Jan. 2, 1962 J. P. NEWMAN 3,015,244

ROTARY IMPACT HAMMER

Filed April 19, 1956 2 Sheets-Sheet 1

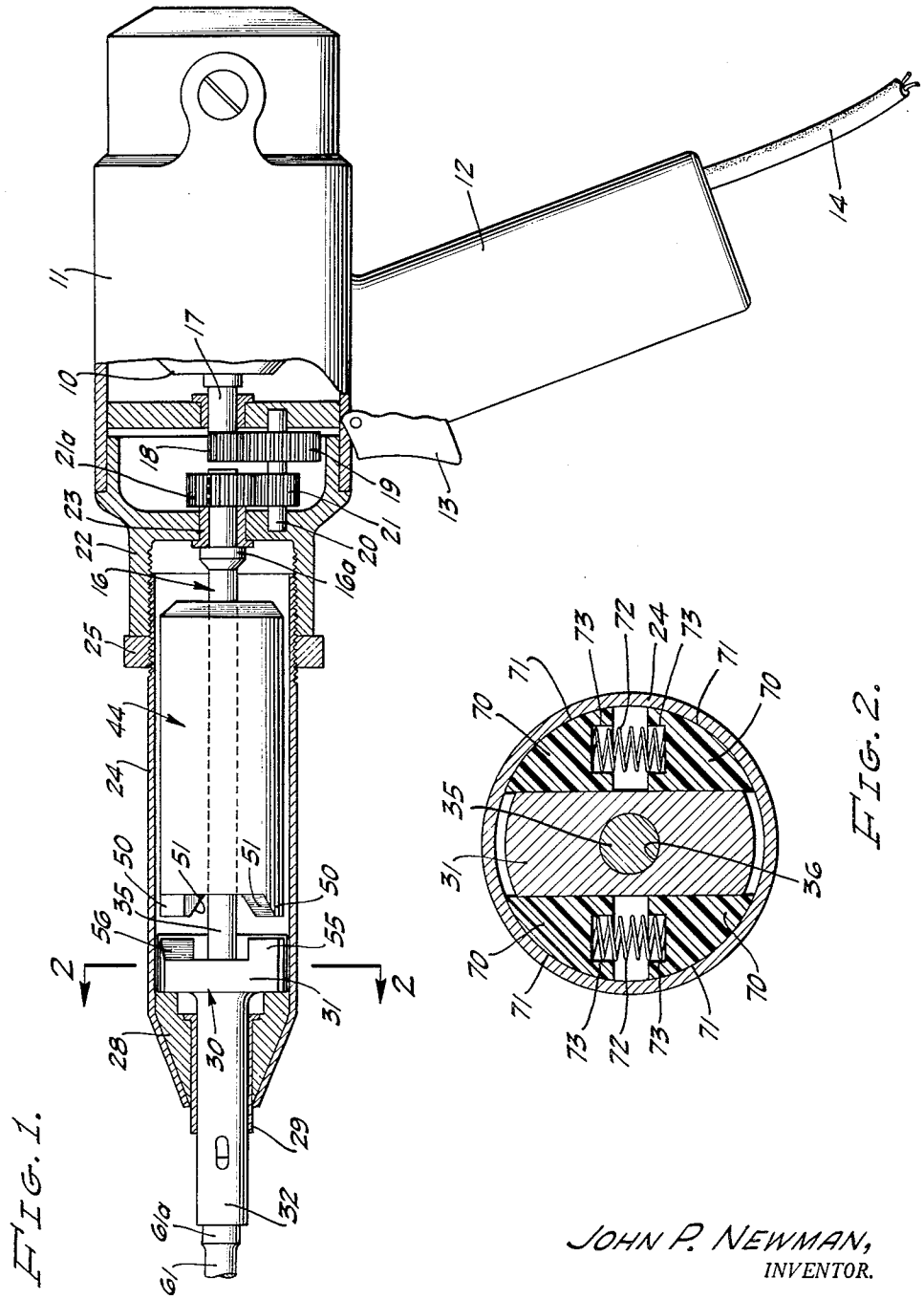


FIG. 1.

FIG. 2.

JOHN P. NEWMAN,
INVENTOR.

BY Lyon & Lyon
ATTORNEYS.

Jan. 2, 1962 J. P. NEWMAN 3,015,244

ROTARY IMPACT HAMMER

Filed April 19, 1956 2 Sheets-Sheet 2

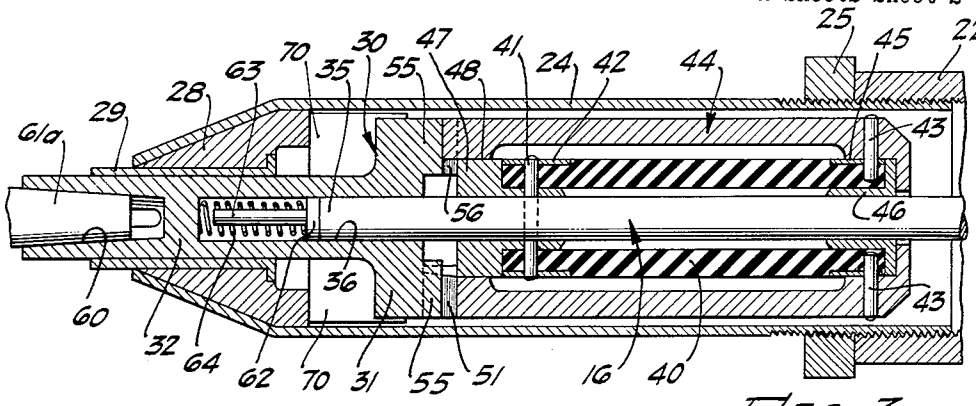


FIG. 3.

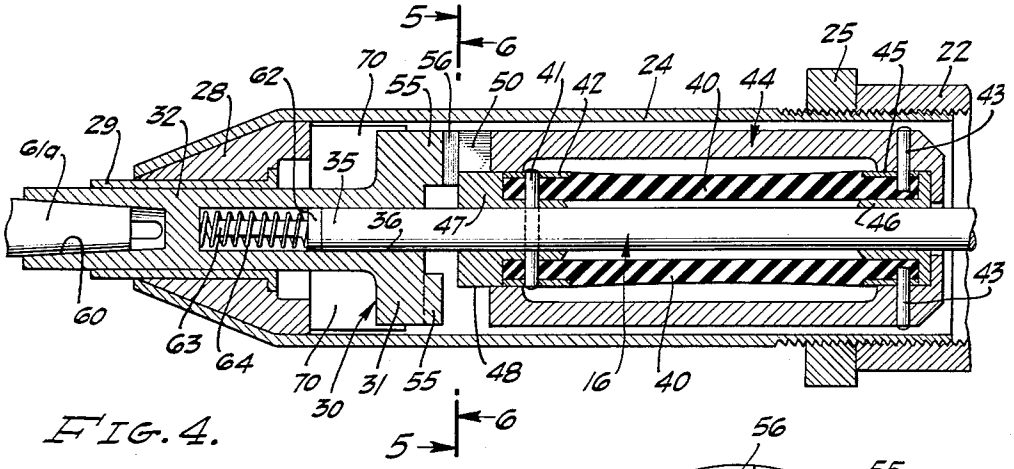


FIG. 4.

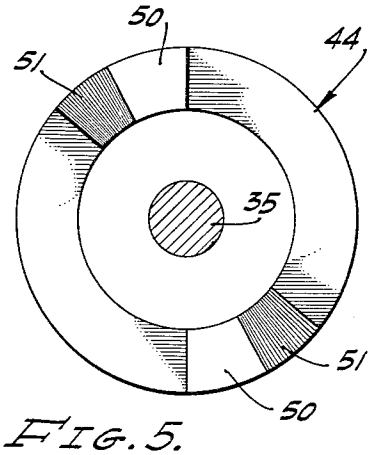


FIG. 5.

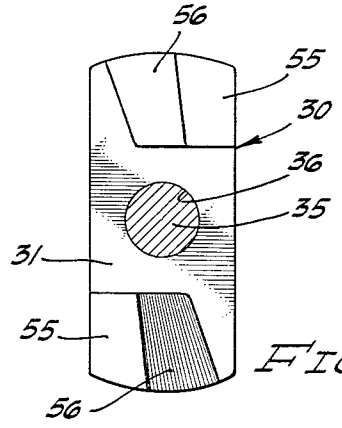


FIG. 6.

JOHN P. NEWMAN,
INVENTOR.

BY Lyon & Lyon

ATTORNEYS.

United States Patent Office 3,015,244 Patented Jan. 2, 1962

3,015,244

ROTARY IMPACT HAMMER

John P. Newman, 821 S. Raymond Ave., Alhambra, Calif.

Filed Apr. 19, 1956, Ser. No. 579,231
8 Claims. (Cl. 81—52.3)

This invention relates to percussive tools and has particular reference to a new and original form of impact hammer.

One of the principal objects of this invention is to provide a power driven impact hammer having novel means for intermittently connecting and disconnecting the driver member from the power driven drive shaft.

Another object of this invention is to provide a power driven impact hammer having novel means for translating the rotary movement of the drive shaft into longitudinal movement of the tool-holding driver member.

Another object of this invention is to provide a power driven impact hammer having means for varying the force of the impacts in response to the amount of force with which the tool is applied to the work by the operator.

Another object of this invention is to provide a power driven, portable impact hammer which is of an extremely simple construction permitting an inexpensive and rugged structure.

Another important object of this invention is to provide an impact hammer of the kind that is adapted to operate a star drill where axial blows are applied with a limited rotative shifting of the drill.

Other objects and advantages of this invention it is believed will be readily apparent from the following detailed description of a preferred embodiment thereof when read in connection with the accompanying drawings.

In the drawings:

FIGURE 1 is a side elevation, partly in section, of an impact hammer embodying the invention.

FIGURE 2 is a sectional elevation taken substantially on the line 2—2 of FIGURE 1.

FIGURE 3 is a fragmentary vertical sectional elevation, on an enlarged scale, of the power transmission assembly.

FIGURE 4 is a view similar to FIGURE 3, but illustrating the hammer in disengaged position.

FIGURE 5 is a sectional elevation taken substantially on the line 5—5 of FIGURE 4.

FIGURE 6 is a sectional elevation taken substantially on the line 6—6 of FIGURE 4.

For purposes of disclosure the invention is disclosed in this application as embodied in an impact hammer of the percussive type whereby a tool, such as a star drill, may be subjected to a succession of axial blows and at the same time shifted to a limited extent in a rotative direction so as to assure proper star drill operation. Thus, this invention comprises a power driven impact hammer including a driver hammer element and an anvil member operated upon by the hammer element, the hammer being connected to the drive shaft by means of a rubber-like cylinder operably connected to the shaft and which is adapted to be placed in torsion to store energy. It has been found that a rubber-like cylinder or sleeve utilized in the impact hammer of this invention, elongates when placed in torsion, the degree of elongation being dependent upon the amount of twisting undergone by the cylinder or sleeve. This phenomenon is utilized in causing the hammer element to be intermittently disengaged from and engaged with the anvil member. As the rubber-like member elongates, it moves the hammer element in a direction away from the anvil member until the hammer element becomes disengaged therefrom, whereupon the energy stored in the rubber-like member is released to cause a rapid rotation of the rubber-like member and hence of the hammer element. The rubber-like member thereupon returns to its original dimensions and thereby

moves the hammer element into engagement with the anvil member causing the hammer to strike the anvil member a sharp blow which is transmitted into longitudinal motion of the anvil member by means of cooperating cam surfaces on the anvil member and the hammer element. Brake means are also provided for limiting rotational movement of the anvil member. The anvil member and the tool-holding driver member attached thereto are axially movable relative to the hammer element so that the magnitude of the hammer blows may be varied.

Referring now to the drawings, the impact hammer embodying this invention may be provided with an electric motor 10 suitably mounted in a housing 11. A downwardly extending handle portion 12 on the housing 11 is proportioned to be received within the palm of the hand of the user and a trigger element 13 pivotally mounted on the handle portion is adapted to operate a control switch (not shown) for regulating the operation of the electric motor 10. Electrical current for the motor is transmitted through the cable 14 which depends from the underside of the handle portion 12. It is to be understood that an air driven motor may be substituted for the electric motor if desired, since the particular type of power means employed for turning the drive shaft does not constitute an important part of the invention.

Reduction gearing may be provided for driving the drive shaft 16 from the motor shaft 17, and as shown in the drawings, this gearing may include the small pinion 18 on the motor shaft engaged with a gear 19 on the counter shaft 20. A pinion 21 also fixed on the counter shaft engages the larger driven gear 21*a* which is keyed to the drive shaft. The housing 11 provides suitable bearings for the motor shaft 17. Secured to the forward end of the housing is a cover member 22 provided with a central bearing 23 for the rearward end of the drive shaft 16. As shown, the drive shaft is provided with a shoulder 16*a* which abuts against the face plate of the bearing 23, preventing rearward thrust of the drive shaft.

A cylindrical housing or shell 24 is threadedly engaged at the rearward end thereof with internal threads on the cover member 22. A lock nut element 25 is provided to maintain the housing extension 24 in the desired position with respect to the cover member 22. The forward projecting end of the housing extension or shell 24 is connected by any suitable means to the bearing 28, which is provided with a bearing sleeve 29. The anvil member 30 includes a flange or anvil portion 31 and a cylindrical driver member 32 journaled in the bearing sleeve 29.

The drive shaft 16 extends axially through the shell 24 and its outer end 35 extends into a counter-bore 36 provided in the anvil member 30. A resilient rubber or rubber-like drive sleeve 40 encircles the drive shaft 16 for a portion of the length thereof and is connected at its forward end in driven relationship with the drive shaft 16 by means of the pin connection 41. The outer ends of the pin 41 extend through a cylindrical reinforcement 42 secured to the sleeve. The rearward end of the sleeve 40 is connected by means of the pins 43 to the rearward end of a hammer member 44 which is rotatably mounted within the shell 24, the pins 43 extending through a cylindrical reinforcement element 45.

A bearing member 46 extends about the inner periphery of the rearward end of the sleeve 40, and contacts the drive shaft 16 to permit relative rotation between the drive shaft 16 and the rearward end of the sleeve 40. A bearing member 47 is secured to the drive shaft 16 and the sleeve 40 by means of the pin 41 and is provided with a cylindrical bearing surface 48 rotatably supporting the forward end of the hammer 44. It will be noted that since the sleeve 40 is constructed of rubber or rubber-like material, the rearward end of the sleeve and also

the hammer may be driven by the shaft **16** but are capable of angular movement with respect thereto.

The hammer member **44** is provided at its forward end with a pair of protruding cam elements **50** disposed 180° apart, each having a cam surface **51** lying in a plane intersecting and inclined at an angle with respect to to the axis of the hammer member. The flange portion **31** of the anvil member **30** is generally rectangular and is provided with a pair of oppositely disposed projections **55**, each having a cam surface **56** lying in a plane intersecting the anvil member axis at the same angle as the planes of the cam surfaces **51** so that the surfaces **51** and **56** are adapted to mate when the hammer member and anvil member are properly aligned. It will be understood that during mutual contact between these cam surfaces and upon rotation of the hammer member relative to the anvil member, the angular disposition of the contacting cam surfaces will cause the anvil member to be simultaneously rotated and moved longitudinally. The relative amounts of each rotational and linear movement will depend upon the angle of inclination of the cam surfaces. Preferably, this angle is about 45° with respect to the axis of the respective hammer and anvil members.

The forward end of the driver member **32** projects from the bearing sleeve **29** and is provided with a tapered central bore or socket **60** for the reception of the shank **61***a* of the work-contacting percussive tool proper, which may take the form of a chisel **61** or any other desired tool.

Abutting the forward end of the drive shaft **16** is a stop pin comprising a head portion **62** and a reduced portion **63**. A helical spring **64** is provided in the counter bore **36** and is under compression to normally maintain the flange portion **31** in abutting relationship with the end face of the bearing **28**. (See FIGURE 1.)

Means are provided for limiting the speed of rotation of the anvil member **30** and as shown in the drawings these means may include two pairs of brake shoes **70**, preferably of plastic such as "nylon," one pair on each side of the flange portion **31**. Each shoe is provided with an arcuate brake surface **71** conforming to the inner surface of the cylindrical housing **24**. The surfaces **71** are maintained in contact with the inner surface of the housing by means of spring elements **72**, one for each pair of shoes, seated in suitable recesses **73** in the shoes.

In operation of the device embodying the invention, the drive shaft **16** is turned by the motor **10** through the reduction gearing described above. With the device in the position shown in FIGURE 1, the cam elements **50** are out of engagement with the cam elements **55**, so that the drive shaft **16**, drive sleeve **40** and hammer member **44** all rotate as a unit without affecting the anvil member **30** and its associated parts. However, upon application of the chisel **61** or other tool to the work by the operator, forward movement of the impact hammer relative to the chisel will cause the cam elements **50** and **55** to become engaged as shown in FIGURE 3.

The resistance to rotation and longitudinal motion of the anvil member **30** afforded by the brake shoes **70** and the forward pressure exerted by the operator, respectively, cause the angular velocity of the hammer member **44** to be reduced. In turn, the speed of rotation of the rearward end of the drive sleeve **40** will be reduced, since it is connected to the rearward end of the hammer member. However, the forward end of the drive sleeve **40** is rigidly connected to the drive shaft **16** and hence this portion of the drive sleeve **40** will be rotated at the same speed as the shaft, i.e., a faster rate of speed than the rearward end of the sleeve. The drive sleeve will accordingly be twisted or placed in torsion an amount dependent upon the degree of relative movement between the hammer **44** and the drive shaft **16**.

As the sleeve **40** is twisted the longitudinal dimension thereof increases, causing the rearward end of the sleeve to move relative to the drive shaft **16** and housing extension **24** in a rearward direction, thus also moving the hammer **44** in the same direction. This movement continues until the cam elements **50** have been moved out of engagement with the mating cam elements **55**, as shown in FIGURE 4. At this instant, the sleeve **40** is freed of any forces tending to maintain it in torsion, and the energy thereby stored in the sleeve is released, causing the rearward portion of the sleeve to be rotated rapidly at a speed greater than the speed of the drive shaft **16**. With the release of this energy, the longitudinal dimension of the sleeve **40** is reduced to the original magnitude as shown in FIGURE 3, and the cam elements are again engaged. The hammer **44** has a relatively large mass and accordingly, the cam elements **50** strike the anvil cam elements **55** with a sharp blow or impact. Continued holding of the tool **61** on the work causes a repetition of the above described cycle of storage of energy in the sleeve **40**, disengagement of the hammer from the anvil, release of the energy stored in the sleeve and subsequent engagement of the hammer with the anvil together with the impact therebetween. During these cycles, the majority of the rotational movement of the hammer member is absorbed by the brake shoes **70** so that the anvil and the tool **61** are caused to rotate very slowly with respect to the speed of the drive shaft **16**. However, the succession of impacts causes the anvil and tool **61** to be repeatedly projected forwardly to impact a succession of hammer blows upon the work through the tool **61**.

The magnitude of the individual impacts transmitted to the anvil member may be varied by the operator simply by increasing or decreasing the longitudinal force he applies to the tool. By so doing, he causes a change in the position of the anvil member relative to the hammer member. Thus, the longitudinal amount of surface contact between the respective cam elements **50** and **55** may be respectively increased or reduced. If a greater magnitude of impacts is desired, the operator follows the natural inclination to press harder on the work with the impact hammer. By so doing, the anvil member and its associated parts are moved in a direction toward the hammer member and its related parts, thus providing a greater longitudinal surface contact between the respective cam elements. Accordingly, a greater amount of twisting of the sleeve **40** is required in order to cause an elongation of the sleeve sufficient to move the cam elements out of contact with each other. Therefore, a greater amount of energy is stored in the sleeve **40**, causing a greater impact. If, on the other hand, a lesser impact is desired, the operator simply uses less pressure on the tool, again the natural thing to do, and a smaller area of contact between the cam elements is provided, ultimately resulting in a lesser impact.

The outer end of the reduced portion **63** of the stop pin functions as a stop to limit movement of the anvil member and its associated parts in the direction toward the hammer member in order to prevent damage to the sleeve **40** which might occur due to the exertion of excessive force by the operator.

Having fully described my invention, it is to be understood that I do not wish to be limited to the details set forth, but my invention is of the full scope of the appended claims.

I claim:

1. In an impact hammer, the combination of a drive shaft, an anvil member mounted coaxially on the drive shaft for rotational and longitudinal movement with respect thereto, power means for rotating the drive shaft, a hammer member rotatably mounted coaxially of the drive shaft, a cylindrical resilient driving member adapted to rotate the hammer member and driven from the drive shaft, cooperating means on said hammer member and other means on said anvil member for releasable engagement therebetween, said means including cam surfaces

arranged to impart both rotational and longitudinal motion to said anvil member, brake means operably connected to said anvil member for limiting the speed of rotation of said anvil member, means for connecting one end of the resilient driving member to the drive shaft, and means for connecting the other end of the resilient driving member to the hammer member so that upon relative roational movement between the hammer member and the drive shaft the resilient driving member is twisted and thereby elongated to move the hammer member out of engagement with the anvil member.

2. In an impact hammer, the combination of a drive shaft, an anvil member mounted coaxially on the drive shaft for rotational and longitudinal movement with respect thereto, power means for rotating the drive shaft, a hammer member rotatably mounted coaxially of the drive shaft, a cylindrical resilient driving member adapted to rotate the hammer member and driven from the drive shaft, cooperating means on said hammer member and other means on said anvil member for releasable engagement therebetween, said means including cam surfaces arranged to impart both rotational and longitudinal motion to said anvil member, brake means operably connected to said anvil member for limiting the speed of rotation of said anvil member, means for connecting to the hammer member the end of the resilient driving member most remote from the cooperating means, and means for connecting the other end of the resilient driving member to the drive shaft so that upon relative rotational movement between the hammer member and the drive shaft the resilient driving member is twisted and thereby elongated to move the hammer member out of engagement with the anvil member.

3. In an impact hammer, the combination of a drive shaft, an anvil member mounted coaxially on the drive shaft for rotational and longitudinal movement with respect thereto, power means for rotating the drive shaft, a hammer member rotatably mounted coaxially of the drive shaft, a cylindrical resilient driving sleeve adapted to rotate the hammer member and driven from the drive shaft, cooperating means on said hammer member and other means on said anvil member for releasable engagement therebetween, said means including cam surfaces arranged to impart both rotational and longitudinal motion to said anvil member, brake means operably connected to said anvil member for limiting the speed of rotation of said anvil member, means for connecting one end of the resilient driving sleeve to the drive shaft, and means for connecting the other end of the resilient driving sleeve to the hammer member so that upon relative rotational movement between the hammer member and the drive shaft the resilient driving sleeve is twisted and thereby elongated to move the hammer member out of engagement with the anvil member.

4. In an impact hammer, the combination of a drive shaft, an anvil member mounted coaxially on the drive shaft for rotational and longitudinal movement with respect thereto, power means for rotating the drive shaft, a hammer member rotatably mounted coaxially of the drive shaft, a cylindrical resilient driving sleeve adapted to rotate the hammer member and driven from the drive shaft, cooperating means on said hammer member and other means on said anvil member for releasable engagement therebetween, said means including cam surfaces arranged to impart both rotational and longitudinal motion to said anvil member, brake means operably connected to said anvil member for limiting the speed of rotation of said anvil member, means for connecting to the hammer member the end of the resilient driving sleeve most remote from the cooperating means, and means for connecting the other end of the resilient driving sleeve to the drive shaft so that upon relative rotational movement between the hammer member and the drive shaft the resilient driving sleeve is twisted and thereby elongated to move the hammer member out of engagement with the anvil member.

5. In an impact hammer, the combination of a drive shaft, an anvil member mounted coaxially on the drive shaft for rotational and longitudinal movement with respect thereto, power means for rotating the drive shaft, a hammer member rotatably mounted coaxially of the drive shaft, a cylindrical resilient driving member adapted to rotate the hammer member and driven from the drive shaft, cooperating means on said hammer member and other means on said anvil member for releasable engagement therebetween, said means including cam surfaces arranged to impart both rotational and longitudinal motion to said anvil member, brake means operably connected to said anvil member for limiting the speed of rotation of said anvil member, means for connecting one end of the resilient driving member to the drive shaft, means for connecting the other end of the resilient driving member to the hammer member so that upon relative rotational movement between the hammer member and the drive shaft the resilient driving member is twisted and thereby elongated to move the hammer member out of engagement with the anvil member, and means for limiting the longitudinal movement of the anvil member in a direction toward the hammer member.

6. In an impact hammer, the combination of a cylindrical housing, a drive shaft in said housing, an anvil member mounted coaxially on the drive shaft for rotational and longitudinal movement with respect thereto, power means for rotating the drive shaft, a hammer member rotatably mounted coaxially of the drive shaft, a cylindrical resilient driving member adapted to rotate the hammer member and driven from the drive shaft, cooperating means on said hammer member and other means on said anvil member for releasable engagement therebetween, said means including cam surfaces arranged to impart both rotational and longitudinal motion to said anvil member, brake means for limiting the speed of rotation of said anvil member, said brake means including a plurality of brake shoes having surfaces frictionally contacting the inner surface of said housing, means for connecting one end of the resilient driving member to the drive shaft, and means for connecting the other end of the resilient driving member to the hammer member so that upon relative rotational movement between the hammer member and the drive shaft the resilient driving member is twisted and thereby elongated to move the hammer member out of engagement with the anvil member.

7. In an impact hammer, the combination of a cylindrical housing, a drive shaft in said housing, an anvil member mounted coaxially on the drive shaft for rotational and longitudinal movement with respect thereto, power means for rotating the drive shaft, a hammer member rotatably mounted coaxially of the drive shaft, a cllindrical resilient driving member adapted to rotate the hammer member and driven from the drive shaft, cooperating means on said hammer member and other means on said anvil member for releasable engagement therebetween, said means including cam surfaces arranged to impart both rotational and longitudinal motion to said anvil member, brake means for limiting the speed of rotation of said anvil member, said brake means including a plurality of brake shoes having surfaces frictionally contacting the inner surface of said housing, means for connecting to the hammer member the end of the resilient driving member most remote from the cooperating means, and means for connecting the other end of the resilient driving member to the drive shaft so that upon relative rotational movement between the hammer member and the drive shaft the resilient driving member is twisted and thereby elongated to move the hammer member out of engagement with the anvil member.

8. In an impact hammer, the combination of a cylindrical housing, a drive shaft in said housing, an anvil

member mounted coaxially on the drive shaft for rotational and longitudinal movement with respect thereto, power means for rotating the drive shaft, a hammer member rotatably mounted coaxially of the drive shaft, a cylindrical resilient driving member adapted to rotate the hammer member and driven from the drive shaft, cooperating means on said hammer member and other means on said anvil member for releasable engagement therebetween, said means including cam surfaces arranged to impart both rotational and longitudinal motion to said anvil member, brake means for limiting the speed of rotation of said anvil member, said brake means including a plurality of brake shoes having surfaces frictionally contacting the inner surface of said housing, means for connecting one end of the resilient driving member to the drive shaft, means for connecting the other end of the resilient driving member to the hammer member so that upon relative rotational movement between the hammer member and the drive shaft the resilient driving member is twisted and thereby elongated to move the hammer member out of engagement with the anvil member, and means for limiting the longitudinal movement of the anvil member in a direction toward the hammer member.

References Cited in the file of this patent

UNITED STATES PATENTS

1,104,064	McKnight	July 21, 1914
2,012,916	Pott	Aug. 27, 1935
2,049,273	Pott	July 28, 1936
2,158,303	Pott	May 16, 1939
2,476,632	Shaff	July 19, 1949
2,533,703	Wilhide et al.	Dec. 12, 1950
2,733,621	Newman	Feb. 7, 1956