

May 16, 1939.

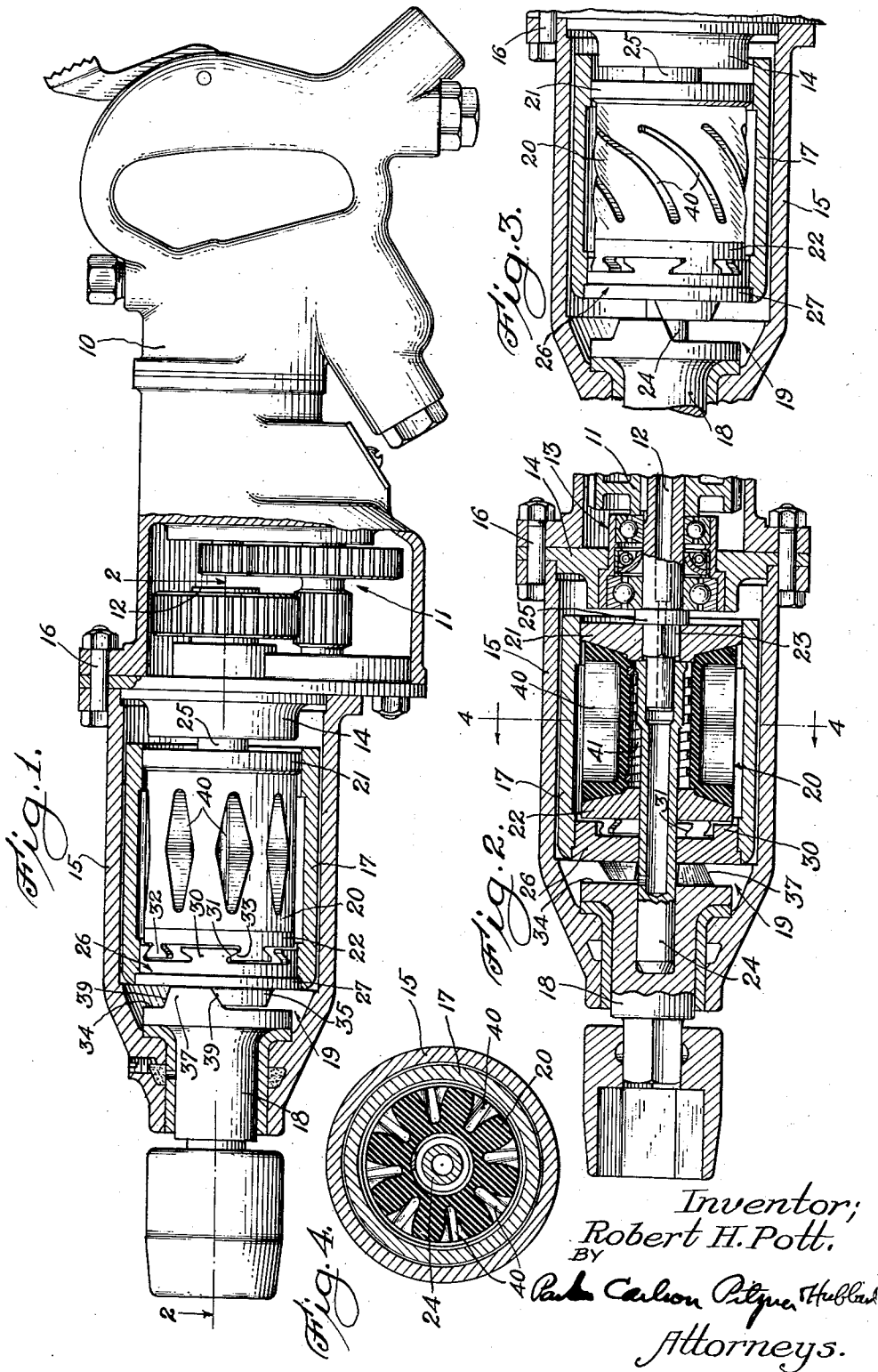
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2,158,303

IMPACT TOOL

Filed Aug. 14, 1935

2 Sheets-Sheet 1



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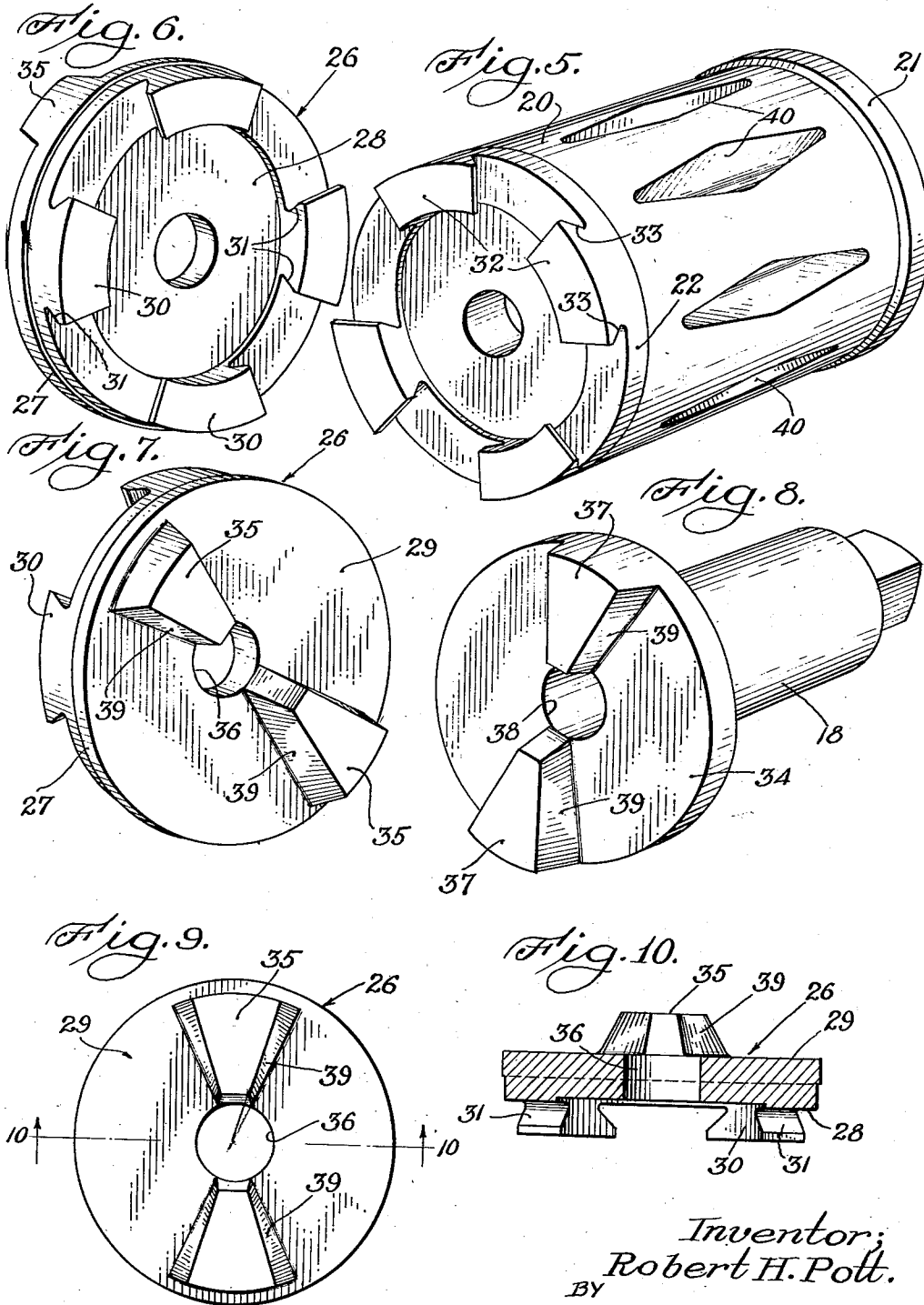
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UNITED STATES PATENT OFFICE

2,158,303

IMPACT TOOL

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Application August 14, 1935, Serial No. 36,112

2 Claims. (Cl. 192—30.5)

The invention relates generally to impact tools and more particularly to tools of this character for applying a torsional force.

An object of the invention is to provide a tool of this character embodying new and improved means for producing a rapid succession of impacts of much greater force than could be obtained directly from the prime mover.

Another object of the invention is to provide in an impact tool of this character a novel means for preventing distortion or damage of the impact-
ing faces.

More particularly stated, another object is to provide meeting faces on the interengageable elements of an impact tool which are so arranged that said faces meet on impact with a substantially full surface contact. In this connection, in impact tools of the type in which separation of cooperating rotatable impact members is effected by relative axial separation thereof followed by a relative return along the resultant of rotative and axial movements, this end is attained by generating the impact faces on the proper spiral angle.

Another object of the invention is to provide, in an impact tool having separable and reengageable elements, new and improved means other than said elements for effecting a relative separating movement therebetween.

Another object more specifically stated is to provide in a device of this character a resilient accumulator, which will yield to the imposition of a twisting force and is fashioned to diminish in length a predetermined amount as it is twisted to a predetermined extent, said accumulator having a positive connection with a hammer element for moving said element axially as said accumulator shortens upon twisting.

Other objects and advantages will become apparent in the following description and from the accompanying drawings, in which:

Figure 1 is a side view of a tool embodying the features of the invention, a portion of the tool housing and the side wall of the hammer being shown in longitudinal section.

Fig. 2 is a fragmentary view of the tool in axial section taken along the line of 2—2 of Fig. 1, illustrating the assembled relation of the accumulator and impact elements.

Fig. 3 is a fragmentary view showing the position of the parts with the accumulator under torsional stress.

Fig. 4 is a cross sectional view taken substantially along the line 4—4 of Fig. 2.

Fig. 5 is an enlarged view in perspective of the

accumulator looking toward the hammer-engaging end thereof.

Fig. 6 is an enlarged view in perspective illustrating the side of the hammer engaged by the accumulator.

Fig. 7 is an enlarged view in perspective illustrating the reverse side of the hammer.

Fig. 8 is an enlarged view in perspective of the tool head or anvil.

Fig. 9 is an end elevation on an enlarged scale of the side of the hammer shown in Fig. 7.

Fig. 10 is a cross section of the hammer taken along the line 10—10 of Fig. 9.

While the invention is susceptible of various modifications and alternative constructions, I have shown in the drawings and will herein describe in detail the preferred embodiment, but it is to be understood that I do not thereby intend to limit the invention to the specific form disclosed, but intend to cover all modifications and alternative constructions falling within the spirit and scope of the invention as expressed in the appended claims.

As illustrated, the invention is embodied in a portable tool and the machine organization in general comprises a prime mover for driving a hammer element which in turn, through releasable and automatically reengageable connections, drives a tool head. The driving connections between the hammer and the prime mover include a resilient power accumulator which, when the tool is running normally, serves simply as a driving connection, but, when movement of the tool head is opposed by a force in excess of normal, will accumulate energy from the constant input of the prime mover to produce, when the detachable driving connection between the hammer and the tool head is released, an automatic reestablishment of the connection with an impact force resulting from the expenditure of accumulated energy.

Referring more particularly to Fig. 1 of the drawings, the numeral 10 designates generally a motor housing within which a suitable pneumatic or electric motor is mounted. This motor may be reversible or reversing gearing may be employed. The motor, through a train of reduction gears 11, drives a shaft 12 which is journaled, as shown in Fig. 2, in bearings 13 supported by a plate 14 which is mounted between the end of the housing 10 and a continuation housing 15 connected thereto by such means as bolts 16. Within the housing 15 a hammer element 17 is disposed for rotational and axial shifting movement and the outer end of the housing 15 sup-

ports a tool head 18 or similar member to be driven. The hammer 17 is in the form of a substantially cylindrical cup-shaped member having a closed end which is disposed in opposition to the inner end of the tool head 18, and complementary releasable and reengageable driving connections, indicated generally at 19, are carried by said opposed ends.

Located within the hammer 17 is a power accumulator 20 preferably in the form of a comparatively thick, strong, tubular sleeve of resilient rubber. The accumulator is generally cylindrical and at its ends carries plates 21, 22 which are affixed to the accumulator in any suitable manner as by vulcanizing. The plates 21, 22 have an axial bore therethrough communicating with the hollow interior of the accumulator. The bore in the end plate 21 is squared or otherwise angularly fashioned to provide a close fitting driving connection with a complementarily shaped portion 23 on the shaft 12. The end of the shaft 12 beyond the angular portion 23 projects into the accumulator and is there supported by a bearing sleeve 24 supported in the tool head 18 to extend through an axial bore in the end of the hammer and thence into the accumulator through the accumulator end plate 22. The sleeve 24 extends nearly to the end plate 21 and prevents axial movement of the end plate 21 and associated part of the accumulator in one direction (to the left in Fig. 1). On the opposite side of the angular portion 23, the shaft 12 has a collar 25 which abuts against the accumulator end plate 21 and prevents axial movement of the end plate 21 and accumulator in the opposite direction.

As shown in Figs. 1 and 2, the hammer 17 is preferably a two-part structure comprising a cylindrical side wall and an end wall 26 affixed together in any suitable manner. In a preferred construction the end wall 26, as may best be seen in Figs. 6, 7, 9 and 10, is a disk-like plate having an inner face 28 located within the hammer assembly and opposing the plate 22 on the accumulator and an outer face 29 opposing the end of the tool head 18. The inner face 28 has a plurality of lugs outstanding in an axial direction and disposed at spaced intervals near the periphery of the disk. The adjacent side faces of the lugs 30 are undercut, as indicated at 31, to provide in effect dove-tailed slots.

Referring to Fig. 5, the end plate 22 of the accumulator has similar outstanding lugs 32, the opposed end faces of which are likewise undercut, as at 33. The dove-tailed spaces between adjacent lugs 30 on the hammer and lugs 32 on the accumulator end plate 22 are of ample width to permit passage of the lugs on the opposing member, whereby the accumulator end plate and the hammer may be engaged by relative axial movement followed by a slight rotative movement in either direction. This interconnected relationship is best seen in Fig. 1.

Referring to Figs. 7 and 8, the outer face 29 of the hammer and the opposed end face 34 of the tool head are provided with complementary releasable driving elements in the nature of a disengageable clutch. In the present instance, two such elements are provided on each of the faces 29 and 34, although without substantial modification this number may be varied. Referring to Fig. 7, the outer face 29 of the hammer has diametrically opposed wedge-shaped clutch teeth 35 thereon extending from the axial aperture 36 in the end wall substantially to the periphery of

the face. Similarly the face 34 on the tool head 18 has diametrically opposed wedge-shaped teeth 37 extending from the bore 38 in which the sleeve 24 is mounted substantially to the periphery of the face. The teeth 35 and 37 are arranged to provide a disengageable and reengageable driving connection between the hammer and the tool head in either direction of rotation of the hammer, such action in this device being effected by relative axial movement of the hammer and tool head.

In operation the hammer and the accumulator are normally in engagement and the connection formed by the disengageable teeth 35, 37 is established. When the prime mover is running, power is delivered from the shaft 12 to rotate the accumulator through the connection between the shaft and the accumulator end plate 21, which rotary movement of the accumulator is transmitted to the hammer through the interengagement of the lugs 30 and 32 and thence to the tool head 18 through the disengageable clutch elements. This driving relationship obtains as long as the tool head encounters only a normal resistance to rotation. However, as soon as this resistance increases beyond a predetermined point, as when a nut becomes initially seated, the rotation opposing force is transmitted through the several driving connections to the end plate 22 and either holds or tends to hold this end of the accumulator against rotation. The power input from the prime mover, being constantly transmitted to the accumulator end plate 21 at a constant rate, causes a twisting of the accumulator (see Fig. 3) to store up torsional energy in the resilient body.

The accumulator is so proportioned that a predetermined degree of twisting produces a predetermined extent of shortening. For example, in the present tool rotation of the accumulator end plate 21 through an arc of 90° relative to the accumulator end plate 22 produces a shortening of the accumulator through a distance substantially equal to the extent of overlapped engagement between the clutch teeth 35 and 37. Hence, as the accumulator shortens, the interlock between the lugs 30 and 32 is effective to pull the hammer axially whereby at a predetermined point to release the engagement between the clutch teeth. During this movement the end plate cannot move due to the opposing end of the sleeve 24. Upon release, the accumulator end plate 22 and the hammer connected therewith are freed from the rotation resisting force imposed on the tool head 18, whereupon the stored up energy in the accumulator is released to drive the hammer head forward with greatly increased force and momentum. During this movement the accumulator expands, the collar 25 holds the end plate 21 against travel, and the previously disengaged clutch teeth 35, 37 are caused to reengage. Preferably the instant of reengagement occurs at or just prior to return of the accumulator to its normal substantially untensioned condition.

The hammer and accumulator assembly, being of much greater mass than of the tool head, coupled with the fact that these parts are driven by suddenly released stored up energy, causes the clutch teeth 35, 37 to be reengaged with an impact, the force of which is substantially in excess of that which may be otherwise derived from the prime mover. The force of the impact is of course transmitted through the tool head 18 to the work.

As the clutch teeth 35 are moved into reengagement with the clutch teeth 37, the angle of approach is a spiral angle which is the resultant of the rotative and axial movement of the hammer. The engaging faces 39 on the clutch teeth 35 and 37 to withstand wear should meet with a full face contact, otherwise one portion of the meeting faces must withstand the full force of the impact. In the present embodiment the meeting faces 39 on the clutch teeth 35 and 37 are complements of each other and these faces are generated on spiral angles so that the meeting faces will be normal to the line of relative approach. Thus the meeting faces 39 are more nearly vertical near the axis of the associated supporting part than at the periphery. When the meeting faces are so generated, a full surface contact therebetween is obtained at the moment of input. This feature is important since it materially increases the life of these parts. In conjunction therewith, the axial withdrawal of the hammer by the diminution in length of the accumulator is important, since it is not necessary to rely upon the camming action of the angular meeting faces 39 to produce the relative separation of the hammer and tool head.

In the present embodiment, the accumulator has a series of longitudinally extending circumferentially spaced grooves 40 therein (see Figs. 1 to 5 inclusive) which are so shaped that the desired relationship between twisting and shortening of the accumulator is obtained. Each of these grooves at the outer surface of the accumulator is in the shape of an elongated narrow diamond and in depth, as shown in Fig. 2, extends nearly through the body of the accumulator. The side walls preferably slope gently inwardly (see Fig. 4) to provide grooves having relative

narrow bottom walls. The particular dimensions and number of grooves will depend upon the proportion of twisting to shortening required by the construction of any particular tool. If desired, the accumulator body may be internally reinforced by such means as a helically coiled element 41 (Fig. 2).

I claim as my invention:

1. In a tool of the character described, a pair of rotatable members having axes extending generally in the same direction, means releasably engaging the two members intermittently including complementary engageable faces generated normal to the angle of approach of said two members as they move into engagement, and means for storing energy in one of said members while said members are in engagement to be expended upon the other member upon a subsequent reengagement therewith to drive said last mentioned member through a working stroke.

2. In a tool of the character described, a pair of rotatable members disposed substantially coaxially with end faces in opposition, interengageable clutch elements having engaging faces, means for effecting intermittent release and engagement of said clutch elements by relative movement of said members axially, means to impart energy to one of said members at substantially a constant rate, and means to cause the last said member to transmit accumulations of such energy intermittently to the other member upon reengagement of said clutch elements, said elements having a helical line of approach, the engaging faces of said clutch elements being formed on spiral angles normal to the line of approach of said faces into engagement.

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