Jan. 25, 1966 W. DUBILIER 3,230,781

AUTOMATIC IMPACT ASSEMBLY

Filed Nov. 9, 1962 3 Sheets-Sheet 1

Fig. 1.

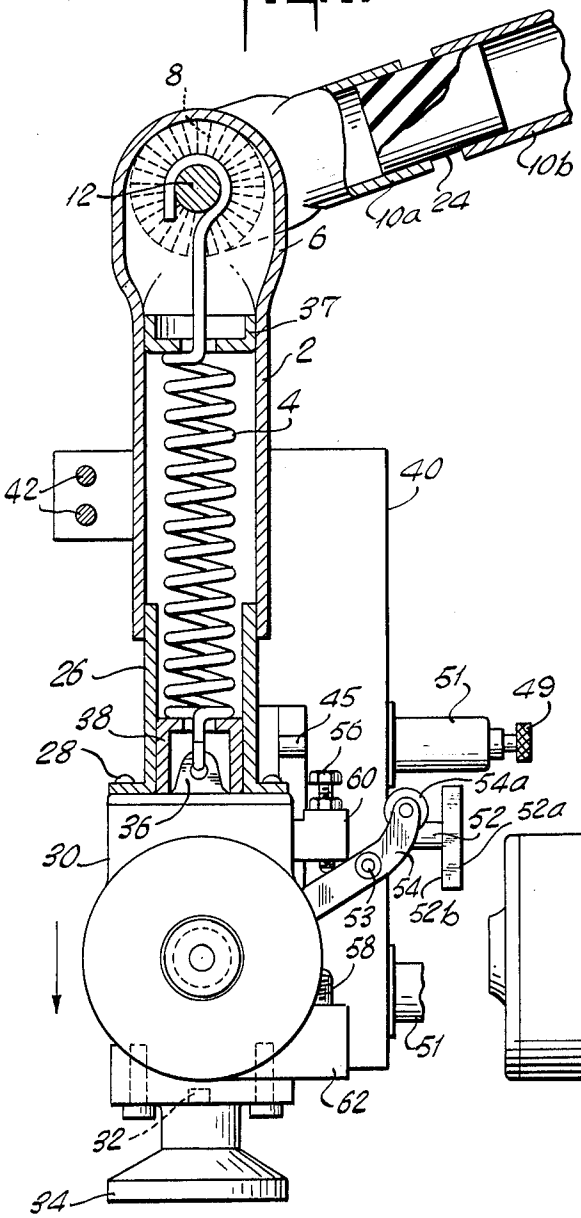
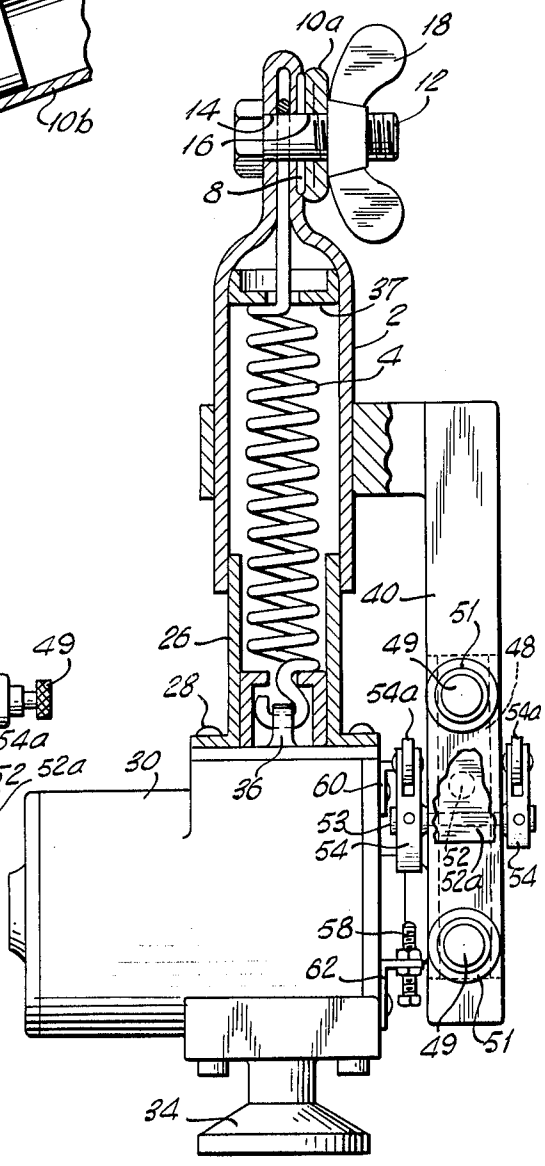


Fig. 2.



INVENTOR.
WILLIAM DUBILIER
BY John M. Pease
ATTORNEY

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Fig. 3.

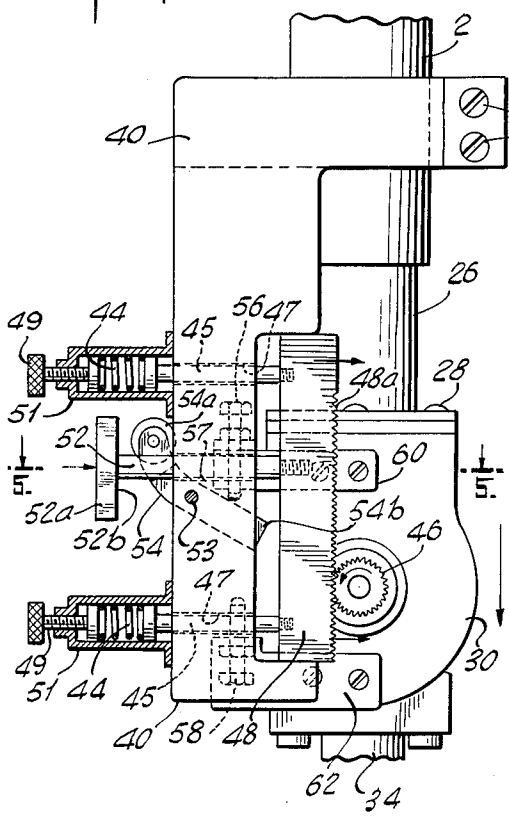
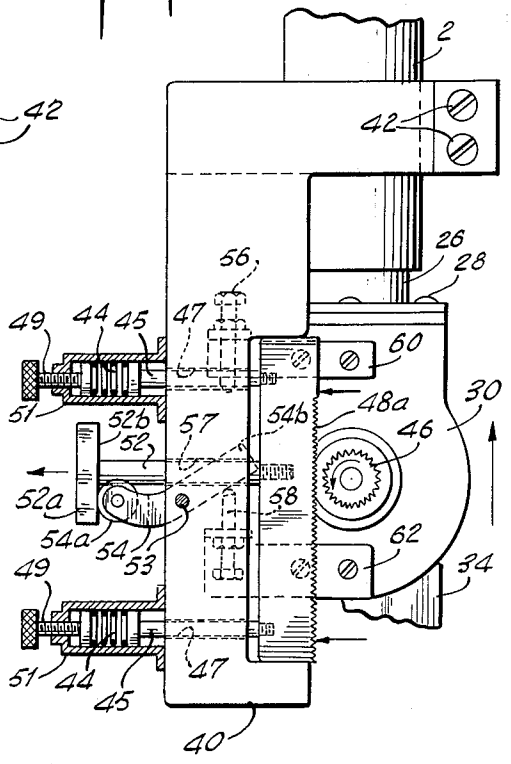


Fig. 4.



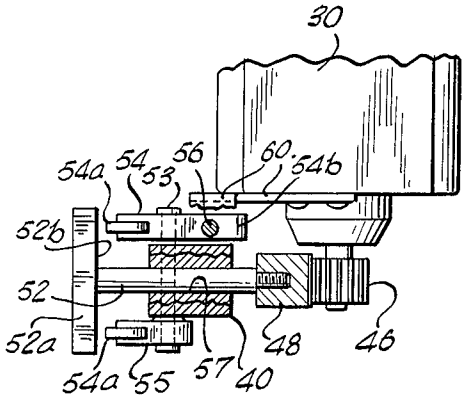


Fig. 5.

INVENTOR
WILLIAM DUBILIER
BY John M. Pearce
ATTORNEY

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AUTOMATIC IMPACT ASSEMBLY

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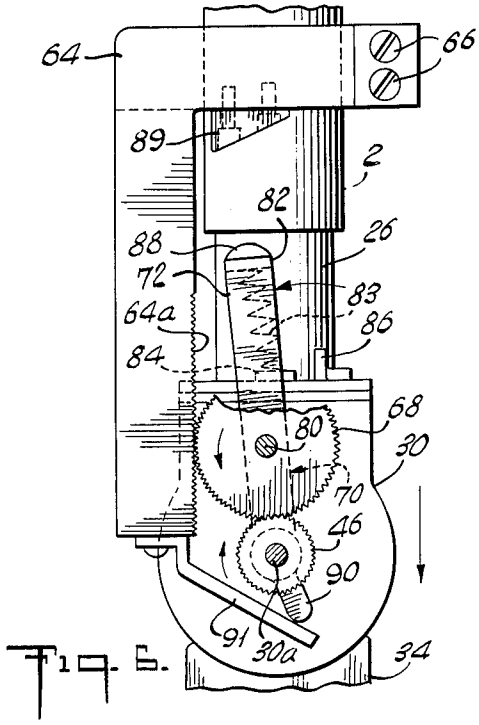


Fig. 6.

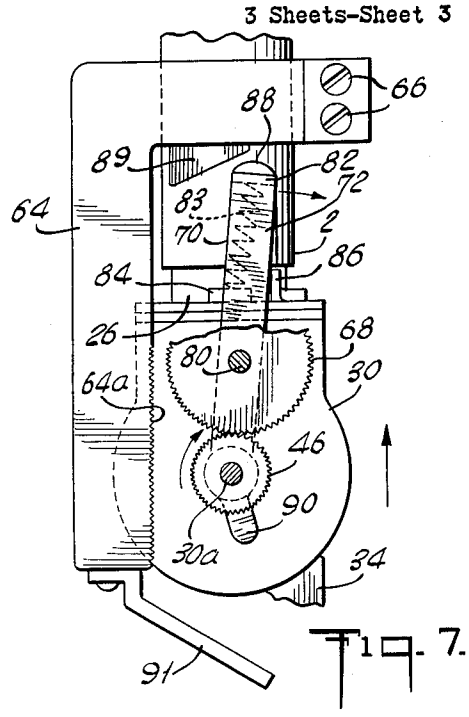


Fig. 7.

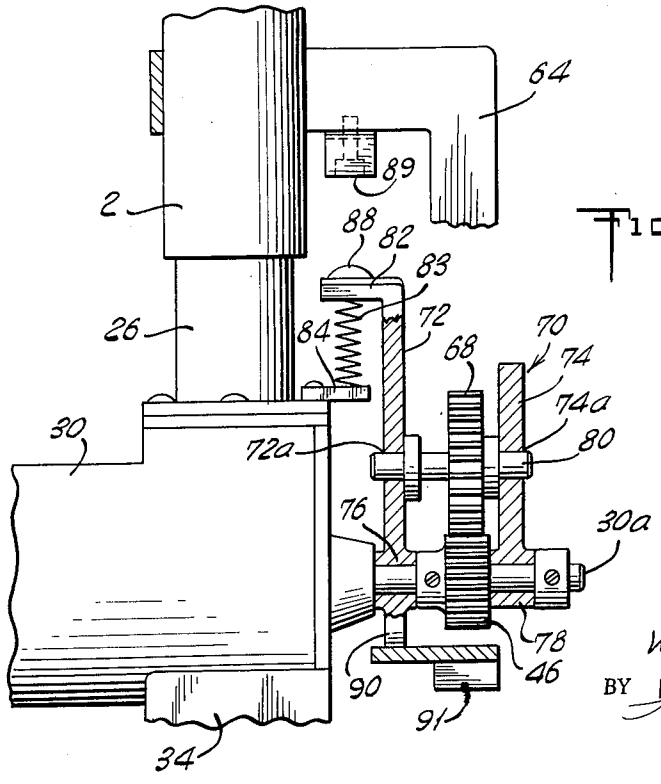


Fig. 8.

INVENTOR.
WILLIAM DUBILIER
BY John M. Pearce
ATTORNEY

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3,230,781

AUTOMATIC IMPACT ASSEMBLY

William Dubilier, 72 Esplanade, New Rochelle, N.Y.

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8 Claims. (Cl. 74—30)

This invention relates to automatically operable mechanical hammers or power operable impact assemblies and, more particularly, to a novel construction for portable power-operated hammers for driving garden stakes, fence posts and other relatively light and varied work.

Prior efforts in this field have normally been designed for heavy duty work relating to a particular application or endeavor and, apart from inherent limitations as to mobility, excessive weight and bulk, have generally been of a complicated and costly construction. Most, if not all, prior efforts in this field have been characterized by utilization of a displaceable heavy impact member and auxiliary impact member displacing means for effecting displacement of said impact member with said auxiliary impact member displacing means being of a required size, weight, bulk and power capacity to effect the required displacement of the impact member.

This invention may be briefly described as an improved construction for a mechanical and automatically operable hammer which includes, in its broad aspects, the incorporation of the impact member displacing means into integral relation with the impact member so as to be displaceable in conjunction therewith.

Other aspects of the invention include the incorporation of energy storage means to supplement the momentum of the impact member and impact member displacing means during selective directional displacements thereof and the incorporation, in a portable unit, of shock absorbing means in the handle member therefor.

Among the advantages attendant the subject invention is the permitted utilization of the weight of the impact member displacing means to supplement the weight of the impact member itself with attendant marked reductions in cost, size, weight and complexity of the component elements thereof.

An object of this invention is to provide an automatic hammer that is simple in construction and efficient in operation.

Another object is to provide an improved automatic hammer having maximum driving effect for minimum weight, bulk and power input.

Another object is to provide an improved hammer usable as a portable common tool for substantially any light weight driving and similar impact applications.

Still another object is to provide an improved automatic hammer which may be applied to the work from any angle and which is also sufficiently small such that in many applications it may be projected through an opening to reach an object to be driven.

A further object is to provide an automatic power-driven hammer having simple inexpensive means to reduce vibrations passed to the handle by which the hammer is supported when necessary.

All of the foregoing and still further objects and advantages of the invention will be apparent to those skilled in the art from the following specifications and claims, taken in conjunction with the accompanying drawings, which illustrate, by way of example, certain presently preferred embodiments of the invention and wherein:

FIGURE 1 is a front elevational view showing a preferred embodiment of the invention;

FIGURE 2 is an elevational view taken from the right side of FIGURE 1;

FIGURE 3 is a fragmentary rear view of the device in drive position corresponding to FIGURE 1;

FIGURE 4 is a fragmentary rear view showing the various parts in a disengaged position of the drive mechanism;

FIGURE 5 is a fragmentary plan view taken on line 5—5 of FIGURE 3;

FIGURE 6 is a fragmentary view of an alternative embodiment of the invention showing the parts in drive position;

FIGURE 7 is a fragmentary view corresponding to FIGURE 6 showing the parts in a disengaged position of the drive mechanism; and

FIGURE 8 is a fragmentary end elevational view with parts broken away and parts in section.

Briefly, in the illustrated preferred embodiment of a portable, lightweight unit incorporating the principles of the invention there is provided a fixed guide housing, a displaceable impact or hammer assembly slidably mounted in the guide housing and including a hammer or impact member and an impact member displacing means including a prime mover drive means. Also provided is energy storage spring means positioned in the guide housing to supplement the momentum of the displaceable impact or hammer assembly during the drive stroke, means for automatically and selectively coupling and decoupling the impact or hammer assembly means to the guide housing to effect directional displacement of said impact assembly, and handle means incorporating a shock absorbing element, for supporting and manipulating said unit.

Referring now to FIGURES 1 and 2 of the drawings, there is provided an elongated hollow guide housing **2** adapted to receive a compression spring **4** and flattened at its upper end **6** and serrated on both faces to form gripping surfaces. A hollow tubular handle **10** is formed of sections **10***a* and **10***b*. One end of section **10***a* is flattened and serrated on both sides to form gripping surfaces **8**. The adjacent serrated faces of the flattened ends of the housing and handle are clamped together by suitable means such as a bolt **12** passing through aligned apertures **14** and **16** in the flattened end pieces, a wing nut **18** being secured to the bolt **12**. Thus, the handle **10** may be secured to the upper end of the housing **2** in any angular relation about the axis of the bolt **12**. Also, if desired for further resistance to angular movement of the handle with respect to the housing **2** a plurality of alignable apertures may be formed in the flattened end pieces to receive, through the aligned apertures, a lock pin.

The remainder of the handle **10**, i.e., section 10_b is secured to the section 10_a by a shock resistant means which in FIGURE 1 is shown as a plastic plug section **24**, having some flexibility and resiliency. The plastic plug may be press fit into the adjacent open ends of the handle sections 10_a and 10_b and a screw may be used if desired for a more secure connection. A plurality of plug sections may be used if desired to further dampen shock waves. Also in some applications a tightly coiled spring may be used in place of the plastic plug.

Slidably received in the lower end of the guide housing **2** is the upper and open end of a tube **26**. The other end of the tube **26** is secured by studs **28** or other suitable means to one side of a gear reduction motor **30** which is to serve as a prime mover drive means. On the opposite side of the motor **30** is mounted as by a project-

ing stud 32 or other suitable means an impact head 34. The tube 26, motor 30 and head 34 form what will be herein delineated as a hammer assembly.

The hammer assembly is supported from the housing 2 by the spring 4 which has one hooked end secured by the bolt 12. The other end of the spring is attached as by a lug 36 or other suitable means to the motor 30. Spacer rings 37 and 38 secured respectively to the housing 2 and tube 26 abut the opposite coiled portions of the spring 4 to avoid compression force on the straight end portions of the spring. Thus, movement of the hammer assembly inwardly in the direction of the housing 2 will compress the spring 4 to store energy for an outward stroke of the assembly when the force compressing the spring is released. An advantage of the construction described above is that all parts of the automatic hammer are assembled on the spring 4 which facilitates assembly and disassembly.

To move the hammer assembly inwardly and compress the spring 4 any number of suitable means to releasably drive couple the motor 30 to the housing 2 may be employed. In one preferred embodiment applicant provides, as seen in FIGURES 1 through 5, a depending bracket 40 secured to the guide housing 2 by screws 42 or other suitable means. Supported on the bracket 40 and slidably biased by springs 44 in the direction of the output drive wheel 46 of the motor 30 is a displaceable drive member 48 having serrations on a surface 48*a* thereof adjacent the drive wheel 46. The periphery of the drive wheel 46 is also serrated. The drive member 48 is attached to spaced studs 45 threaded into the member 48 and slidable in guide apertures 47 formed in the bracket 40. Studs 49 threaded in brackets 51 welded or otherwise secured to the bracket 40 provide for adjustment of compression of the springs 44. The drive member 48 is moved into engagement with the drive wheel 46 responsive to the bias of springs 44. To release the drive element 48 a stud 52 and a cam lever 54 are provided. The stud 52 is threaded into the drive member 48 and is formed with a head 52*a* presenting a flange surface 52*b* against which a roller end 54*a* of the cam lever 54 acts. The cam lever 54 has a companion lever 55 (FIGURE 5) both secured to a pivot pin 53 rotatably fixed in the bracket 40. The stud 52 is slidably received in a guide aperture 57 of the bracket 40. Adjustable brackets 60 and spaced actuators 56 and 58 are attached to the motor by brackets 60 and 62.

Operation

The drive wheel 46 when rotating and in contact with the serrated face 48*a* of the drive member 48 moves the drive assembly including the tube 26, motor 30 and impact head 34 inwardly toward the guide housing 2 thereby compressing the spring 4 and storing energy therein.

When the drive assembly is at the inward extent of its stroke and the spring 4 is compressed to the extent that member actuator 58 engages the end 54*b* of lever 54 the lever is rotated to the position shown in FIG. 4 and the drive 48 is moved away from the wheel 46.

The inward driving force being thus removed from the hammer assembly the compressed spring 4 then moves the hammer assembly outwardly from the housing 2 on an impact stroke. Near the bottom of the impact stroke the actuator 56 engages the end 54*b* of lever 54 rotating it to the position shown in FIG. 3 to allow the drive 48 to move into engagement with the wheel 46 responsive to the bias of springs 44. The inward driving force being thus restored to the hammer assembly, the cycle is then repeated.

The frequency of cycle of the hammer assembly is governed by the motor speed and the ratio of gear reduction. The degree of compression of the spring 4 and hence the impact force available may be controlled by

adjustment of the actuator 58. The stroke of the hammer assembly may be adjusted by both the actuators 56 and 58.

Modification

In a modified form of applicant's invention as shown in FIGS. 6, 7 and 8, the drive assembly and housing 2 remain the same. In place of the bracket 40, which in the previously described embodiment included a drive in the nature of a displaceable rack element, a bracket 64 is provided attached to the housing 2 by suitable means, as, for example, screws 66 and the bracket contains no movable rack-like element.

To releasably drive couple the motor 30 to the guide housing 2 applicant provides an additional drive wheel 68, preferably larger in diameter than the drive wheel 46 and mounted in a bracket indicated generally at 70 (see FIG. 8) to ride on and be driven by the wheel 46. The bracket 70 is formed with depending legs 72 and 74 connected respectively to bearing collars 76 and 78 journalled on shaft 30*a* of motor 30 on opposite side of the drive wheel 46. The wheel 68 is mounted on a shaft 80 rotatably journalled in apertures 72*a* and 74*a* formed in the legs 72 and 74. As thus far described the wheel 68 may be angularly positioned about the axis of the shaft 30*a* toward and away from the bracket 64 to engage and disengage the wheel 68 with the adjacent face 64*a* of bracket 64.

To provide for automatic engagement and disengagement of wheel 68 with the bracket 64 applicant provides an extension 82 on the frame 70 and a compression toggle spring 83 connected between the extension 82 and an adjacent tab 84 fixed to the motor 30 to form an overcenter toggle mechanism. Angular movement of the bracket 70 and the wheel 68 to one side is limited by engagement of the wheel 68 with the adjacent surfaces of bracket 64. Angular movement in the opposite direction is limited by a tab 86 also fixed to the motor 30. Formed on the upper extremity of brack 70 is a rounded projection 88 aligned with a cam-faced stop 89 fixed to the bracket 64. Secured to the lower end of the frame 70 is an angularly disposed projection 90 aligned with a cam-faced stop 91 fixed to the lower end of the bracket 64.

Operation

Operation of the modified embodiment of the invention is as follows:

At the outward extremity of the stroke of the hammer assembly the stop 91 engages the projection 90 to rotate the bracket 70 and the wheel 68 in a direction to engage wheel 68 with the adjacent surface 64*a* of bracket 64. The toggle spring 83 maintains the engaged position of the wheel 68 and provides a spring biased pressure of the wheel on the bracket 64.

Wheel 68 thereupon moves the hammer head assembly inwardly toward the housing 2 compressing the spring 4. At the upper end of the stroke the projection 88 engages the stop 89 rotating the bracket 70 and the wheel 68 away from the bracket 64. The extent of rotation of the bracket is limited by the stop tab 86.

Drive force being thus released the spring 4 releases its energy driving the hammer assembly outwardly on an impact stroke. At the limit of the impact stroke the stop tab 91 again engages the projection 90 and the cycle is repeated. The periphery of the wheel 68 and the adjacent face of the bracket 64 are serrated to provide gripping drive surfaces. Included in the advantages of the alternative drive mechanism is the fact that the difference in diameters of the wheels 46 and 68 results in a speed reduction which eliminates one speed reduction step in the motor 30.

It will be understood from the above that applicant's device because of its light weight and compact arrangement is readily adapted to use as a portable tool requiring no mounting frame and requiring no setup to place the tool in use.

Also advantageous is the fact that due to its light weight, compact arrangement and energy storing drive feature, it may be applied to work from any angle with respect to vertical and horizontal and may be inserted into openings to drive at a point within such opening.

The provision of simple, inexpensive shock absorbing means in the sectionalized handle is advantageous in some applications. For other applications the shock absorbing means may be omitted and a conventional shovel-type hand grip handle may be secured directly to the housing **2**. Further, if desired, two handles of the type **10** described may be mounted by the bolt **12** and positioned to extend outwardly on opposite sides of the housing **2**.

Applicant's device is also a tool of universal use being usable to drive fence posts, garden stakes and other objects. It is not limited to a specific special use.

Also in view of the ready detachability of the impact head various forms and sizes of impact heads and types of tools may be used.

In addition to the above, the device is adaptable to low cost manufacture and readily disassembled for repair or replacement of parts.

While applicant has illustrated and described a preferred embodiment of the invention, it will be obvious to those skilled in the art that various changes and modifications in arrangement and structure may be made without departing from the spirit and scope of the invention and it is intended that all such changes and modifications be included in the appended claims.

What is claimed is:

1. A power driven hammer comprising a hammer assembly including a prime mover connected thereto and displaceable in conjunction therewith, a guide structure supporting said assembly for reciprocable motion intermediate an advanced and retracted position, and means for reciprocating said assembly, said means comprising an automatic drive element selectively connectable between said prime mover and said guide structure in response to the positionable disposition of said hammer assembly relative to the limits of reciprocation thereof to periodically displace said assembly from said advanced to said retracted position and a compression spring connected between said hammer assembly and said guide structure to displace said assembly from said retracted to said advanced position.

2. A light weight manually portable power driven hammer comprising in combination a guide housing, a hammer assembly slidably guided by said housing for reciprocatory motion intermediate an advanced and a retracted position, spring means mounted in said housing to urge said assembly from said retracted to said advanced position, said assembly including a prime mover mounted to reciprocate therewith, and drive means releasably connectable between said prime mover and said housing in response to the position of said hammer assembly relative to the limit of reciprocation thereof to move said assembly in opposition to said spring means from said advanced to said retracted position and to release said assembly and prime mover for an impact stroke of said motor and assembly.

3. A power driven hammer comprising in combination a hammer assembly including an electric motor, an impact member connected to the lower side of said motor and an elongated vertical hollow member having its lower end integral with said motor, a guide housing to slidably receive and support said vertical member, a compression spring position in said housing and vertical member, said spring being connected to said housing and to said motor to support said assembly, handle means for supporting said housing and depending assembly, drive means connected to said housing and releasably connectable to said motor in response to the positional disposition of said hammer assembly relative to said guide housing to automatically derive power from said motor to move said assembly inwardly and compress said spring and to automatically release said assembly for an outward impact stroke.

4. In a power driven hammer of the type comprising a stationary structure, a hammer assembly mounted for reciprocal motion from an advanced to a retracted position in relation to said stationary structure, and compression spring means for urging said assembly in a direction toward said advanced position, the improvement comprising a prime mover incorporated in the assembly to reciprocate therewith, and drive means releasably connectable between said prime mover and said stationary structure in response to the position of said hammer assembly relative to said stationary structure to move said assembly on one stroke in a direction to compress said spring and to release said assembly and prime mover for a reverse impact stroke of said motor and assembly.

5. An improved power hammer comprising in combination a guide structure, a hammer assembly including a prime mover and an impact head slidably engageable with said guide structure for linear reciprocation toward and away from said structure, spring means connected to said structure and assembly to urge said assembly outward from said structure when said spring is compressed and drive means selectively connectable between said motor and said structure to move said assembly and to compress said spring when said drive means is engaged and to allow said assembly to move away from said structure for an impact stroke when said drive means is disengaged, and means responsive to the positional disposition of said impact head relative to said guide structure for automatically engaging and disengaging said drive means.

6. A power driven hammer comprising a stationary guide structure, a hammer assembly including a prime mover mounted on said guide structure for reciprocal motion intermediate an advanced and retracted position spring means connected between said guide structure and said assembly to urge said assembly from said retracted to said advanced position, automatically operable drive means connected between said prime mover and said guide structure responsive to the positional disposition of said hammer assembly relative to said guide structure to derive power from said prime mover to drive said assembly from said advanced to said retracted position against the opposition of said spring for one half cycle and to disengage said prime mover to allow said spring to drive said assembly from said retracted to said advanced position in the next one-half cycle.

7. An automatically operable power driven hammer assembly comprising

a guide housing,

a hammer member slidably guided by said guide housing for reciprocatory displacement intermediate an advanced and a retracted position,

a continuously operable prime mover mounted on said hammer member and reciprocably displaceable in conjunction therewith intermediate said advanced and retracted position,

energy storage means mounted in said housing normally biasing said hammer member and prime mover toward said advanced position,

and drive means responsive to the positional disposition of said hammer member relative to said advanced position for automatically effecting displacement of said hammer member and prime mover from said advanced to said retracted position counter to the biasing action of said energy storage means.

8. The combination as set forth in claim **6** including means responsive to the positional disposition of said hammer member relative to said retracted position for disengaging said drive means and permitting said energy storage means to displace said hammer member and prime mover from said retracted to said advanced position.

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BROUGHTON G. DURHAM, *Primary Examiner.*

FRELING E. BAKER, *Assistant Examiner.*