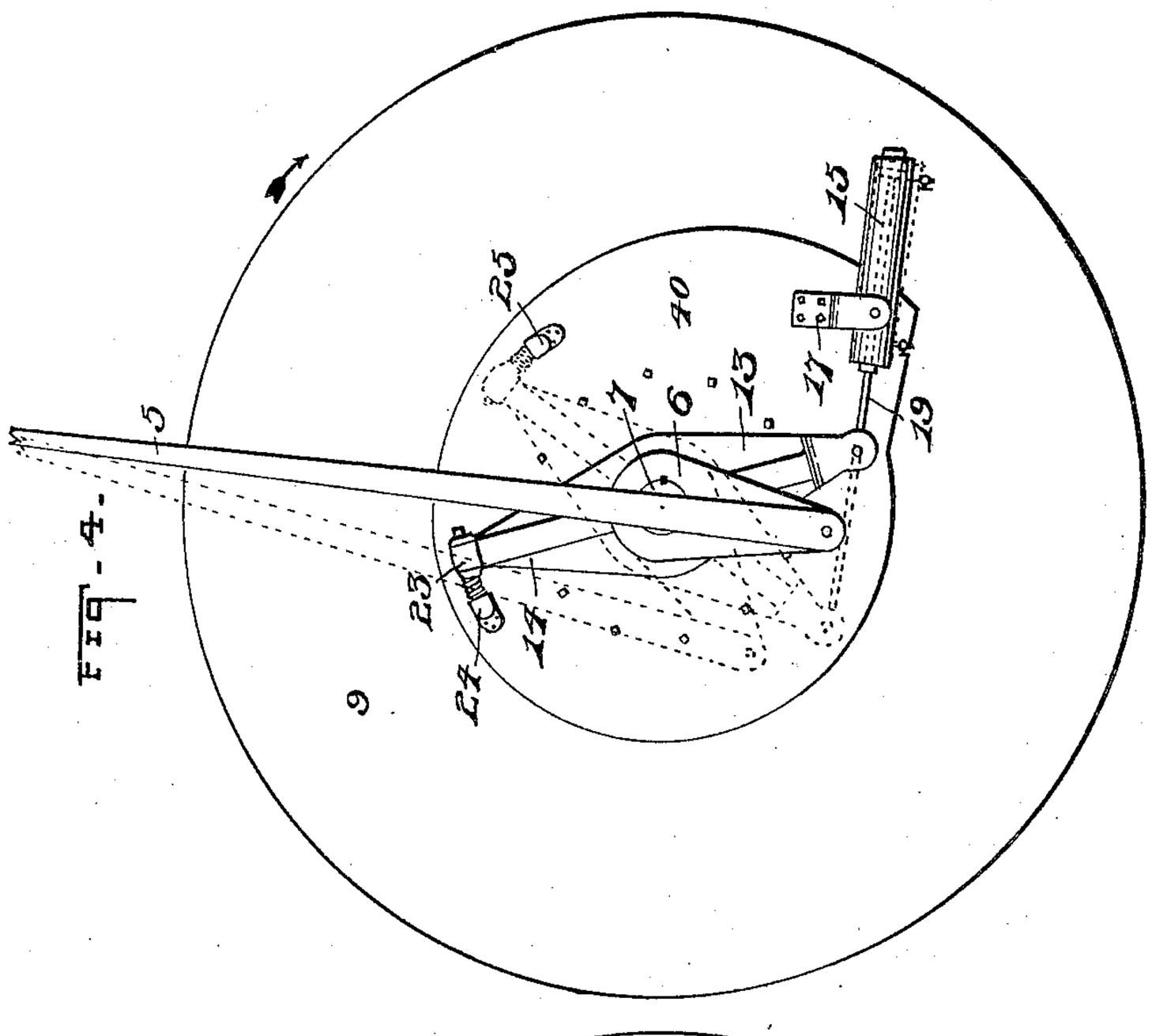
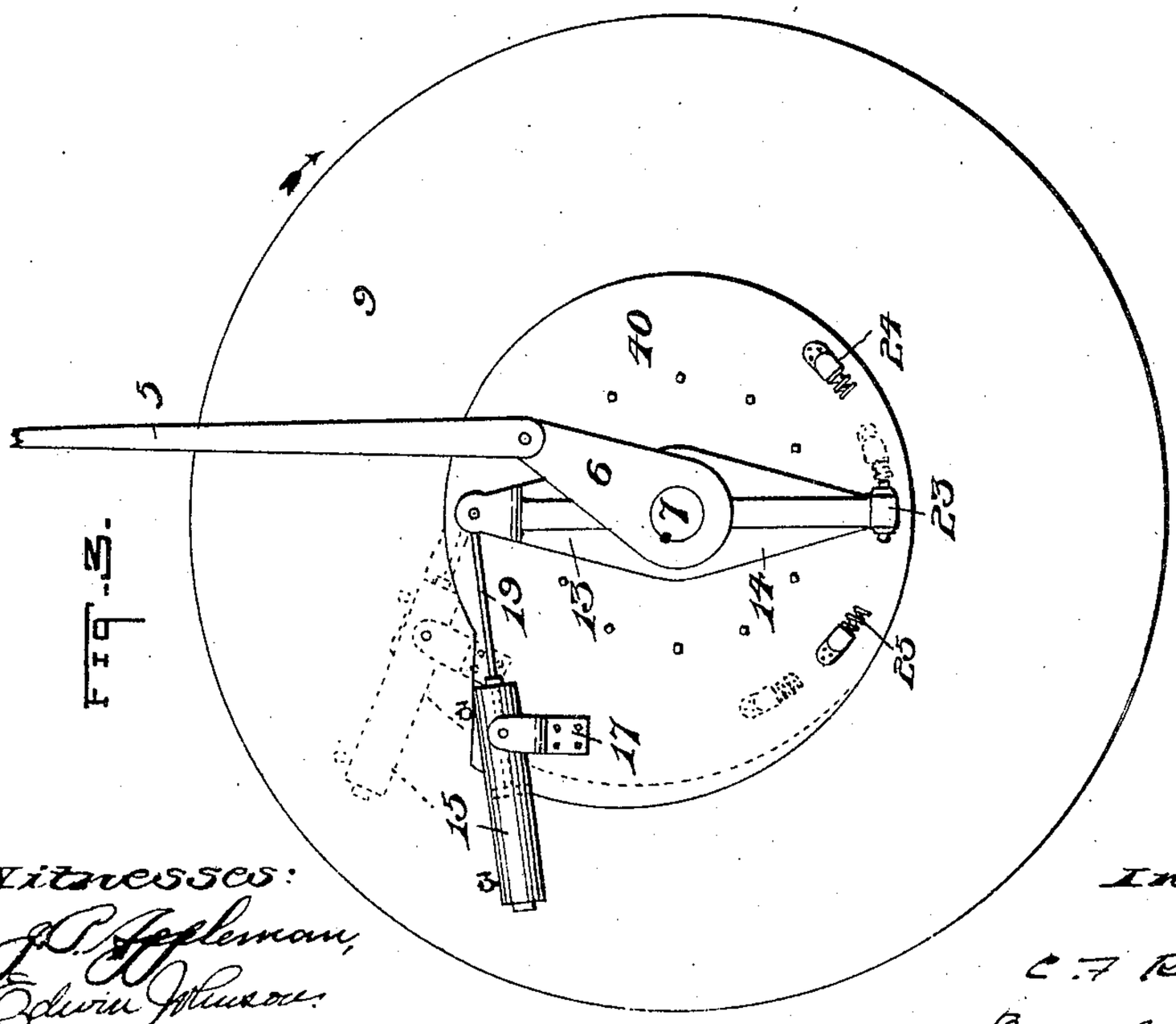


Fig. 5.



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3 SHEETS—SHEET 3.

Fig. 5.

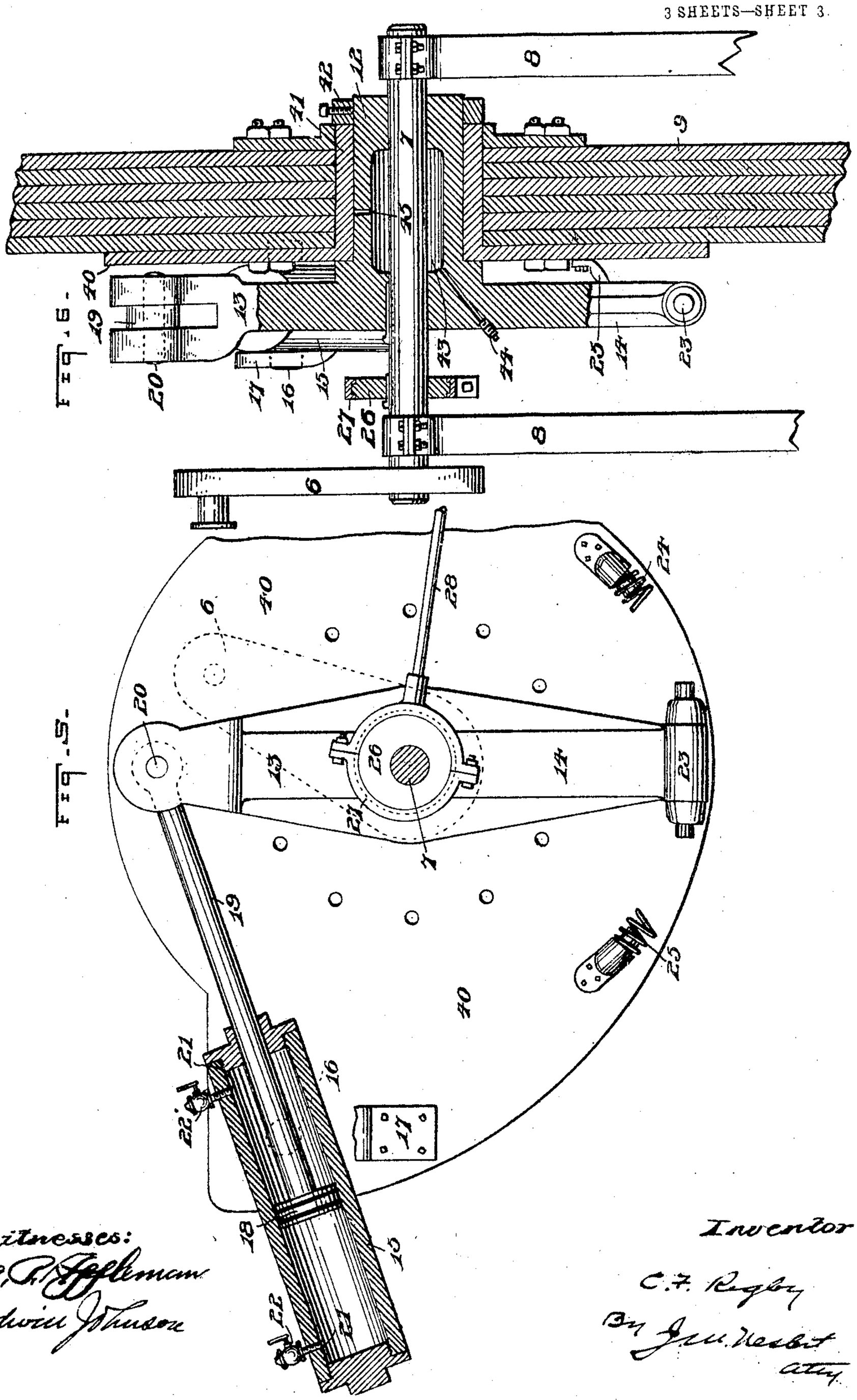

Fig. 5.

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UNITED STATES PATENT OFFICE.

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WELL-DRILLING APPARATUS.

No. 798,449. Specification of Letters Patent. Patented Aug. 29, 1905.

Application filed October 8, 1903. Serial No. 176,175.

To all whom it may concern:

Be it known that I, CLARK F. RIGBY, a citizen of the United States, residing at New Martinsville, in the county of Wetzel and State of West Virginia, have invented certain new and useful Improvements in Well-Drilling Apparatus, of which the following is a specification, reference being had therein to the accompanying drawings.

A wire cable for deep-well drilling is in many ways superior to the universally-used manila cable. Its first cost is much less and it is far more durable. With a manila cable when the hole fills or partially fills with water it is necessary to place a long auger-stem or sinker-bar in the string of tools to overcome the buoyancy of the cable, so that effective blows may be struck. In many instances, however, the water becomes so deep that the cable practically floats the tools, and the only remedy is to case the well to a point below the water-bearing strata and bail out the hole. The casing is costly and much time is consumed in inserting it. With a wire-drilling cable a sinker-bar is unnecessary, as the cable affords sufficient weight without it, and being devoid of any tendency to float it is unnecessary to shut off the water, and the expense of casing the well is saved. A further advantage incident to the use of a wire cable is that the tools will strike an effective blow at every downstroke of the cable and it is unnecessary to actuate the same at very low speed to accomplish this, whereas with a manila cable the speed must be slow, otherwise the sudden pulls on the cable will so stretch it that the tools will not be lifted, and especially is this the case when the drilling has progressed to a considerable depth. But seemingly insurmountable difficulties have attended the use of wire cable. It is practically devoid of spring or stretch, so that in the attempts to actuate it with the mechanism adapted for manila cable the entire weight of the tools and cable is thrown on the engine at one instant and at another instant the whole weight is released and exerts a strong and sudden jerk and forward pull on the driving mechanism. These sudden and violent fluctuations of load and speed have proven fatal to even the most stoutly-equipped apparatus.

This invention is directed to overcoming the objections noted by providing a compensating connection between the band-wheel and band-wheel shaft, so that during the first portion of the rapid downstroke of the tools the shaft moves more rapidly than the band-wheel, and on the upstroke, or when the tools are lifted, the band-wheel at first moves more rapidly than the shaft, so that the load is taken up gradually, and these compensating movements, combined with effective cushioning means, greatly reduce the objectionable variations in load and speed and render drilling with a wire cable entirely practicable.

In Letters Patent No. 532,338, granted to me January 8, 1895, I show and describe a mechanism for cutting off steam from the engine during the downstroke of the tools, which has been quite effective in overcoming the difficulties attending the use of wire cable; but I have found that by combining that invention with the compensating connection between the band-wheel and shaft the wear and tear on the machinery is greatly reduced, and the drilling proceeds with greater uniformity in the strokes than heretofore.

In the accompanying drawings, Figure 1 is a side elevation of a drilling equipment provided with my improvement, and Fig. 2 is a plan view of a portion of the same. Figs. 3 and 4 are side views of the band-wheel, crank-shaft, and uniting connections, showing the same in different positions. Fig. 5 is a side elevation of a portion of the same on a larger scale, and Fig. 6 is a sectional view of the same.

Referring to the drawings, 2 designates the walking-beam fulcrumed on samson-post 3, and depending from the outer end thereof is the usual drilling-cable connection 4, while from its rear end depends the pitman 5, which connects with crank 6 on band-wheel shaft 7, the latter being journaled in jack-posts 8 in the usual manner, said shaft being driven by band-wheel 9, belt 10, and engine 11.

Instead of keying the band-wheel to shaft 7 as heretofore it is rotatably mounted on a hub 12, which is keyed to the shaft, and projecting from this hub in opposite directions are arms 13 and 14. A cylinder 15 is trunnioned at 16 between the side of the band-wheel and a bracket 17, and operative therein is a piston 18, from which projects rod 19, which connects with pin 20 in the forked extremity of arm 13. Adjacent opposite ends of the cylinder are air-vents 21, controlled by cocks 22 and 22′. At the extremity of arm 14 is the double-ended head 23, and secured to the side of the band-wheel, at opposite sides

of said head and in the radius thereof, are the spring-buffers 24 and 25.

In operation the parts rotate in the direction indicated by the arrows in the several views, so that with crank 6 in position shown in Figs. 1 and 5 and in full lines in Fig. 3 it has begun to pull downward on pitman 5 and to raise the tools in the well. Instead of said crank and shaft moving positively with the band-wheel in accomplishing this stroke said wheel first moves cylinder 15 inward over piston 18, with the confined air in the cylinder cushioning the stroke. Cock 22 may be closed or it may be partially open to permit the air to exhaust gradually. In either event there is an appreciable forward movement of the band-wheel and cylinder in advance of shaft 7 and before a positive connection is made with arm 13, rigid with the shaft, as shown in dotted lines in Fig. 3. This same movement brings head 23 of arm 14 in contact with spring-buffer 24, which not only provides an additional connection between the parts, but also operates as a supplemental cushion and prevents them from uniting with a jolt. The load is thus gradually and easily thrown upon the band-wheel, and crank 6 is carried down over the bottom center, as shown in full lines in Fig. 4, and the tools raised. At this juncture the tools begin the downward stroke, and crank 6 is not only relieved of load, but is subjected to a strong upward jerk and pull, which is of course communicated to shaft 7 and arms 13 and 14, as all of said parts are rigidly united; but before a positive connection is made with the band-wheel piston-rod 19 is drawn outward and crank 6 and arms 13 and 14 move to position shown in dotted lines in Fig. 4 with head 23 of arm 14 in engagement with buffer 25. Piston 18 moves in cylinder 15 toward cock 22′ to cushion the stroke in the manner above described, and this, together with spring-buffer 25, compensates in a great measure for the sudden jolt and accelerated movement which would otherwise be communicated to the band-wheel. At the completion of the downstroke of the tools and at the commencement of the upstroke the parts are in position shown in Figs. 1 and 5 and in full lines in Fig. 3, and the operation is repeated.

Vents 21 are purposely located inward from the ends of cylinder 15, so that even though cocks 22 and 22′ are so set as to permit a rapid outflow of air a sufficient amount will remain in the cylinder ends after the piston has passed over said vents to appreciably cushion the same and prevent it from coming in violent contact with the cylinder-heads.

Coöperating with the compensating connection between the shaft and band-wheel is a steam-cut-off mechanism similar to that described in my above-mentioned patent for depriving the engine of steam during the downstroke of the tools and shutting off the power excepting when needed for lifting the tools, thereby greatly reducing the wear and tear incident to the sudden changes in load and speed. In the present adaptation shaft 7 is provided with an eccentric 26, embraced by strap 27, and projecting from the latter is rod 28, which reciprocates through bracket 29, pivoted to post 30. Fulcrumed on this post is lever 31, which is connected by rod 32 with cut-off valve 33 in the steam-supply 34 of engine 11. A weighted arm 31′ at the lower end of lever 31 holds the latter normally drawn inward or toward shaft 7, with valve 33 closed. The arrangement is such that toward the completion of the downstroke of the tools the extremity of rod 28 pushes outward on lever 31, so that at the completion of said stroke the valve is entirely open and is so held by the described connections until the completion of the lifting or up stroke. Upon completion of the latter rod 28 has receded sufficiently to permit lever 31 to begin to respond to the pull of the weight, and the valve gradually closes. When it is desired that the engine shall have a constant supply of steam, as when drawing tools, &c., the automatic cut-off may be rendered inactive by securing lever 31 to a rack 35 out of reach of rod 28 and with valve 33 open.

36 is the engine throttle-valve, which is operated in usual manner by endless rope or belt 37, which passes over an operating-wheel 38, mounted in the derrick adjacent lever 31. Thus control of the entire apparatus is within convenient reach of the driller as he stands in his usual station on the derrick-floor near the drilling-cable.

The body of band-wheel 9 is preferably of wood and formed of a plurality of thin sections, as is usual in this class of built-up pulleys. At the side of the wheel adjacent arms 13 and 14 is the circular plate 40, upon which cylinder 15 is mounted, said plate being bolted to and forming a rigid part of the band-wheel. Integral with plate 40 is the box or hub 41, which extends through and forms the center of the wheel and fits hub or bearing 12, being confined thereon by collar 42. Bearing 12 is preferably cored to form oil-cavity 43, which is filled through duct 44, while oil feeds to the outer or bearing surface through one or more apertures 45.

While the compensating connection between the power-transmitting shaft and its driving element is here shown and described in connection with well-drilling apparatus, it will be understood that it may be applied to other uses without departing from the spirit and scope of the invention.

I claim as my invention—

1. In well-drilling apparatus, the combination of a shaft having a crank, drilling means connected to and reciprocated by the crank, a shaft-driving wheel having limited movement independent of the shaft thereby permitting

the wheel to move faster than the shaft at the beginning of the upstroke of the drilling-tools and permitting the shaft to move faster than the wheel at the beginning of the downstroke of the drilling-tools, and cushioning means for resisting the latter portion of each of said independent movements.

2. In well-drilling apparatus, the combination of a horizontal shaft having a crank, a connection with the crank for raising the drilling-tools as the crank turns downward, a band-wheel loose on the shaft thereby permitting the shaft and crank to move independently of and more rapidly than the band-wheel during the upward movement of the crank, stop means for positively connecting the wheel and shaft while the crank is moving in a downward direction, and a constant compensating connection between the wheel and shaft.

3. In well-drilling apparatus, the combination of a shaft having a crank, a connection with the crank for raising and lowering the drilling-tools, a wheel for driving the shaft having limited movement independent thereof whereby the wheel may move faster than the shaft and vice versa, an air-cylinder carried by the wheel having its piston connected to the shaft, and controlled air-ports for the opposite ends of the cylinder.

4. In well-drilling apparatus, the combination of a shaft having a crank, a connection with the crank for raising and lowering the drilling-tools, a wheel for driving the shaft having limited movement independent thereof whereby the wheel may move faster than the shaft and vice versa, an air-cylinder carried by the wheel having its piston connected to the shaft, and controlled air-ports for opposite portions of the cylinder positioned inward from the cylinder extremities, whereby air-cushions are formed in said extremities irrespective of said ports.

5. In well-drilling apparatus, the combination of a shaft having a crank, drilling means connected to and reciprocated by the crank, a rotating body for driving the shaft, an arm projecting from the shaft, a cylinder mounted to oscillate on said body, a piston, the cylinder being constructed and arranged to form air-cushions in its ends for the reverse movements of the piston, and a rod connecting the piston with said arm.

6. In well-drilling apparatus, the combination of a shaft having a crank, drilling means connected to and reciprocated by the crank, a body loose on the shaft for rotating the latter, an arm projecting from the shaft, separated stops on the body between which the arm extends and with which the arm coöperates for limiting the independent movement of the shaft and body, and a compensating device forming a constant connection between the shaft and said body.

7. In well-drilling apparatus, the combination of a shaft having a crank, drilling means connected to and reciprocated by the crank, a body loose on the shaft for driving the latter, two arms projecting from the shaft, separated stops on the body between which one of said arms extends and with which the arm coöperates for limiting the independent movements of the shaft and body, a cushioning device mounted to oscillate on the body, and a longitudinal movable connection between the other of said arms and the cushioning device.

8. In well-drilling apparatus, the combination of a horizontal shaft having a crank, a rod connected to the crank for raising the drilling-tools as the crank turns downward, a stop carried by the band-wheel, an arm projecting from the shaft and adapted to engage said stop during the downward movement of the crank and thus form a positive connection between the shaft and band-wheel during said movement, a second stop carried by the band-wheel and separated from the first-mentioned stop to afford the arm limited movement independent of and faster than the band-wheel when the crank begins its ascent, and a constant compensating connection between the shaft and band-wheel.

9. In well-drilling apparatus, the combination of a shaft having a crank, drilling means connected to and reciprocated by the crank, a shaft-driving wheel having limited movement independent of the shaft thereby permitting the wheel to move faster than the shaft at the beginning of the upstroke of the drilling-tools and permitting the shaft to move faster than the wheel at the beginning of the downstroke of the drilling-tools, cushioning means for resisting said independent movements, an engine for driving said wheel, and a connection between the shaft and engine for shutting off steam from the latter during the downstroke of the tools.

10. In well-drilling apparatus, a shaft for transmitting power to the drilling-cable, an eccentric actuated by the shaft, a bar adapted to be oscillated by the eccentric, a weighted lever adapted to be oscillated by the ba[illegible] an engine-valve, and a connection between the lever and said valve.

In testimony whereof I affix my signature in presence of two witnesses.

CLARK F. RIGBY.

Witnesses:

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ALEX. S. MALON.