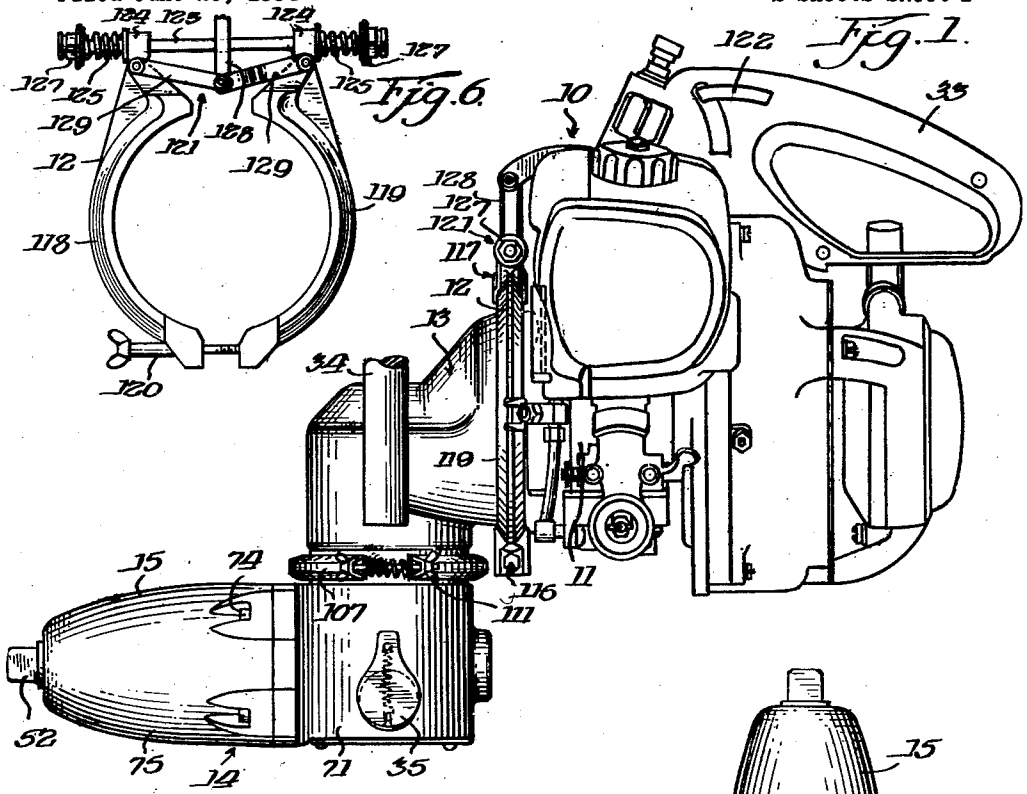
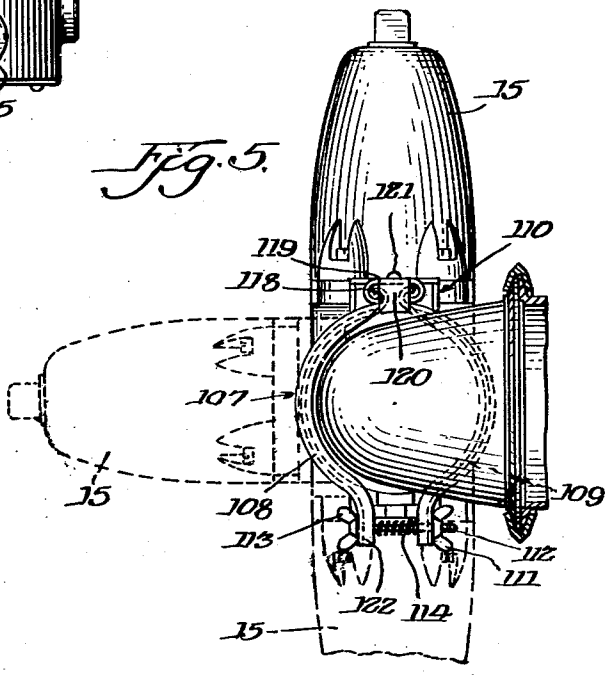
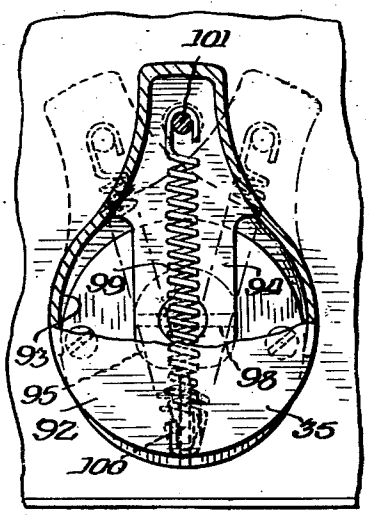
Dec. 10, 1957 A. W. MALL 2,815,834

PORTABLE POWER TOOL DRIVE MECHANISM

Filed June 29, 1954 2 Sheets-Sheet 1







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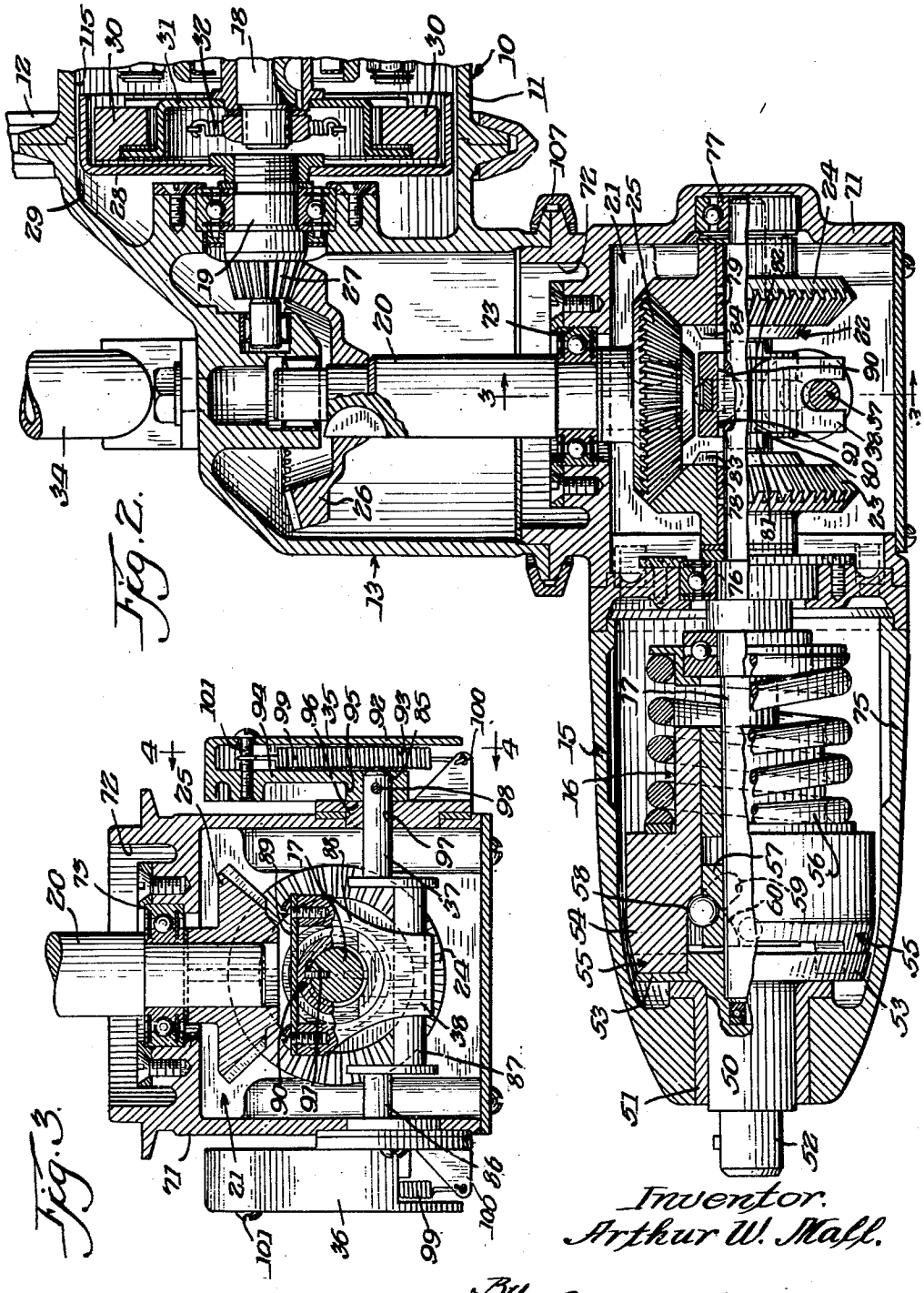


Fig. 2.

Fig. 3.

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PORTABLE POWER TOOL DRIVE MECHANISM

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Application June 29, 1954, Serial No. 440,107

7 Claims. (Cl. 192—3.5)

This invention relates to a power tool and more particularly to a gasoline engine operated impact wrench.

In the conventional impact wrench the tool head or as known in the art, the anvil member, is arranged to receive a succession of rotary impacts from a hammer member to drive the socket. Power is supplied from a reversible electric or pneumatic motor and is transmitted through gearing to the impact mechanism resulting in a compact arrangement of the impact mechanism, gearing, and motor in a unitary housing.

In field locations where electricity or compressed air is not in convenient supply thus making these tools useless, it is highly desirable to have available an impact wrench powered by a light, efficient two or four cycle gasoline engine. It is the principal object of this invention to provide such a machine which has widely different applications particularly in the construction and railroad industries, for brick and concrete boring, drilling, reaming, tapping, and grinding metal, driving lag bolts in laying rail and for other uses, wherever the need exists to drive a tool head with the high torque produced by the rotary hammer action of an impact mechanism.

A further object of this invention is to provide an impact wrench as an attachment for a gasoline engine which is specially adapted to power a number of different machines and tools. This is accomplished in a preferred form of the invention by making the engine separable from the transmission housing of the impact wrench attachment with a clamp to fasten the housing sections together. This arrangement offers an obvious advantage in economy since the impact wrench attachment may be of relatively low cost and be only one of a family of attachments to be driven by the same gasoline engine freeing the engine for use on other jobs except when actually used to drive the impact wrench mechanism.

The conventional electric or pneumatic motor used for powering an impact wrench is constructed so as to be reversible and thus enables the socket to be driven either in a forward or a reverse direction. With the gasoline engine powered impact wrench, however, because the engine only operates in one direction, the reversing must be accomplished by means in the transmission. Accordingly, it is another object of this invention to provide a durable and dependable reversing mechanism featuring positive engagement in the forward and reverse positions.

A principal feature of this invention, in a preferred form, involves providing means for increasing the versatility of this gasoline engine impact wrench. It is desirable to permit the head of the impact wrench attachment to be adjustable to different positions for normally the engine is supported in front of the operator or by one hand at his side with the impact wrench head pointing forward to engage a nut or bolt projecting toward the operator. In this preferred form, the head is so mounted that it may be swivelled and clamped in various positions from one side to the other and also the head as a unit with the entire transmission housing may be swivelled about the

axis of the engine crankshaft to engage a bolt standing otherwise than directly in front of the operator.

It is another object of this invention, therefore, to provide a housing for the transmission and the impact wrench mechanism formed in two sections which are clamped together with the plane of this connection substantially at right angles to the plane of the connection between the transmission housing and the crank case housing of the engine. Consequently, the head can be indexed and swivelled when the clamp is relaxed about axes perpendicular to each other, the head of the impact wrench being adjustable in a horizontal plane so that the impact wrench head may be rotated into an operative position perpendicular to the axis of the engine while the entire transmission housing is movable in a vertical plane.

Further objects will be apparent from the following description read in connection with the accompanying drawings:

Fig. 1 is a view in side elevation illustrating the impact wrench attachment fastened on the crank case housing of an internal combustion engine;

Fig. 2 is a view in section of the impact wrench attachment;

Fig. 3 is a view in section taken on line 3—3 of Fig. 2;

Fig. 4 is an enlarged detail view of the reversing lever taken on line 4—4 of Fig. 3;

Fig. 5 is a view in section of the impact wrench attachment head illustrating several different positions the head may assume;

Fig. 6 is a detailed view of the clamping ring provided on the gasoline engine.

As shown in Figs. 1 and 2, in a preferred form of the invention, engine 10 has in the front of crankcase housing 11 a flanged opening where there is clamped by means of a clamping ring 12 transmission housing 13 of impact wrench attachment 14. Head 15 of the attachment comprises an impact wrench mechanism 16 driven by spindle shaft 17 from crankshaft 18 through stub shaft 19 and jack shaft 20. Reversing mechanism 21, Fig. 3, comprises a clutch 22 operative to lock spindle shaft 17 alternately with bevel gear 23 or bevel gear 24 which are journalled on the spindle shaft and are mounted to be in mesh with bevel gear 25 which is keyed to the lower end of jack shaft 20. Bevel gear 26 keyed on the upper end of jack shaft 20 is in engagement with gear 27 on the stub shaft 19 which carries on the outer end clutch drum 28 centered within the flanged round opening 29 in the transmission housing of the attachment.

Clutch drum 28 is engaged on its inner peripheral surface by centrifugal clutch shoes 30 carried in a conventional assembly shown for illustrative purposes only on the end of crankshaft 18, comprising shoes 30 pivotally mounted on clutch plate 31 and held against outward movement by spring 32. A centrifugal clutch as shown in Patent No. 2,634,770 granted to A. W. Mall may be used in this arrangement. When the engine is brought up to speed by the operator clutch shoes 30 are thrown out to engage the inner surface of drum 28. A throttle trigger in the handle 33 of the engine 10 is provided for controlling engine speed, the entire unit being carried in two hands, with the aid of handle 34 on the attachment.

Figs. 2 and 3 show in detail the reversing mechanism which is employed to reverse the direction of rotation of the impact wrench spindle to permit both running down and loosening of bolts and the like with the unit. Accessible on each side of the attachment housing are levers 35, 36 which through a shifter 37 and fork 38 operate to shift the clutch assembly back and forth along the spindle shaft to engage either bevel gear 23 or bevel gear

24 and cause the spindle shaft 17 to be driven in a forward or reverse direction.

Referring again to Figs. 1 and 2, the impact wrench mechanism portion housed in the head 15 includes an anvil 50 supported in sleeve bearing 51, provided with a terminating section 52 adapted to receive a socket for engaging a bolt, nut, or the like. The anvil 50 has ears 53 which are engaged by face jaws 54 on hammer 55 which is urged forward by spring 56. When a minimum of resistive torque is applied to the anvil 50, such as occurs during the period of running down a nut, the unit operates to drive the socket from the shaft 20 through either bevel gear 23 or bevel gear 24 depending on the direction of rotation, spindle 17, and the clutch formed by face jaws 55 on hammer 54 and ears 53 on anvil 50. But as the resistive torque applied to the anvil 50 increases, a condition normally encountered when the nut begins to seat, the impact clutch operates to cause the hammer to deliver a succession of rotary impacts or blows against the anvil. Cam 57 draws the hammer back out of engagement with the anvil to compress the spring 56 when the resistive torque is increased and comprises balls 58 in inclined opposed grooves 59, 60 which are cut respectively on the peripheral surface of cam member 57 which is locked to the spindle shaft and on the inner surface of hammer 55. In Fig. 2 ball 58 is shown in a portion of the track formed by said opposed grooves. This backward movement of the hammer results when by reason of the resistance to rotation delivered by the anvil member the hammer is caused to retard slightly behind the rotating spindle 17; this relative movement causing the ball cam to draw the hammer out of engagement with the anvil. When the hammer is separated from the anvil all resistance to rotation of the hammer is removed and the hammer jaws ride over the ears on the anvil. The hammer then spins down into engagement with the anvil imparting a rotary blow as it whirls into engagement. This cycle is repeated at high speeds when the nut, bolt or the like is run down toward the end, causing the nut or bolt to be seated as a result of the high torque.

Referring to Figs. 2 and 3 disclosing in detail the reversing arrangement enabling the impact mechanism spindle 17 to be driven alternately in forward or reverse direction, it will be observed right and left hand levers 35, 36 are mounted on the corresponding sides of housing 71 containing the parts making up this assembly. Housing 71 is substantially rectangular in form with an upwardly directed circular flanged opening 72 surrounding jack shaft 20 which is supported in bearing 73 in the opening, and is fastened by bolts 74 or the like at the front to housing 75 which encloses the impact wrench clutch. Bearing 76 supports spindle shaft 17 as it passes through the front of housing 71 and said spindle shaft 17 extends the length (or across) housing 71 to be supported in bearing 77. On this shaft 17 bevel gears 23 and 24 are journalled preferably with bushings 78, 79 interposed to present bearing surfaces. Keyed to prevent rotational but allow axial movement relative to shaft 17 is clutch member 80 which has jaws 81 facing toward bevel gear 23 and similar jaws 82 oppositely arranged facing toward bevel gear 24. Teeth 83, 84 are provided on the adjacent faces of these gears 23, 24 which are engaged by or mesh with the jaws 81, 82 when clutch member 80 is shifted either to the right or left as viewed in Fig. 2 from the neutral position as shown.

Levers 35, 36 are mounted on the ends of shifter 37 which includes rod-like end sections 85, 86 supported in the side walls of housing 71, with a crank center section 87 straddled by fork 38. It will be apparent that by throwing lever 35 (or lever 36) forward or back the crank 87 will swing and move fork member 38 along spindle 17 and thus place one of the bevel gears 23, 24 in driving relation with spindle 17. Member 38 is U-shaped with arms 88 embracing clutch member 80 which is formed as a sleeve sliding on shaft 17 and keyed thereto. Member 80 is moved by fork 38 by means of a strap 89, which as shown in Fig. 2 rides flat in a portion of the circumferential groove formed in member 80, and is provided with a longitudinally extending slot or keyway 91 for key 90 which permits member 80 to move axially to engage jaws 81, 82 alternately with jaws 83, 84 of the bevel gears. Having moved member 80 to the left in Fig. 2 for example, jaw 83 on gear 23 will engage with jaw 81 on sleeve member 80. In turn this sleeve member, which is keyed to spindle 17, will transmit the rotary movement of gear 23 to spindle 17 and to the impact mechanism.

As shown in Figs. 3 and 4 levers 35, 36 may be generally teardrop shaped in plan, having a front wall 92 and a cavity 93 closed by rear wall 94. On rear wall 94 a boss 95 is formed bearing at 96 against the side of housing 71. An opening 97 receives the end of shifter 37 and the lever may be fastened thereto by a pin 98. Spring 99 hooked into a bracket 100 fastened on housing 71 and looped over the bolt 101 provides a snap action to the lever causing the lever and thus the reversing mechainsm to be held positively in either the forward or reverse positions when the lever is tilted to the left or right to the dotted positions as viewed in Fig. 4.

For convenience the impact wrench mechanism may be considered to include the impact clutch housed in head 15 and the reversing mechanism mounted on spindle 17 and contained within housing section 71. Thus the impact wrench mechanism housing comprises the housing portion 71 and housing section 75.

Transmission housing 13 is clamped to the impact mechanism housing by means of a ring 107 (Fig. 5) made up of two semi-circular arms 108, 109 hinged at 110 and locked in place by wing nut 111 on the threaded end of bolt 112 which is provided at the other end with a winged head 113. Compression spring 114 acts to spread the ends of the ring thus simplifying the operation of loosening the clamping ring to the single step of twisting the wing nut a few turns, whereupon the ring automatically opens.

Each arm 108, 109 may be constructed of sheet metal or the like V in section with reversely curved ends 118 seated within a hinge enclosure formed by hook 119 with a U-shaped bracket 120 placed over the central portion of the hook and secured in place by a screw 121. The straight spaced ends of arms 108, 109 are provided with opposed openings 122, through which bolt 112 passes and are spread by spring 114 through which the bolt 112 also passes.

Clamping ring 12 constitutes a feature provided on the gasoline engine 10 which has a flanged opening 115 in the bell shaped section of the crank case surrounded by the ring and in which is centered the crankshaft 18 and centrifugal clutch assembly 28 mounted on the end thereof. As shown particularly clearly in Fig. 2 transmission housing 13 is also provided with a flanged opening 29, and when the crankcase and transmission housings are brought together in the position shown the flanged edges of these openings seat and may be clamped together by ring 12. This ring may be constructed in the same manner as ring 107 of two semi-circular parts hinged at one end 116 and closed at the other by means of a releasable connection 117 or as shown in Figs. 6 may comprise arms 118, 119 held together at their lower end by a threaded bolt and nut connection 120 which may be completely disconnected to disassemble the clamp assembly. Assembly 121 at the other end of the arms is operated by actuator 122 to loosen the clamp. Stud 123 passes through collars 124 mounted on the ends of the arms and compression springs 125 which seat against nuts 127. Springs 125 bear against collars 124 and urge the upper ends of the arms together, tightening the clamp automatically. To relax the clamp actuator 122 is pressed lifting strap 128 to straighten linkage 129 spreading collars 124 and relaxing the clamp.

In Fig. 5 head 15 is shown in solid lines positioned at

90° to the axis of the engine crankshaft and in dotted lines in its normal position and in a position 180° from the full line position. The head **15** may be positioned at any angle throughout the 180° swing as desired and locked in that position by clamping ring **107**. Similarly, referring to Figs. 1 and 2, the transmission housing **13** may be swivelled in the vertical direction about the axis of the joint formed with the end of the crankshaft housing, and the entire attachment thus may be positioned at any angle through the 360° travel allowed at the joint. Clamping ring **12** serves to clamp the parts in the position selected.

Modifications to the invention may be effected without departing from the spirit of the invention as defined in the following claims.

I claim:

1. A portable power tool comprising a gasoline engine having an engine shaft, an engine housing, and an impact wrench attachment for said engine including, a transmission housing clamped on said engine housing, a transmission shaft journalled in said transmission housing, a driving connection between the engine shaft and the transmission shaft, an impact mechanism housing fastened on said transmission housing, an impact mechanism having a terminating section adapted to receive a work engaging member and operably mounted in said impact mechanism housing, and a reversing coupling between the transmission shaft and said impact mechanism enabling the work engaging member to be driven in opposite directions.

2. A portable power tool comprising a gasoline engine having an engine shaft, an engine housing, and an impact wrench attachment for said engine including, a transmission housing clamped on said engine housing, a transmission shaft journalled in said transmission housing, a driving connection between the engine shaft and the transmission shaft, an impact mechanism housing fastened on said transmission housing, an impact mechanism having a terminating section adapted to receive a work engaging member and operably mounted on said impact mechanism housing, and a reversing coupling between said transmission shaft and said impact mechanism comprising members driven from said transmission shaft in opposite directions and arranged to be selectively engaged with said impact mechanism enabling the work engaging member to be driven in opposite directions.

3. A portable power tool comprising, a gasoline engine having an engine shaft, an engine housing having a bell-shaped section, the end of said engine shaft being centered in the mouth of the bell, and an impact wrench attachment for said engine including, a transmission housing mounted on the engine housing, said transmission housing formed with an opening surrounded by an annular rim to be clamped on the bell-shaped section of said engine housing allowing the transmission housing to be swivelled relative to the engine housing, transmission shafting journalled in the transmission housing terminating in said opening, a driving connection between said engine shaft and said transmission shafting, an impact mechanism housing mounted on said transmission housing, an impact mechanism having a terminating section adapted to receive a work engaging member, and a coupling between said transmission shafting and said impact mechanism.

4. A portable gasoline engine tool comprising a motor having an engine shaft, an engine housing having a bell-shaped section provided with a flanged rim, the end of said engine shaft being centered in the mouth of the bell, a clamping ring arranged around the rim, and an impact wrench attachment for said engine including a transmission housing mounted on the engine housing, said transmission housing having a flanged opening formed to be fastened by said clamp against the flanged rim of the bell-shaped section of the engine housing allowing the transmission housing to be swivelled relative to the engine housing, transmission shafting journalled in the transmission housing, a driving connection between said engine shaft and said transmission shafting, an impact mechanism housing mounted on said transmission housing, an impact mechanism having a terminating section adapted to receive a work engaging member, and a reversing coupling between said transmission shafting and said impact mechanism comprising members driven in opposite directions and arranged to be selectively engaged with said impact mechanism enabling said work engaging member to be driven in opposite directions.

5. A portable power tool comprising a gasoline engine having an engine shaft, an engine housing, and an impact wrench attachment for said engine including, an impact mechanism having a terminating section adapted to receive a work engaging member, a spindle, and an impact clutch coupling the spindle and the terminating section, a housing for said impact mechanism, a transmission connecting the engine and the impact mechanism comprising a transmission shaft, a driving connection between the engine shaft and said transmission shaft, and a reversing clutch coupling said transmission shaft and said spindle enabling the work engaging member to be driven in opposite directions, and a housing for said transmission fastened to said impact mechanism housing and fastened to said engine housing by clamps allowing said housings to swivel relative to each other.

6. A portable power tool comprising a gasoline engine having an engine shaft, an impact wrench attachment for said engine including a terminating section adapted to receive a work engaging member, a spindle, an impact clutch coupling the spindle and the work engaging member, and a transmission shaft, said spindle being angularly and adjustably disposed relative to the transmission shaft with the axes of said shafts intersecting, and a driving connection between the spindle and the transmission shaft, said transmission shaft being angularly and adjustably disposed relative to said engine shaft, the axes of said shafts intersecting and said shafts having a driving connection therebetween.

7. A portable power tool comprising a gasoline engine having an engine shaft, an engine housing, an impact wrench attachment for said engine, including a transmission housing clamped on said engine housing to be adjustable about the axis of the engine shaft, a transmission shaft mounted in said transmission housing at an angle relative to the engine shaft, driving means between the engine shaft and the transmission shaft, an impact mechanism including a spindle disposed at an angle to the transmission shaft, and a coupling between the transmission shaft and the spindle, said impact mechanism including a terminating section adapted to receive a work engaging member and an impact clutch coupling the spindle and the terminating section.

References Cited in the file of this patent

UNITED STATES PATENTS

650,190	Petrelli	May 22, 1900
930,431	Stewart	Aug. 10 1909
1,507,620	Oppenheimer	Sept. 9, 1924
2,348,266	Selby	May 9, 1944