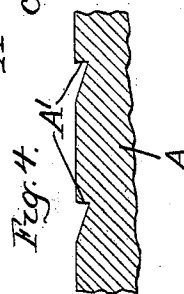
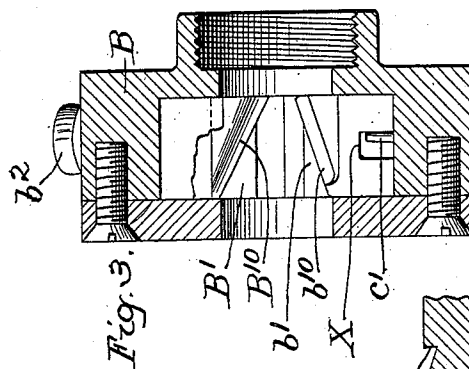
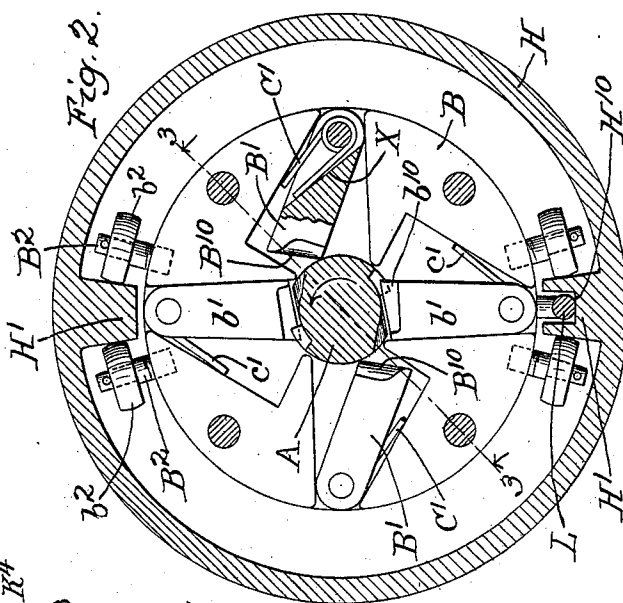
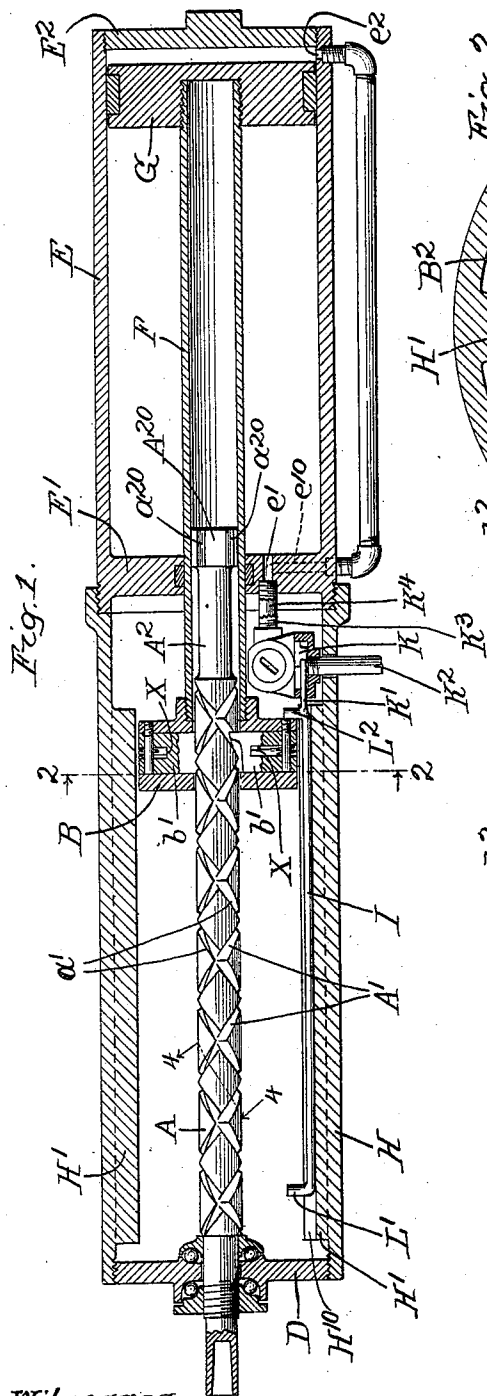


H. HARTWIG.
DEVICE FOR CONVERTING MOTION.

No. 583,802.

Patented June 1, 1897.



Witnesses.

E. T. Wray,
Jean Elliott

Inventor.

Henry Hartwig
by Burton and Burton
his attys

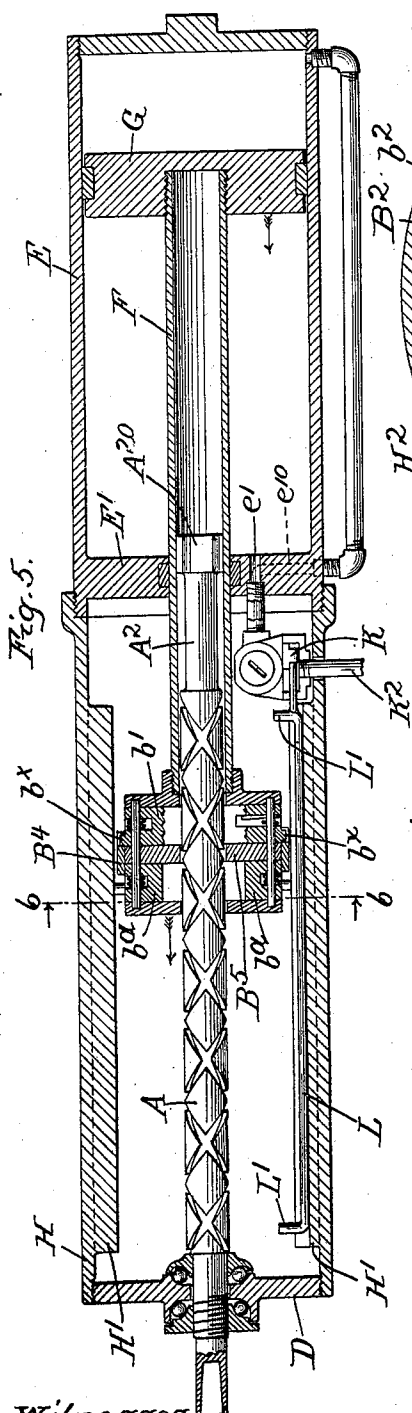
(No Model.)

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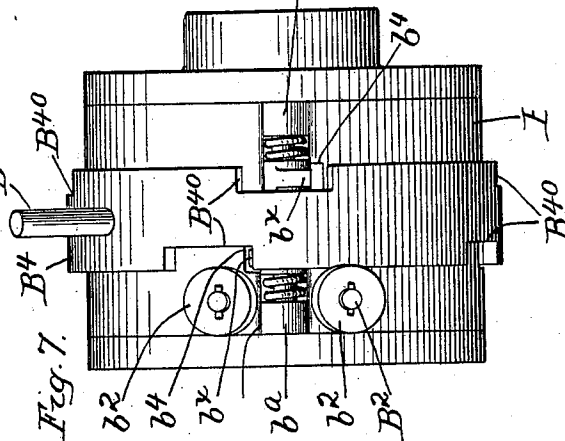
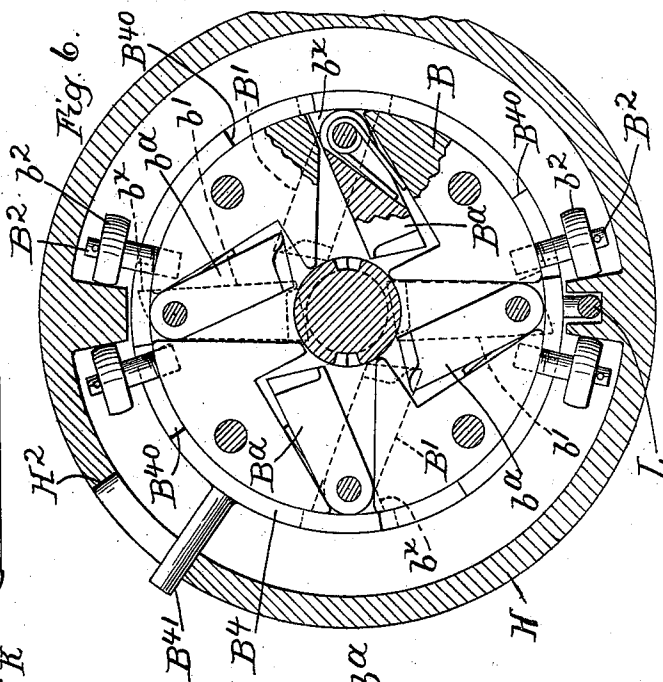
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UNITED STATES PATENT OFFICE.

HENRY HARTWIG, OF CHICAGO, ILLINOIS, ASSIGNOR OF ONE-HALF TO
WILLIAM OLDFIELD, OF SAME PLACE.

DEVICE FOR CONVERTING MOTION.

SPECIFICATION forming part of Letters Patent No. 583,802, dated June 1, 1897.

Application filed July 13, 1896. Serial No. 598,946. (No model.)

To all whom it may concern:

Be it known that I, HENRY HARTWIG, a citizen of the United States, residing at Chicago, county of Cook, and State of Illinois, have invented certain new and useful Improvements in Devices for Converting Motion, which are fully set forth in the following specification, reference being had to the accompanying drawings, forming a part thereof.

This invention is an improved device for converting reciprocating into rotary motion; but it is specifically designed as an improved drill motor or device for rotating a drill by means of a reciprocating traveler. Further, specifically, it includes improvements in mechanism for operating such a device by compressed air.

Figure 1 is an axial section of my improved drill-motor. Fig. 2 is an enlarged section at the line 2 2 on Fig. 1. Fig. 3 is a detail axial section of the traveler removed from the shaft at the plane of the line 3 3 on Fig. 2. Fig. 4 is a detail section of the shaft, on an enlarged scale, at such point as that indicated by the line 4 4 on Fig. 1. Fig. 5 is an axial section showing a portion of the shaft with its housing and the traveler in a modified form adapted to rotate the shaft in either direction at will by proper adjustment. Fig. 6 is a section at the line 6 6 on Fig. 5. Fig. 7 is a side elevation of the traveler removed from the case.

My invention consists of a shaft having spirals of opposite pitch and a traveler having dogs adapted to engage such oppositely-pitched spirals so arranged that the dogs which engage the spirals of one pitch are in engagement only when the traveler is moving in one direction and the dogs which engage the spirals of opposite pitch are in engagement only when the traveler is moving in the opposite direction.

My invention also includes, in connection with the feature above stated, a piston connected with the traveler and actuated in the cylinder by compressed air or other fluid under tension to reciprocate the traveler along the shaft.

A is the shaft, provided with spirals (in the form of depressions) $a' a'$ and $A' A'$, such spirals extending over so much of the length

of the shaft as constitutes the course of the traveler in its reciprocating motion, hereinafter described, the spirals of opposite pitch crossing each other, as shown in the drawings.

B is the traveler, which is a collar or sleeve having a central aperture adapting it to pass onto the shaft A and having suitable seats or chambers for the dogs $B' B'$ and $b' b'$. The chambers which are cut in the traveler B to receive the dogs $B' b'$ are adapted to permit the dogs to stand radially in the traveler, and they are each pivoted at their outer extremity to the traveler, their inner extremities being provided with oblique feathers $B^{10} B^{10}$ and $b^{10} b^{10}$, the direction of obliquity of the feathers corresponding to the pitch of the spirals A' and a' , respectively, the dogs B' having their feathers B^{10} adapted to engage the spirals A' and the dogs b' having their feathers b^{10} adapted to engage the spirals a' .

In the traveler B there is provided space for each of the dogs to swing about its pivot away from radial position far enough to cause it to carry its feather out of engagement with the spiral of the shaft. The dogs are arranged in pairs—that is, opposite dogs constituting a pair and engaging spirals of the same pitch—all the dogs swinging in the same direction about their pivots to clear their respective spirals. Springs $C' C'$ and $c' c'$ are provided, operating upon the dogs $B' B'$ and $b' b'$, respectively, with a tendency to hold said dogs in radial position, such springs being coiled about the pivots of the dogs, respectively, and stopped at one end against the oblique wall of the chamber or cavity provided in the follower for the dog and in the other end stopped against a suitable abutment X on the dog. Now if the follower be passed onto the shaft and the four dogs brought into engagement with the four spirals of the shaft, respectively, a movement of the follower longitudinally on the shaft will tend to swing the dogs by reason of the engagement of the oblique feathers on the dogs with the respective spirals of the shaft, and such tendency will be toward opposite movement of the two pairs of dogs. For one pair the tendency will be to move in the only direction in which movement is possible—that is, away from the side of their chambers against

which they are stopped toward the other side. For the other pair the tendency will be to move in the opposite direction, and such movement being impossible the result will be rotary movement of the shaft as the feather of the dogs, which cannot swing about their pivots, travels along the shaft in engagement with the spiral of the latter. If the motion of the traveler were in the opposite direction, the dogs which in the first described action become disengaged from the spirals of the shaft would become the actuating pair of dogs, and the other pair would become disengaged; but the actuating-dogs in the first instance are engaged with spirals of opposite pitch from the spirals which are engaged in the second instance. If the movement were in the same direction, therefore, the opposite pitch would result in opposite rotation of the shaft, but since the direction of movement of the traveler and the pitch of the operating-spiral are both reversed at the same time the direction of the resultant rotation of the shaft remains the same. I thus obtain, by means of the traveler reciprocating back and forth over the shaft, a rotation of the shaft continuously in the same direction. This device might be employed without any substantial additions for the purpose of driving a drill by hand, the traveler being reciprocated back and forth on the shaft, the latter carrying a drill in one end and being held to its work by pressure against the other end in a manner familiar to those accustomed to such devices; but a further part of my invention consists in adapting this tool to be operated by compressed air or similar medium of power. For this purpose I journal the shaft A at a point beyond its spirals toward one end in a head or cap D, said head being made rigid with a cylinder E, located beyond the other end of the shaft A, and from the traveler B, I extend a hollow shaft F through the head E' of said cylinder E, and within the cylinder secured to said extension I provide the piston G.

The cavity of the shaft F is adapted to permit the shaft A to telescope within it, and in order that said shaft A may be centered with respect to the follower independently of such bearing as it may obtain in the follower itself immediately adjacent to the dogs I extend the shaft A at this end beyond its spirals, as seen at A², this extended portion being reduced in diameter, and at the extremity of this extended portion I make it of suitable diameter at the part A²⁰ to bear properly in the shaft F, thus obtaining for the shaft a center bearing in which it may rotate without cramping and obtaining at the same time for the traveler a steadying-bearing for its reciprocating movement. It will now be understood that, proper provision being made for introducing compressed air or other proper medium alternately at opposite sides of the piston G, said piston, by means of the tubular shaft F, will reciprocate the traveler B and rotate the shaft A, which will telescope

within the shaft F as the piston and traveler reciprocate. In order that the journal end A²⁰ of the shaft A may not operate as a piston in the shaft F and be forced to compress the air ahead of it as it reciprocates, one or more longitudinal grooves a²⁰ may be made on the journal A²⁰ to constitute air-vents. It is essential, of course, that the traveler be prevented from rotating if it is to be made the means of forcing the shaft A to rotate, and this I accomplish by providing longitudinal guideways for the follower on the inner wall of the pipe H, which constitutes the rigid connection from the head D to the cylinder E. These guideways are seen at H', and in order that the guidance of the traveler may be obtained thereon with the least friction I provide studs B² B², projecting radially from the periphery of the follower B and provided with antifriction-rolls b² b², which bear against the opposite sides of the ribs H' H', respectively.

I deem it desirable to make the follower B serve as a means of reversing the communication of the compressed air or other medium of power with the cylinder—that is, shifting it from side to side of the piston—and for this purpose I locate the controlling-valve K in the pipe H beyond the travel of the follower therein toward the cylinder E, and from the operating-lever K' of the valve I extend the reversing-rod L along within the pipe H outside the path of the traveler. Most conveniently this rod L is provided with supports and guidance by lodging it in a channel H¹⁰, formed in one of the ribs H'. From the rod L two spurs L' L² project into the path of the traveler B at such positions that the traveler engages them, respectively, just before it reaches the limit of its opposite movements, respectively, whereby it is adapted to shift the rod at the finish of each movement sufficiently to cause the rod to shift the lever of the controlling-valve.

The structure of the valve need not be herein explained, constituting no part of my invention. It will be sufficient to point out that the inlet for compressed air is shown at K² and that the valve has nipples K³ and K⁴, the former communicating with the cylinder at one side of the piston directly through the port e' in the head E' and the other communicating through the passage e¹⁰ in said head and by means of the exterior pipe with the opposite end of the cylinder through the port e² near the head E².

If it should be desired to make the device adapted to rotate the shaft and tool in either direction at will it may be accomplished in the manner shown in Figs. 5 and 6, wherein the traveler is provided with two complete sets of dogs which are mounted upon opposite sides of the diaphragm B³ in the traveler. The second set is denoted by the letters B^a b^a. The second set differs from the first set merely in that the dogs swing in the opposite direction about their pivots to clear the spirals of the shafts. The individuals of the second set

are among themselves related precisely as the individuals of the first set—that is to say, the dogs B^a and b^a are adapted to engage the spirals of opposite pitch. In order that the operator may control the dogs and cause either set at will to be operative and the other set inoperative they are each provided with a tail or finger b^x, which protrudes through a slot b⁴ in the cylindrical shell of the follower, this finger or tail being adapted to extend beyond the outer surface of the cylindrical body of the traveler when the dog is radial—that is, in position to engage the shaft—but when the dog is thrown out of engagement the tail is withdrawn, so that it is only flush at its outer end with the outer surface of the traveler. On the traveler I mount a band or belt B⁴, encompassing the entire series of slots b⁴ and projecting fingers b^x, eight in number. This band or belt B⁴ has slots B⁴⁰, into which the tails b^x of the dogs project when the dogs are in the position to cause such tails to protrude beyond the outer surface of the traveler. It will be seen that the rotation of the band about the traveler in one direction will cause it to force the tongues of one set of dogs back and swing the dogs to oblique position out of engagement with the shaft, while permitting the other set of dogs to remain in operative position, two at a time, according to the method already described, and that a rotation of the band a few degrees in the opposite direction will reverse the action, withdrawing from engagement the set of dogs which was engaged on the shaft, and permitting the other set, which was before withdrawn from engagement, to come into such engagement. This belt or band, therefore, gives the operator control over the dogs, enabling him to determine the direction of rotation of the shaft at will. In order that the band B⁴ may be accessible for the purpose of such adjustment, a longitudinal opening H² is made in the pipe or frame H, which guards the traveler, and a tongue or boss B⁴¹ is formed on the band in position to be reached through said longitudinal slot, and used as a handle by means of which to rotate the band through the necessary angle to change the rotation of the dogs.

I claim—

1. In combination with the shaft having spirals of opposite pitch, the traveler having dogs adapted to engage such spirals respectively, such dogs being movable in the traveler into and out of engagement with the spirals, the dogs being pivoted to the traveler and stopped thereon at positions to engage the spirals respectively of the shaft, and adapted to swing about their respective pivots to escape such engagement.

2. In combination with the shaft having spirals of opposite pitch, the traveler having dogs adapted to engage such spirals respectively, such dogs being movable in the traveler into and out of engagement with the spirals, dogs pivoted to the traveler and stopped thereon at positions at which they engage the

spirals respectively of the shaft, said dogs moving about their pivots in planes transverse to the shaft and all in the same direction about their respective pivots to escape such engagement.

3. In combination with the shaft having the exterior spirals and the traveler adapted to reciprocate on the shaft and provided with means for engaging the strippers, whereby it rotates the shaft in such reciprocation; a piston rigid with the traveler; a cylinder in which it reciprocates; a valve which controls the supply and exhaust of the fluid under tension to operate the piston in the cylinder; a slide connected to the operating-lever of such valve having abutments engaged by the traveler at the limits of its reciprocation in each direction to reverse the valve.

4. In combination with the cylinder having exterior spirals, and a traveler adapted to reciprocate thereon and having suitable means for engaging the spirals to rotate the shaft by such reciprocation; a bearing for the shaft beyond the spirals toward one end, through which that end projects, a rigid frame extending from said bearing to a point beyond the other end of the shaft, and a cylinder coaxial with the shaft rigid with said frame; a tubular extension or shaft from the follower extending through the head of said cylinder therewith, and a piston within said cylinder on said tubular extension, the shaft being adapted to telescope into said tubular extension of the traveler.

5. In combination with the shaft A having superficial spirals and a traveler B thereon having suitable means for engaging the spirals to rotate the shaft, the pipe or frame H having at one end a bearing for the shaft through which it protrudes and having interior longitudinal guideways H' for the traveler; the cylinder E, rigid and coaxial with the pipe or frame H, the piston G reciprocating in such cylinder having its stem tubular and extending through the head of the cylinder proximate the frame H, and made fast to the follower and adapted to permit the shaft A to telescope within it.

6. In combination with the pipe E H, having fixed heads E and E² and the diaphragm E', the shaft A having superficial spirals extending through and obtaining journal-bearing in the head D, the traveler adapted to reciprocate in said shaft and engage the spirals having a tubular stem in which the shaft may telescope, said stem extending through and obtaining bearing in the diaphragm, and a piston terminating said stem within the cylinder E beyond the diaphragm, and suitable means for longitudinally guiding the traveler and for reciprocating the piston.

7. In combination with a shaft having spirals of opposite pitch, a traveler having two sets of dogs adapted to engage the spirals, each set having two sorts of individuals, one sort being adapted to engage the spirals of one pitch when the traveler moves in one di-

rection along the shaft, and the other sort being adapted to engage spirals of opposite pitch when the traveler moves in opposite direction, each sort being adapted to be thrown
 5 out of engagement by that movement of the traveler which engages the other sort, and means for holding all the individuals of either set at will out of engagement with the spirals.

8. In combination with the shaft having
 10 spirals of opposite pitch, the traveler having two sets of dogs pivoted to it, each set comprising individuals of two sorts, one sort being adapted to engage the spirals of one pitch, and the other sort being adapted to engage
 15 the spirals of the opposite pitch, all being adapted to turn about their pivots respectively to clear the spirals, but the two sets being adapted to turn in opposite direction for that purpose, and means for holding either
 20 set at will in disengaged position.

9. In combination with the shaft having spirals of opposite pitch, the traveler having two sets of dogs pivoted to it and adapted to turn about their pivots in planes transverse
 25 to the shaft and stopped on the traveler in respect to such movement at positions in which they are respectively engaged with the spirals, part of the dogs of each set being adapted to engage the spirals of one pitch,
 30 and the remainder to engage the spirals of the opposite pitch, all individuals of each set

turning in the same direction about their pivots, but the two sets turning in opposite directions to escape such engagement.

10. In combination with the shaft having
 35 spirals of opposite pitch, the traveler having two sets of dogs pivoted to it and oscillating in planes transverse to the shaft and adapted respectively to engage the spirals thereof, and stopped on the traveler in respect to such
 40 pivotal movement at positions at which they engage the spirals respectively, and free to move from such positions, said dogs having projections which protrude through the shell
 45 of the traveler, and a band or collar encompassing the latter and engaging said projections at the side suitable for swinging the dogs out of engagement with the spirals, the dogs of one set being adapted to turn about
 50 their pivots in the opposite direction from the dogs of the other set to escape such engagement; whereby the encompassing band may be moved in one direction to disengage one set
 55 and in the opposite direction to disengage the other set.

In testimony whereof I have hereunto set my hand, in the presence of two witnesses, at Chicago, Illinois, this 7th day of July, 1896.

HENRY HARTWIG.

Witnesses:

CHAS. S. BURTON,
 JEAN ELLIOTT.