Sept. 6, 1966 L. H. BASSETT ETAL 3,270,821

POWER TOOL

Filed Sept. 20, 1963 4 Sheets-Sheet 1

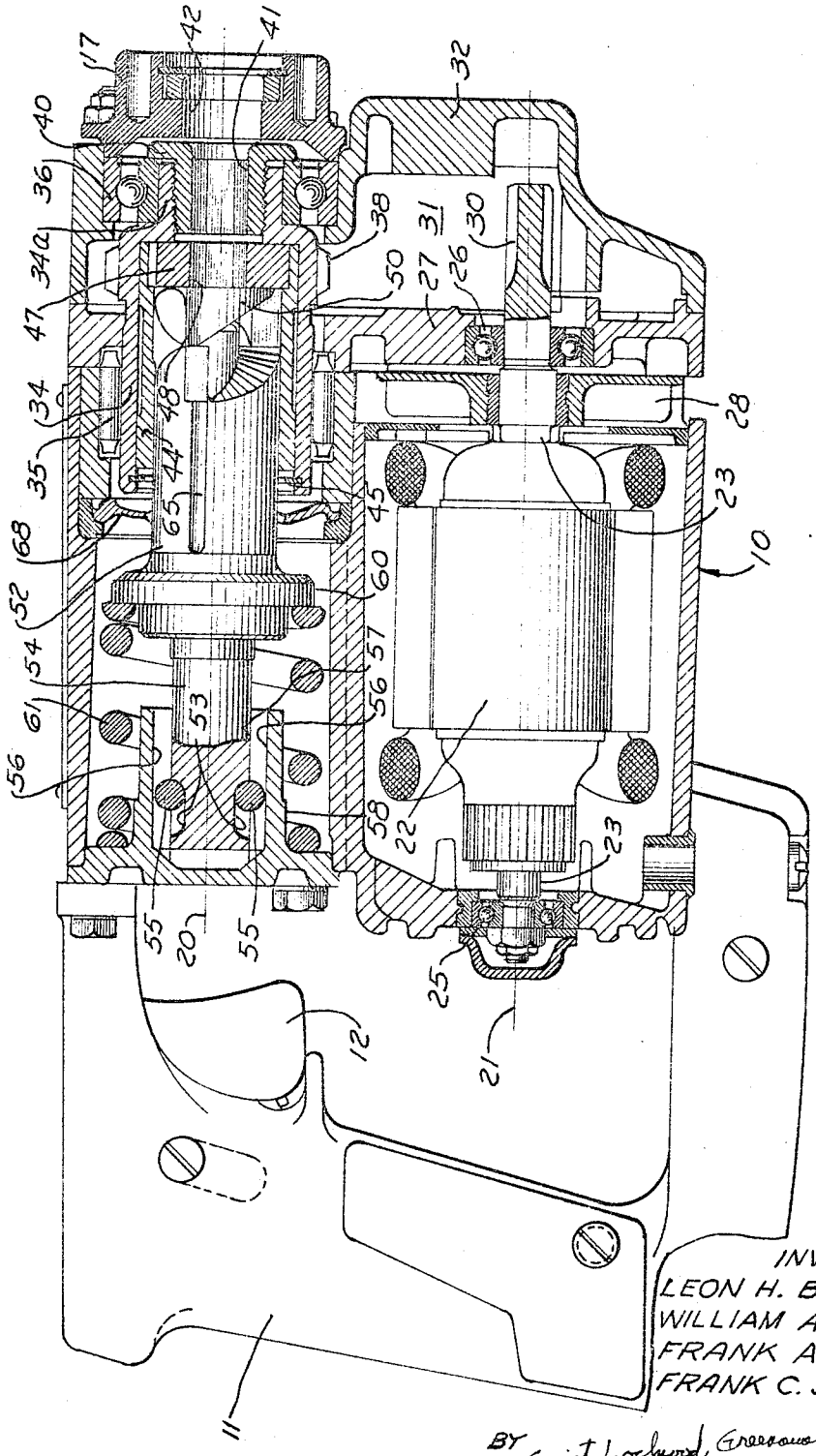

FIG. 1

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4 Sheets-Sheet 2

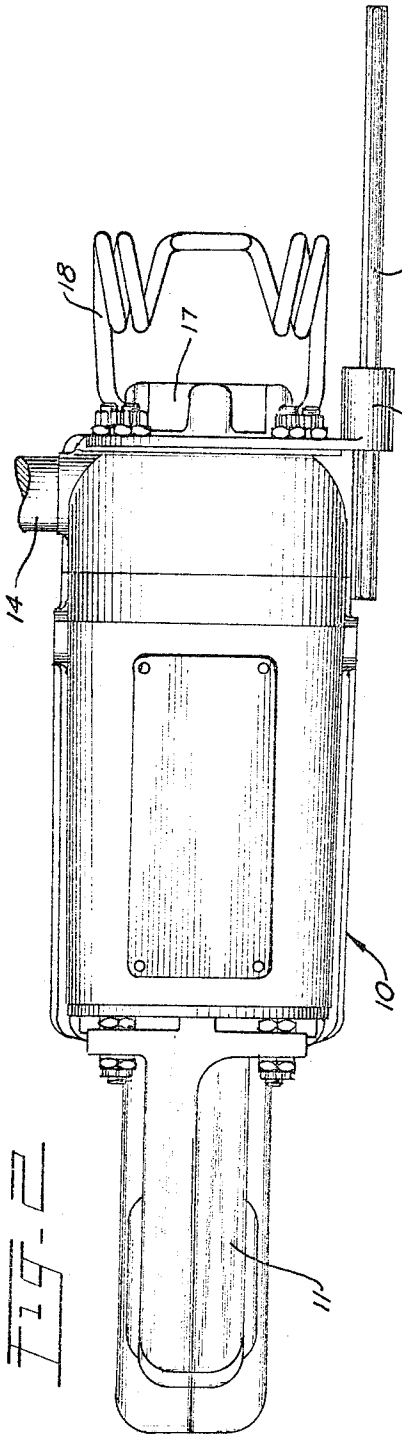

FIG. 2

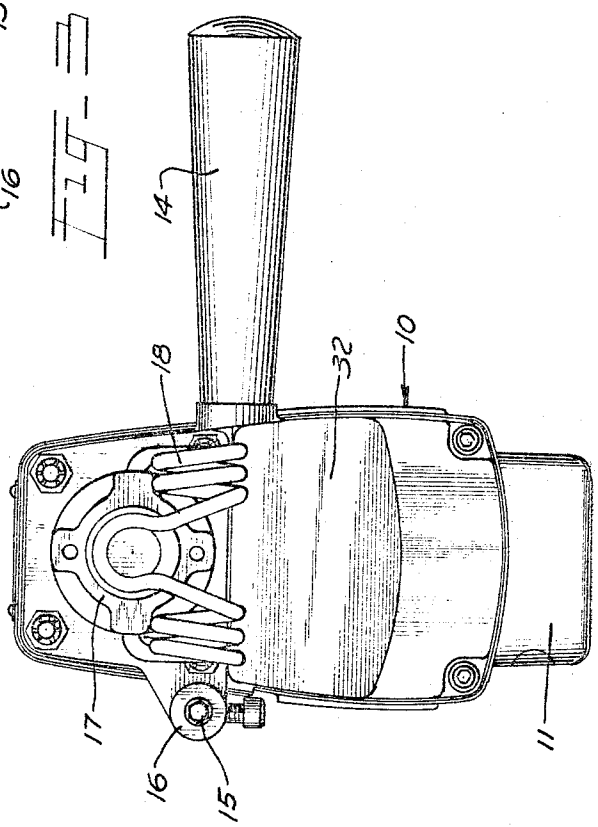

FIG. 3

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Fig. 4

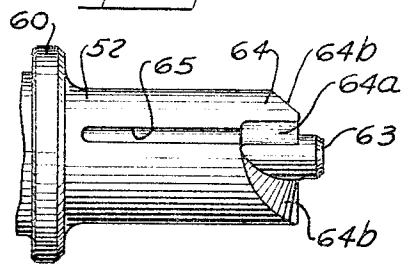


Fig. 5

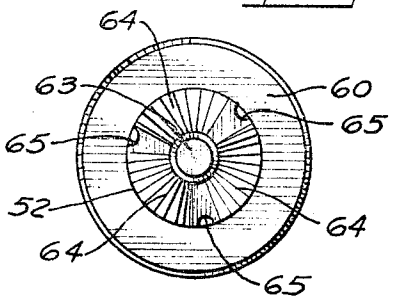


Fig. 7

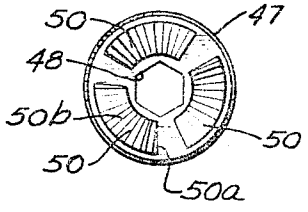


Fig. 6

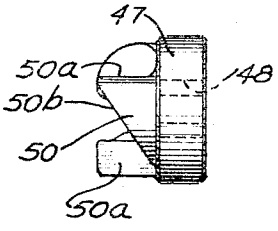
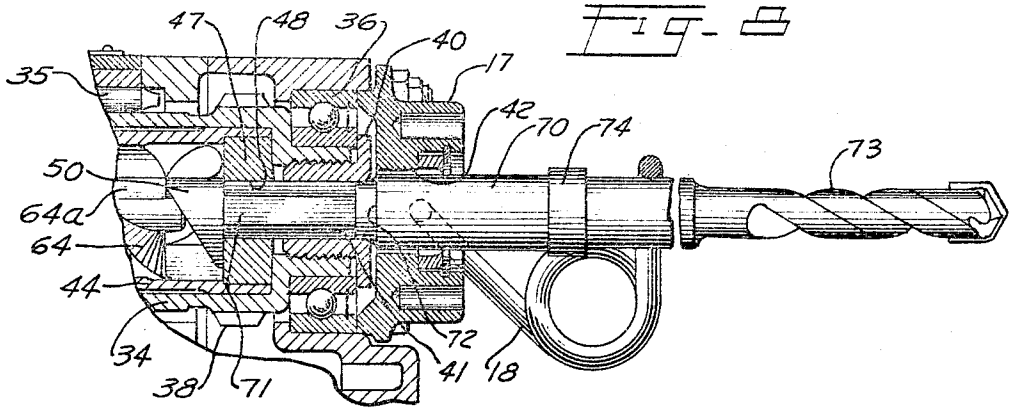


Fig. 8



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POWER TOOL

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Fig. 9

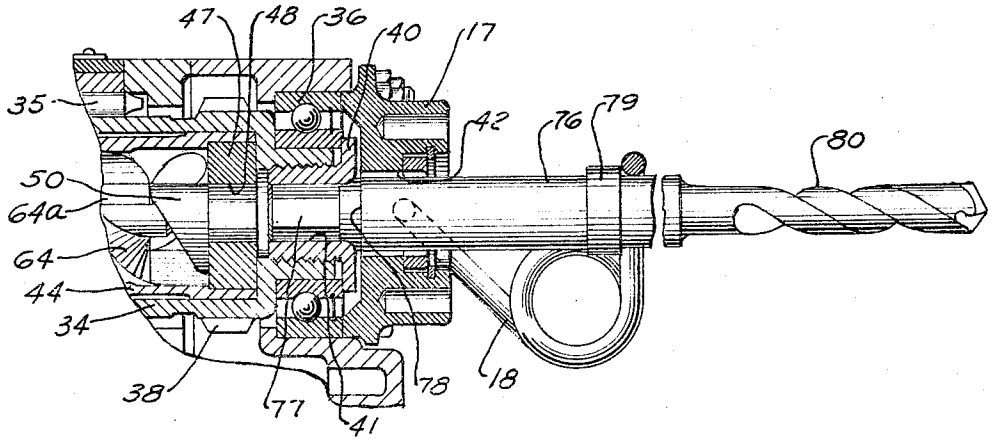
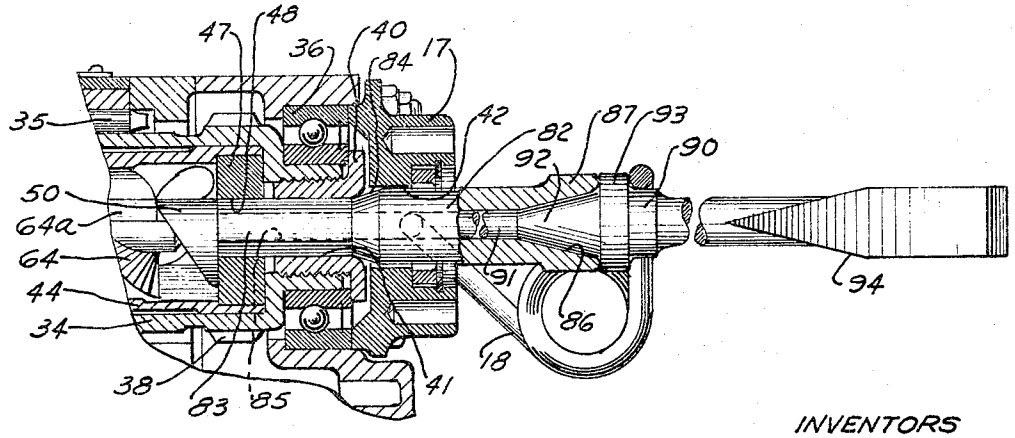


Fig. 10



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3,270,821

POWER TOOL

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Filed Sept. 20, 1963, Ser. No. 310,347
13 Claims. (Cl. 173—123)

This invention relates to power hand tools, and more particularly to a power hand tool adapted to impart simultaneous hammering and rotating movements to a tool element.

Power hand tools of the type just mentioned are known in the art. Because of the component parts necessary for imparting hammering and rotating movements to a tool element, these known tools are rather bulky and heavy making them tiring to operate and difficult to manipulate in confined spaces or in locations where the operator of the tool is not able to obtain a good footing, e.g., on a ladder or scaffold. Further, these prior art tools are rather complicated in operation and expensive to manufacture, these disadvantages being the direct result of the necessary component parts of the tool for imparting the combined movements to the working tool member or element.

One of the basic underlying concepts in the design of the tool of this invention is that of compact, simple, and lightweight construction. This concept is partially effectuated in the design of the tool of this invention by the provision of new and unique impact generating means. This design concept is further effectuated in the subject tool by a novel cooperative relationship between the impacting or hammering means and the rotary means of the power tool, i.e., the means for imparting rotation to the tool element. This compact design concept is further materialized in the tool by the mounting arrangement of the motor means of the tool with respect to the hammering and rotating means thereof.

A principal object of the present invention is the provision of improved cam actuated striker means for a power tool.

Another principal object of the present invention is the provision of power tool cam operated striker means which are adapted to be actuated by the tool element receiving the hammering movement from the striker means.

A further principal object of the present invention is the provision of tool element hammering means and separate tool element rotating means for a power tool, the hammering means being brought into operation by the tool ement rotated by the rotating means in a manner whereby simultaneous hammering and rotating movements are imparted to the tool element.

Another object of the present invention is the provision of a power tool including a housing having a pair of parallel axes, the tool element hammering means and the tool element rotating means being arranged in close longitudinal spaced-apart relation along one of the axes and the motor means of the tool being arranged along the other of the axes and in juxtaposed relation with the hammering and rotating means.

Still another object of the present invention is the provision of tool element hammering means including a striker mounted for axial non-rotatable movement in a rotatable sleeve open at one end thereof, the striker being provided with means for preventing an airlock in the sleeve during axial movement of the striker inwardly of the sleeve.

Even another object of the present invention is the provision of a power tool of the type described which

is readily adaptable for providing hammering movement only or rotating movement only to a tool element.

Another object of the present invention is the provision of a power tool of the type described and means in the nature of an adapter assembly for adapting the power tool to provide hammering only to a working tool.

These and other objects and advantages of the invention will become apparent from the following specification wherein like numerals refer to similar parts throughout.

In the drawings:

FIG. 1 is a sectional side elevation and partial vertical central section of the tool of this invention;

FIG. 2 is a reduced top plan view thereof;

FIG. 3 is a reduced front elevational view thereof;

FIG. 4 is a fragmentary side elevation of the striker forming a part of the tool element hammering means;

FIG. 5 is an end view of the striker as seen from the striking end thereof;

FIG. 6 is a side elevational view of the rotatable member adapted to actuate or cock the striker;

FIG. 7 is an end view of the rotatable member of FIG. 6 as seen from the face of the member having the cam elements thereon;

FIG. 8 is a fragmentary vertical central section of the embodiment of the tool illustrated in FIG. 1 showing a tool element detachably secured to the power tool;

FIG. 9 is a section similar to FIG. 8 but showing a different form of tool element whereby rotation only is imparted to the latter; and

FIG. 10 is a section similar to FIG. 8 but showing means in the nature of an adapter detachably secured to the power tool whereby hammering only is imparted to a working tool.

General description of the invention

A preferred form of the power tool of the present invention includes a housing having a pair of parallel axes extending generally longitudinally of the housing. Rotary motor means, such as an electric motor, having an axially extending output shaft is mounted in the housing with the output shaft being co-axial with one of the housing axes. The tool element hammering means and the tool element rotating means are arranged in the housing in longitudinal spaced-apart relationship along the other housing axis and in general juxtaposed relation with the motor means and the output shaft thereof.

The tool element rotating means includes a cylinder mounted in the nose or forward portion of the housing with the longitudinal central axis of the cylinder being co-axial with the other of the housing axis. The cylinder is connected in driven relationship with the motor output shaft, as by means of a gear train for example, for rotation of the cylinder upon rotation of the motor output shaft. The cylinder has a driving member fixedly mounted in the forward end thereof, which driving member has a central, axially extending, hexagonal aperture adapted for driving engagement with a hexagonal shank portion of a tool element. Energizing the electric motor results in rotation of the tool element by reason of the construction just described.

The novel tool element hammering means of the tool includes a sleeve mounted within the cylinder for co-axial rotation therein relative to the cylinder. As will become apparent herein, when the hammering means is being actuated the sleeve rotates with the cylinder. A striker cocking or actuating member is fixedly mounted in the forward end of the sleeve and in close proximity to the driving member associated with the cylinder. The striker actuating member has a central opening co-axial with the aperture in the driving member and of a size and shape corresponding to the aperture in the driving

member. On the rear face of the cocking member and spaced around the opening therein are a number of cam elements. An elongated striker member co-axial with the cocking member is mounted for axial non-rotatable movement in the housing and has the forward portion thereof slidably supported in the sleeve. The striker includes a centrally disposed striking projection on the forward or striking end thereof, which projection is in alignment with the opening in the striker cocking member. A number of cam elements are provided on the striking end of the striker outwardly of the striking projection. These cam elements on the striker are adapted for complimentary engagement or cooperation with the cam elements on the cocking member to provide rearward axial movement of the striker upon rotation of the cocking member.

In the embodiment of the invention shown for purposes of illustration, the cam elements on the cocking member and striker are designed to cock or force the striker rearwardly three times for every revolution of the cocking member. The significance of this feature will be referred to below. The striker member is urged forwardly in the housing by means of a strong spring.

Combined or simultaneous hammering and rotating movements are imparted to a tool element by the power tool of this invention by inserting the hexagon shaped shank portion of a tool element into the aperture in the driving member and in the opening in the striker cocking member and by axially positioning the tool element so that the inner end of the same may be struck by the striking projection on the striker as the latter approaches its forward limit of axial movement. Because of the non-rotatable engagement between the tool element and the driving member and striker cocking member, rotation imparted to the tool element by the driving member is transmitted to the cam cocking member. Rotation of the striker cocking member brings about operation of the striker for delivering successive hammering blows to the end of the tool element.

By reason of the novel construction of the tool, the end of the tool element which receives the hammering blows brings into operation or actuates the striker member for developing the hammering blows. By the construction of the tool of this invention, rotation only may be imparted to the tool member by merely sliding the tool element forwardly in the housing to a position wherein the extreme inner end of the tool element is clear of the hexagon shaped opening in the cocking member. When this is done, rotation of the driving member does not bring about rotation of the cocking member. In actual practice rotation only is brought about by providing a separate tool element having a shank portion of reduced length so as not to extend into driving engagement in the opening in the striker cocking member. If hammering only is desired to be imparted to a tool element, means in the nature of an adapter are engaged with the driving member and cocking member, such means including relatively rotatable elements whereby rotation is not imparted to the tool element.

By means of the construction just described, the tool element rotating means the separate tool element hammering means may be closely spaced to each other longitudinally in the housing. This construction readily lends itself to compact design by reason of the unique cooperative effect which is brought about by utilizing the rotating tool element to actuate the hammering means. In the embodiment of the tool shown for purposes of illustration, the over-all length of the tool element hammering means and tool element rotating means is substantially the same as the over-all length of the rotary motor means and output shaft thereof. As the tool element hammering means and rotating means are in juxtaposed relation with the motor means, the resulting power tool is of over-all compact and lightweight design and yet capable

of providing combined hammering and rotation, hammering only or rotation only to a tool element.

Detailed description of the invention

Now referring to the drawings, the embodiment of the invention shown for purposes of illustration will be seen to include a housing **10** having a handle **11** at the rear end thereof, which handle supports a trigger **12**. A transversely extending auxiliary handle member **14** is detachably secured to one side of the housing near the forward portion or nose thereof. A gauge rod **15** is suitably supported in a bracket **16** which is mounted on the nose of the housing. A nose member **17** is secured to the nose of the housing, which nose member supports a tool element retainer **18**. This retainer may be of the type shown in Amundsen et al. Patent No. 3,097,858.

Housing **10** includes upper and lower parallel axes **20** and **21**, respectively, extending generally longitudinally of the housing. A rotary motor, such as an electric motor **22**, is mounted in the housing with the central shaft **23** of the motor being co-axial with axis **21**. The rear end of shaft **23** is journaled in a bearing assembly **25** mounted in a rear wall portion of the housing. The forward end of shaft **23** is journaled in another bearing assembly **26** which is mounted in a housing wall **27**. A fan **28** is non-rotatably mounted on shaft **23** just rearwardly of wall **27** for cooling motor **22** in a conventional manner. Motor shaft **23** includes an axially extending, splined, output shaft portion **30** which extends into a gear chamber **31** defined by wall **27** and a housing front wall **32**. It will be understood that suitable wiring means (not shown) are provided so that depression of trigger **12** causes energizing of motor **22** for rotation of output shaft **30**.

A cylinder **34** having its longitudinal central axis co-axial with housing axis **20** is rotatably mounted in the housing near the forward portion thereof by means of a roller bearing assembly **35** and a ball bearing assembly **36**, the bearing assemblies being suitably supported in housing wall portions. Cylinder **34** has a gear ring **38** suitably supported on the exterior surface thereof, the teeth of which gear ring are adapted for meshing engagement with teeth of a gear train (not shown) suitably supported in gear chamber **31** and driven by splined output shaft **30**. It will be understood then that rotation of shaft **30** upon energizing motor **22** results in rotation of cylinder **34**.

Cylinder **34** includes a reduced in diameter portion **34***a* at its forward end, which portion is internally threaded for threading engagement with a driving member or hub **40**. Driving member **40**, which is fixedly mounted for rotation with cylinder **34**, includes a central aperture **41** which is multi-sided (preferably hexagonal) in configuration. The central axis of aperture **41** is co-axial with the housing axis **20**, and aperture **41** is in axial alignment with a bore **42** provided in nose member **17**. Bore **42** is greater in diameter than the distance across aperture **41**, and bore **42** is preferably circular in configuration.

A sleeve **44** is supported within cylinder **34** for rotation about housing axis **20** relative to cylinder **34**. That is, sleeve **44** is journaled in cylinder **34** for rotation within the same. Sleeve **44** is held within the cylinder by engagement of the forward end of the sleeve with an annular shoulder in the cylinder defined by the reduced-in-diameter portion **34***a* and by engagement of the rear end of the sleeve with a retaining ring **45** which is held in an internal annular groove in the rearward end of cylinder **34**.

A striker cocking or actuating member **47** (FIGS. 1 and 6) is fixedly mounted in the forward end of the sleeve for rotation with the same. Actuating member **47** includes a central axially extending opening **48** which is multi-sided and which is in axial alignment with aperture **41** in driving member **40**. It will be understood that the sides defining opening **48** are co-planar with respective sides defining aperture **41**. Member **47** includes three

cam elements **50** on the rear face thereof, which cam elements are circumferentially and equally spaced around opening **48**. Each cam element includes a generally axially extending face portion **50***a* and an inclined or ramp portion **50***b*.

An elongated, circular in cross-section striker **52**, which is supported in housing **10** co-axially with housing axis **20**, has the forward end thereof slidably supported in sleeve **44**. The striker is mounted for reciprocal axial but non-rotatable movement. This mounting is brought about by the provision of a pair of diametrically oppositely disposed, short, axially extending recesses **53** formed in a rear end portion **54** of the striker. A pair of diametrically oppositely disposed grooves **56** are formed in a bore **57** of a cylindrical housing portion **58** which extends inwardly of the housing from the rear wall thereof. Striker portion **54** is axially slidable in bore **57**. A pair of balls **55** are received in the opposed grooves and recesses. It should be apparent that by the construction just described, striker **52** is adapted for axial non-rotatable movement in the housing.

Striker **52** includes an integral annular shoulder **60** intermediate the length thereof. A strong compression spring **61** encircling cylindrical housing portion **58** and striker portion **54** has one end thereof in engagement with shoulder **60** and the other end thereof in engagement with the rear wall of the housing around portion **58**. It will be apparent that spring **61** urges the striker forwardly in the housing. In FIG. 1, the striker is shown in its rearward or cocked position.

As best seen in FIG. 4, striker **52** includes a centrally disposed striking projection **63** on the forward or striking end thereof. Also provided on the striking end of the striker are three cam elements **64** which are equally and circumferentially spaced around projection **63**. Cam elements **64**, which are adapted for complimentary or cooperating engagement with cam elements **50**, each include an axially etxending face portion **64***a* and an inclined or ramp portion **64***b*. Striker **52** also includes three equally spaced-apart, axially extending cavities or recesses **65** which open at the forward or striking end of the striker and extend rearwardly of the striker to a point near annular shoulder **60**.

A ring-like spring **68** concentric with the striker is suitably secured in an internal housing wall of the tool housing. Spring **68** is dished out rearwardly and adapted to be engaged by the forward surface of striker annular shoulder **60** as the striker reaches its forwardmost limit of axial travel in the housing. Spring **68** assists in cushioning and retarding forward movement of the striker after it has delivered a hammering blow to a tool element.

The operation of the power tool of this invention is as follows:

A tool element **70** (FIG. 8) is inserted through bore **42** in nose member **17**. Tool element **70** has an axially extending hexagonal shank portion **71** which is received in aperture **41** in driving member **40** and in opening **48** in striker cocking member **47**. As the hexagonal configuration of tool element portion **71** corresponds to the shape of aperture **41** and opening **48**, tool element portion **71** is non-rotatably engaged with both the driving member and the striker actuating member. The tool element is axially positioned within the power tool so that the extreme inner end of portion **71** terminates approximately in the plane containing the inner face of member **47**. Inward axial movement of tool element **70** is limited by engagement of a shoulder **72** on the tool element with the front face of member **40** around the aperture therein.

Rotation of the driving member by energizing motor **22** results in corresponding rotation of sleeve **44** and striker actuating member **48** by reason of the non-rotatable engagement of the driving member and the actuating member with the tool element shank. In effect, the striker actuating member is locked to the driving member for rotation with the latter. Rotation of the striker actuating member results in rearward axial movement of the striker for cocking of the latter by the inter-action or cooperation of the cam elements on the striking end of the striker and on the rear face of actuating member **47**. More specifically, striker **52** is forced rearwardly in the housing during rotation of member **47** by reason of inclined cam surfaces **64***b* riding up on inclined cam surfaces **50***b*. After these cam surfaces ride up on each other to the positions illustrated in FIGS. 1 and 8, continued rotation of member **47** results in the cam elements on the latter passing the cam elements on the striker. When this occurs the striker is hurled forwardly by spring **61** thereby bringing the striking projection **63** into hammering or striking engagement with the inner end of the tool element for delivering a hammering blow or movement to the latter. Accordingly, combined rotation and hammering movements are imparted to tool element **70**. It will be apparent that continued rotation of the tool element by the driving member results in the striker member imparting hammering blows in rapid succession to the end of the tool element.

In FIG. 8, tool element **70** has a co-axial working tool portion in the form of a drill bit **73**. The working tool has an annular shoulder **74** intermediate the length thereof, which shoulder is adapted to be engaged by the central looped portion of tool retainer **18** for retaining the tool element to the power tool during operation of the latter.

In the embodiment of the invention illustrated, three sets of cam elements are provded on the striker actuating member and on the striking end of the striker. This results in three hammering blows of the striker for every revolution of the actuating member and the tool element in non-rotatable engagement therewith. The provision of three cam elements is of significance when imparting combined hammering and rotating movement to a tool having a two jaw bit, such as tool bit **73** illustrated in FIG. 8. By this construction, during one revolution of the working tool the same is hammered or impacted three times and at each time of impact the tool element is in a different angular position. As is known to those skilled in the art, this results in more rapid pulverizing of the work. For example, if only two hammering blows per revolution were provided with a two jaw bit, i.e., if only two equally spaced-apart cam elements were provided on the actuating member and striker, two hammering blows would be provided per revolution of the tool element and the angular position of the working end of the tool element would in effect be the same during the delivery of each hammering blow. This is because the tool working end, which is symmetrical about its longitudinal axis, rotates through 180°. The results would be the same if, for example, three hammering blows per revolution were imparted to a three jaw bit. If four cam elements were provided on the actuating member and striker, for every revolution of a two jaw bit working tool four hammering blows would be provided but two of these blows would in effect be provided with the working tool in one angular position and the other two blows would in effect be provided to the working tool at a second angular position at right angles to the first position. Therefore, a prime number of cam elements, beginning with three, is preferred on the actuating member and striker when using a working tool having a two jaw bit. However, the invention herein is not to be limited to the particular number of cam elements on the actuating member and striker.

As mentioned above, striker **52** is provided with three axially extending cavities or grooves **65** which run from the striking end of the striker to a point along the latter just forwardly of annular shoulder **60**. The outer cylindrical surface of the striker forms a smooth sliding fit with the interior of sleeve **44**. Accordingly, when a tool element is mounted in opening **48** in the actuating member, the space defined by the closed end of the sleeve and the striking end of the striker is substantially air tight. Therefor, air must be allowed to escape from this space

during forward travel of the striker so as not to form an air block in the sleeve which would greatly retard forward movement of the striker. The axially extending cavities **65** in the striker allow air forwardly of the striker to escape during forward movement of the striker in the sleeve. Cavities **65** extend rearwardly of the striker for a sufficient distance to extend beyond the rear end of the sleeve **44** when the striker is in its forwardmost position in the sleeve.

The compact power tool of this invention is extremely durable and is capable of delivering sharp and powerful hammering blows to a tool element while the latter is being rotated.

When it is desired to provide rotation only by the power tool of this invention, a tool element illustrated in FIG. 9 is detachably connected with the power tool. This form of tool element includes a cylindrical body portion **76** having a reduced hexagonal portion **77** adapted to be non-rotatably received in aperture **41** in driving member **40**. It will be noted that hexagonal portion **77** does not extend into opening **48** in the cocking member and therefore does not bring about rotation of the latter for cocking or actuation of the striker. Inward movement of tool element **76** in the power tool is limited by engagement of a shoulder **78** on the tool element with the front face of driving member **40** around the aperture therein.

Tool element **76** includes an annular shoulder **79** intermediate the length thereof, which shoulder is adapted to be engaged by the central looped portion of tool retainer **18** for retaining the tool element to the power tool during operation of the latter. Tool element **76** is provided with a co-axial working tool portion in the form of a drill **80**. It should be apparent that actuation of the power tool with tool element **76** detachably secured thereto will result in rotation only being imparted to the tool element.

If hammering only is to be provided by the power tool of this invention, means in the nature of an adapter assembly are detachably secured to the power tool as illustrated in FIG. 10. Such means include a cylindrical tool element **82** having a hexagonal shank portion **83** joining with the cylindrical portion of the tool element at a conical portion **84**. Inward movement of tool element **82** in the power tool is limited by engagement of conical portion **84** with the front face of driving member **40** around the aperture formed therein. It will be understood that shank portion **83** is in non-rotatable engagement in aperture **41** and in opening **48** and terminates within the latter. Accordingly, rotation of shank portion **83** by the driving member results in rotation of the striker cocking member for cocking or actuation of the striker.

Tool element **82** includes a central, axially extending, circular in cross-section bore **85** opening at one end thereof at the inner end of shank portion **83** and opening at the other end thereof into an outwardly flared conical bore portion **86**. Conical portion **86** is formed in the forward or other end of tool element **82** which is provided with an outer annular shoulder **87**.

The means adapting the power tool of this invention for providing hammering only further includes a working tool **90** which includes a circular in cross-section stem **91**, which stem is adapted to be rotatably received within bore **85** of tool element **82**. Working tool **90** includes a conical portion **92** joining stem **91** with an annular shoulder **93** which is located at the approximate mid-point of the working tool. It will be understood that working tool conical portion **92** is adapted smoothly to engage conical bore portion **86** of the working tool for limiting axial movement of the working tool relative to the tool element in a direction inwardly of the latter. Alternatively, shoulder **93** may abut the outer end of the tool element for limiting axial movement of the tool element inwardly of the tool element.

When working tool **90** is fully seated within tool element **82**, the inner or free end of stem **91** extends rearwardly of hexagonal portion **83** so that the stem is struck by striking projection **63** as the striker approaches its forward limit of travel in the tool housing for having a hammering blow delivered to working tool **90** from striker **52**. Preferably, the free end of stem **91** projects rearwardly a sufficient distance beyond the inner end of hexagonal portion **83** so that a full hammering blow is imparted to the working tool with little or no part of this blow being delivered to tool element **82**. Shoulder **93** is adapted to be engaged by the central looped portion of tool retainer **18** for retaining the working tool and the tool element to the power tool during operation of the latter.

It will be apparent that rotation of driving member **40** brings about rotation of tool element **82**, and rotation of the tool element results in rotation of the striker cocking member **47** for actuating the striker. The striker delivers a series of hammering blows to the working tool in the manner described above. Working tool **90** is not rotatably driven by driving member **40** or striker cocking member **47** because of the rotatable engagement between the stem of the working tool and the central bore in the tool element. Accordingly, hammering action only is imparted to working tool **90**. Actually, a certain amount of rotation is imparted to working tool **90** by reason of the frictional engagement between the stem thereof and the bore in the tool element. However, when the working end of tool **90**, which may be in the form of a chisel **94** as seen in FIG. 10, is brought into engagement with the work, working tool **90** is prevented from rotating and tool element **82** rotates freely about the stem of the working tool.

It should be pointed out that by reason of the rugged construction of the tool of this invention, the tool may be safely operated for imparting hammering blows to a tool element when the latter is not in contact with a workpiece. As is known to those skilled in the art, during normal operation of a hammering tool, i.e., when the working tool is in engagement with the work, substantially all of the energy from the hammering or striking member is absorbed by the working tool and not by the power tool itself. The energy absorbed by the working tool is of course transferred to the work. However, if the power tool is actuated for hammering action when the working tool is not in engagement with the work, the energy of the hammering or striking member must be absorbed by the power tool itself thereby necessitating extremely rugged construction in the tool. Such a condition occurs when an operator of the power tool actuates the same for hammering action without bringing the working tool into contact with the work.

It should be apparent from the above description that this invention provides a power tool of lightweight and compact construction and yet which is capable of delivering combined rotation and hammering to a tool element. By reason of the novel cooperation between the tool element driving means and the tool element hammering means, rotation only may be imparted to the tool element merely by providing such a tool element with a shank portion of reduced length and hammering only may be imparted to a working tool by means of the relatively rotatable tool element and working tool described above.

While the invention has been shown in but one form it will be obvious to those skilled in the art that it is not to be so limited, but on the contrary it is susceptible of various changes and modifications without departing from the spirit and scope of the appended claims. For example, it will be understood that the non-rotatable engagement of the tool element with the driving member and striker actuating member may be brought about by means other than the provision of the hexagonal formation on the tool element shank portion and in the opening and aperture in the actuating member and the driving member respectively. By way of example only,

non-rotating engagement of the tool element with the driving member and the actuating member could be brought about by means of a keyed connection.

We claim:

1. In a power tool, a housing, a sleeve mounted for rotation in said housing and having an actuating member fixedly mounted in the forward end thereof, a striker mounted for axial non-rotatable movement in the housing and having at least the forward portion thereof axially slidable in said sleeve toward and away from said actuating member, said striker being provided with at least one axially extending cavity communicating the space defined by said sleeve and said end of the striker with the interior of said housing, spring means for urging the striker forwardly in the housing, first cam means on the strking end of said striker, second cam means on said actuating member cooperating with said first cam means for effecting periodic rearward axial movement of the striker upon rotation of said sleeve, and said actuating member having a central opening co-axial with said striker for receiving a tool element to be struck by said end of the striker as the latter approaches its forward limit of axial movement in the housing.

2. In a power tool, a housing, tool element hammering means and separate tool element rotating means mounted in longitudinal spaced-apart relation along a common axis in the housing, said hammering means including relatively rotatable members and being operable by relative rotation between such members, said rotating means being mounted for rotation independently of both of said rotatable members, means in the housing connected with said rotating means for rotating the latter, and a tool element in detachable coupling engagement with one of said rotatable members and with said rotating means thereby connecting the same together for actuating said hammering means upon rotation of said rotating means.

3. In a power tool, a housing, tool element hammering means including striking means and a relatively rotatable actuating member therefor, separate tool element rotating means mounted in said housing in coaxial longitudinal spaced-apart relation with said hammering means, the rotating means being disposed forwardly of the hammering means being mounted for rotation independently of asid actuating member, means in said housing connected with said rotating means for rotating the latter, and a tool element in coaxial non-rotatable engagement with said actuating member and said rotating means thereby coupling the same together for actuating the hammering means upon rotation of the rotating means.

4. In a power tool, a housing, a spring biased striker, a rotatable striker cocking member, and a rotatable driving member mounted in serial, longitudinal spaced-apart relation along a common axis in said housing with the driving member being disposed at the forward end of the housing, means in said housing connected with said driving member for rotating the latter independently of said striker cocking member, and a tool element co-axial with said axis and in detachable coupling engagement with said driving member and said cocking member thereby to rotate the latter upon rotation of the former, the striker being adapted to strike the tool element when the latter rotates the cocking member, whereby hammering and rotating movements are imparted to the tool element.

5. In a power tool, a housing, a striker mounted for axial non-rotatable movement in the housing, spring means adapted to urge the striker forwardly in the housing, a rotatable member mounted in the housing co-axial with said striker and proximate with the striking end of the latter, first cam means on said end of the striker cooperating with second cam means on said member for effecting periodic rearward axial movement of the striker upon rotation of the member, said first and second cam means each including a plurality of individual cam elements for effecting rearward axial movement of the striker a prime number of times for each revolution of said member, said member having a central opening, a tool element slidably and non-rotatably mounted in said opening and axially positioned within the latter for being struck by said striker as the latter approaches its forward limit of axial movement in the housing, which tool element is of the type having a two jaw bit, and motor means for rotating said tool element, whereby hammering and rotating movements may be simultaneously imparted to the tool element.

6. In a power tool, a housing, a cylinder rotatably mounted in the housing and having a tool element driving member in the forward end thereof, a sleeve supported in said cylinder for co-axial rotation relative thereto and having an actuating member in its forward end continguous with said driving member, a striker mounted for axial non-rotatable movement in the housing and having at least the forward portion thereof axially slidable in said sleeve toward and away from said actuating member, spring means adapted to urge said striker forwardly in said housing, first cam means on the striking end of said striker cooperating with second cam means on said actuating member for effecting periodic axial rearward movement of the striker upon rotation of the actuating member, said actuating member having a central opening and said driving member having a central aperture co-axial with said opening, a tool element in slidable and non-rotatable engagement with said opening and aperture and axially positioned in the opening for being struck by said striker as the latter approaches its forward limit of axial movement in the housing, and motor means for rotating said cylinder, whereby hammering and rotating movements may be simultaneously imparted to the tool element.

7. The tool according to claim 6 wherein said striker includes an axially extending open ended cavity having one end thereof terminating at the striking end of the striker for allowing escape of air in the space defined by the sleeve and said end of the striker.

8. In a power tool, a housing, a striker mounted for axial non-rotatable movement in the housing, spring means adapted to urge the striker forwardly in the housing, a rotatable member mounted in said housing co-axially with said striker and proximate with the striking end of the latter, said striker having a centrally disposed striking surface on said end thereof, first cam means on said end of the striker disposed radially outwardly of said surface and cooperating with second cam means on said rotatable member for effecting periodic rearward axial movement of said striker upon rotation of the rotatable member, said rotatable member having a central opening, a driving member rotatably mounted in said housing forwardly of said rotatable member and co-axial with said striker, which driving member has a central aperture co-axial with said opening, a tool element in slidable and non-rotatable engagement with said opening and aperture and axially positioned in the opening for being struck by said surface as the striker approaches its forward limit of axial movement in the housing, and motor means for rotating said driving member, whereby hammering and rotating movements may be simultaneouly imparted to said tool element.

9. In a power tool, a housing, a striker mounted for axial non-rotatable movement in the housing, spring means adapted to urge the striker forwardly of the housing, a rotatable member mounted in said housing co-axial with said striker and proximate with the striking end of the latter, first cam means on said end of the striker cooperating with second cam means on said rotatable member for effecting periodic rearward axial movement of said striker upon rotation of the rotatable member, said rotatable member having a multi-sided central opening, a driving member rotatably mounted in said housing forwardly of said rotatable member and co-axial with said striker, which driving member has a multi-sided central aperture co-axial with said opening, a tool element having a shank portion slidably mounted

in said opening and aperture and axially positioned in the opening for being struck by said striker as the latter approaches its forward limit of axial movement in the housing, motor means for rotating said driving member, said shank portion having a multi-sided configuration corresponding to the shape of said opening and aperture for locking the rotatable member with the driving member, whereby hammering and rotating movements may be simultaneously imparted to the tool element.

10. In a power tool, a housing having a pair of parallel axes extending generally longitudinally of the housing, rotary motor means in said housing including an axially and forwardly extending output shaft, which shaft is co-axial with one of said axes, a cylinder rotatably mounted in the housing and having the longitudinal central axis thereof co-axial with the other of said axes, which cylinder has a tool element driving member fixedly mounted in the forward end thereof, a sleeve supported in said cylinder for co-axial rotation relative thereto and having an actuating member in its forward end contiguous with the driving member, a striker mounted for axial non-rotatable movement in the housing and having at least the forward portion thereof axially slidable in said sleeve toward and away from said actuating member, spring means adapted to urge said striker forwardly in said housing, the striker and driving member being in general juxtaposed relation with the motor means and shaft, respectively, first cam means on the striking end of said striker cooperating with said second cam means on said actuating member for effecting periodic axial rearward movement of the striker upon rotation of the actuating member, said actuating member having a central opening and said driving member having a central aperture, the opening and aperture being co-axial with each other and with said other axis, a tool element slidably mounted in said opening and aperture and axially positioned in the opening for being struck by said striker as the latter approaches its forward limit of axial movement in the housing, said tool element, said opening and said aperture having cooperating non-circular cross sections such that the tool element is effective to couple said actuating member and said driving member together for rotation in unison, means connecting said cylinder with said shaft for rotation of the former upon rotation of the latter, whereby hammering and rotating movements may be simultaneously imparted to the tool element.

11. In a power tool, a housing, a spring biased striker, a rotatable striker cocking member, and a rotatable driving member mounted in serial, longitudinal spaced-apart relation along a common axis in said housing with the driving member being disposed at the forward end of the housing, means in said housing connected with said driving member for rotating the latter, said cocking member and said driving member having respective aligned central openings, a generally cylindrical tool element co-axial with said axis and non-rotatably engaged with said openings for rotation of the cocking member upon rotation of the driving member whereby said striker is actuated, which tool element has an axially extending through bore, a generally cylindrical working tool disposed forwardly of said tool element and having a stem rotatably received in said bore, which stem is adapted to have the inner end thereof struck by said striker, whereby hammering movements only are imparted to said working tool.

12. The tool according to claim **11** wherein said openings are multi-sided and of the same size and shape and wherein said tool element includes a shank portion which is multi-sided and corresponds in cross-sectional size and shape with said openings for effecting the non-rotatable engagement between the tool element and the cocking and driving members.

13. In a power tool including a housing enclosing a motor, the combination of centrally apertured, rotary driving means connected with said motor for being driven by the latter, hammering means including relatively rotatable members and being operated by relative rotation between such members, one of the members being non-rotatable and constituting the hammer and the other of the members being centrally apertured and in co-axial relation with said rotatary driving means adjacent the latter, said other member being rotatably mounted, spring means engaged with said one member and cooperatnig elements on respective members for cocking said one member against the spring means, the central aperture of said rotary driving means and said one member being adapted for non-rotatable engagement with a common tool element, which tool element serves as the sole means transmitting rotation to said other member and thereby operating said hammering means, said one member being adapted to strike such a tool element when the same is in non-rotatable engagement with said rotatary driving means and said one member, said rotary driving means and said one member being arranged so that the tool element must be engaged with the former prior to engaging the latter.

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