Sept. 26, 1967 J. CARNESECCA, JR., ETAL 3,343,613

POWER OPERATED TOOL

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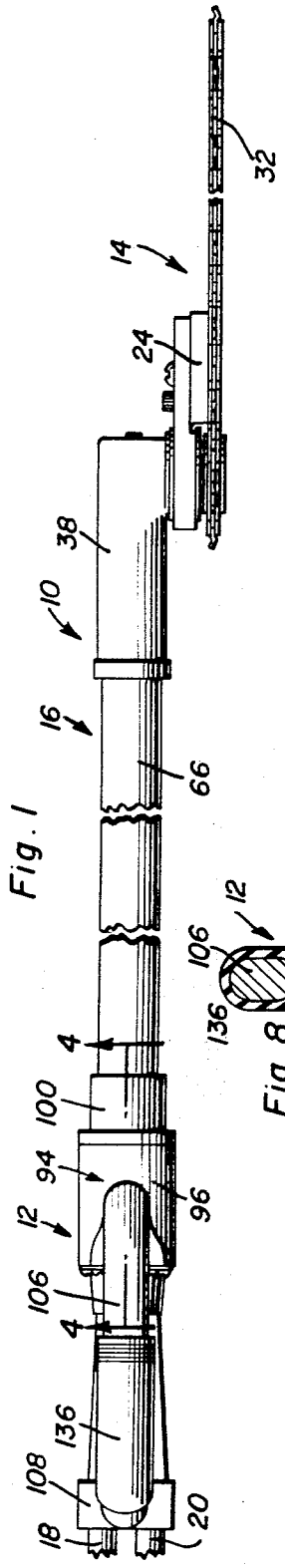

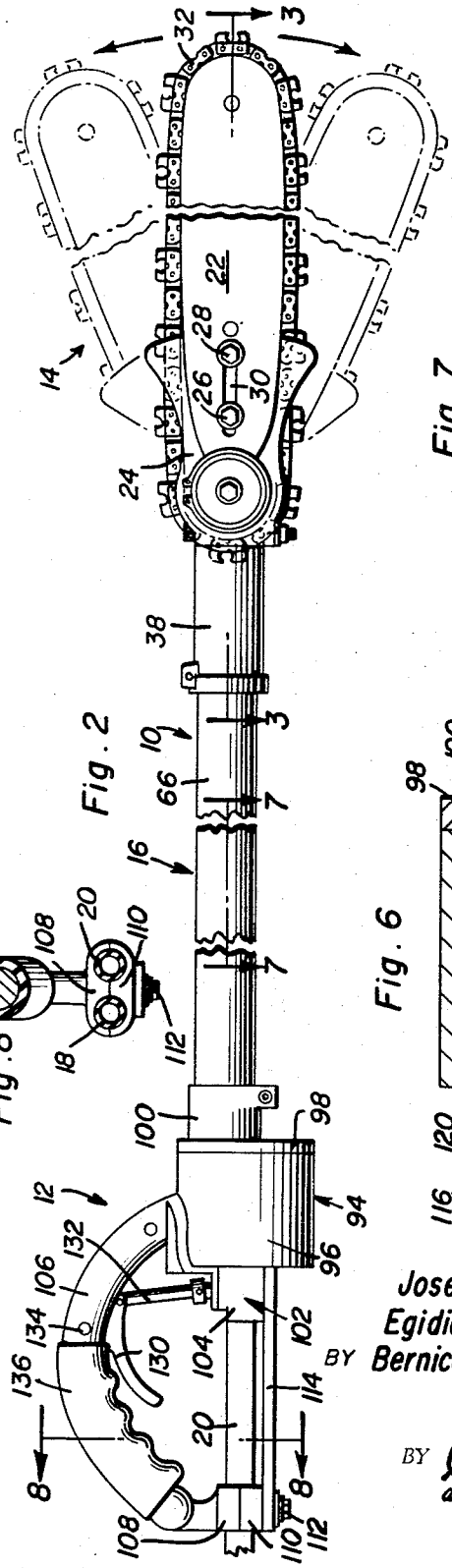

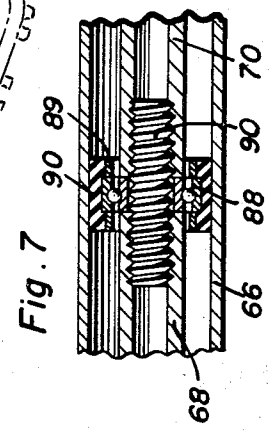

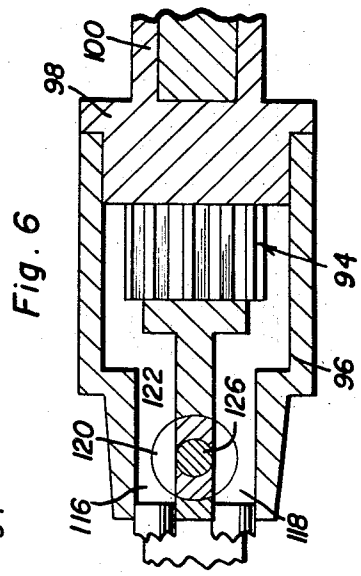

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POWER OPERATED TOOL

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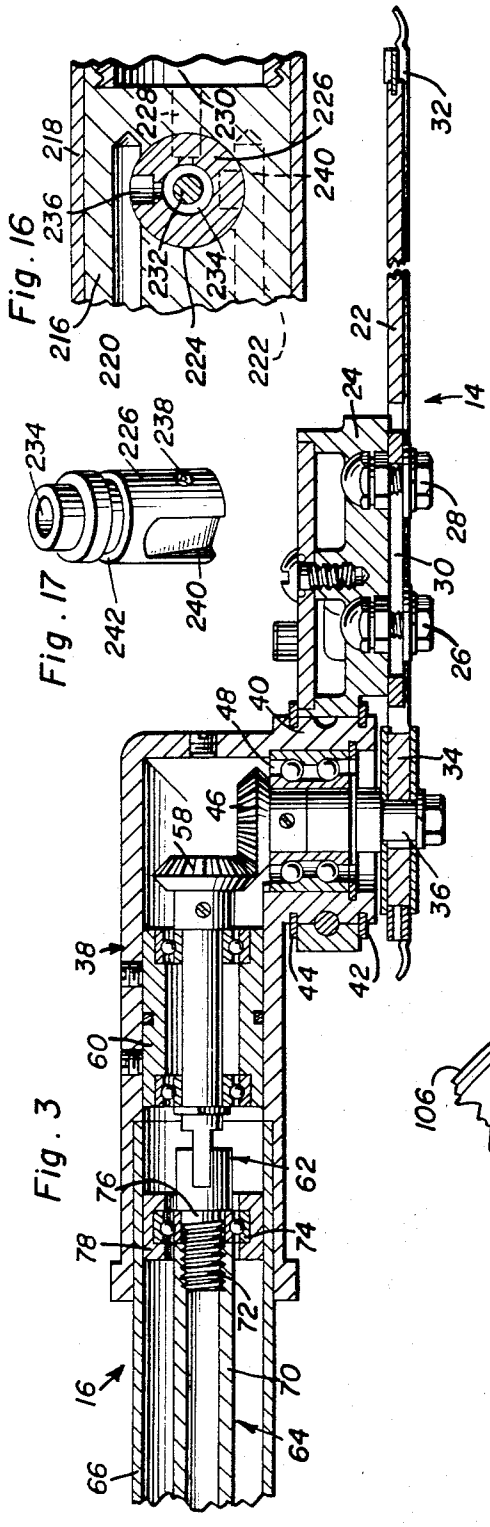

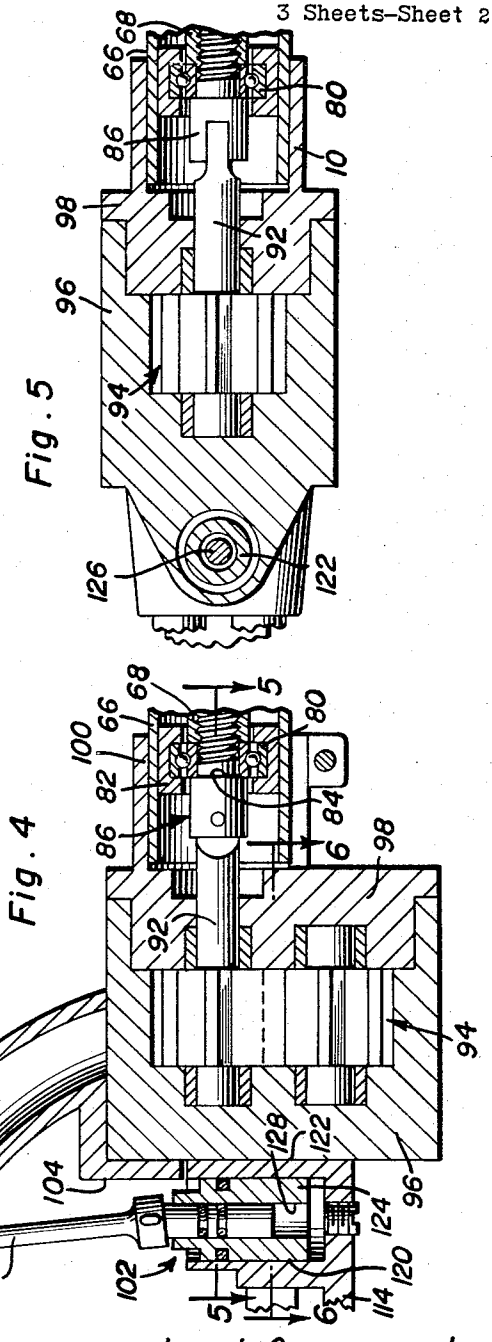

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POWER OPERATED TOOL

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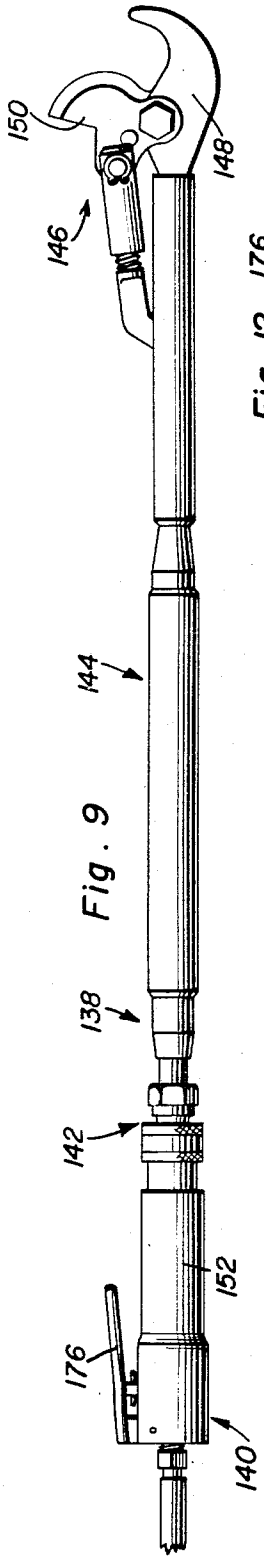

Fig. 9

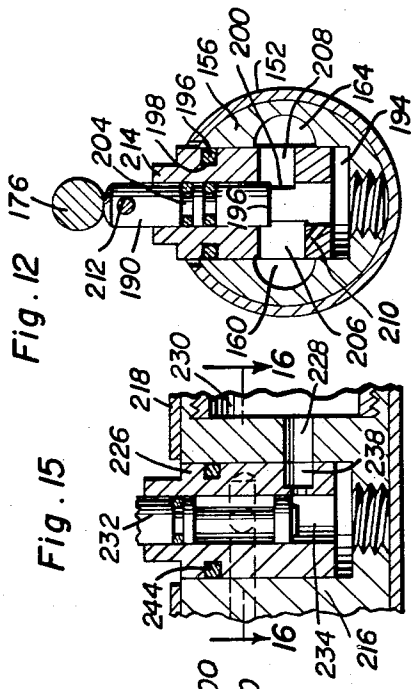

Fig. 12

Fig. 15

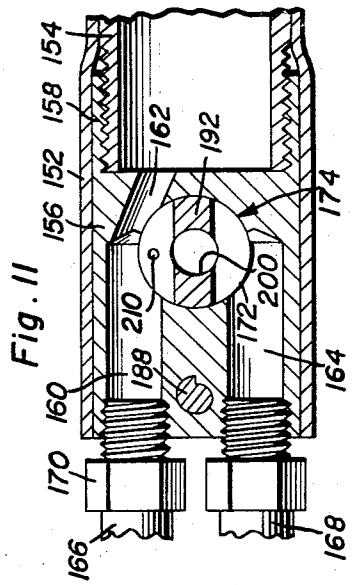

Fig. 11

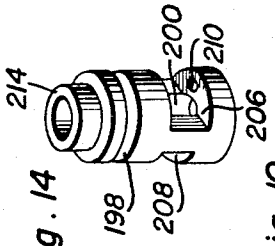

Fig. 14

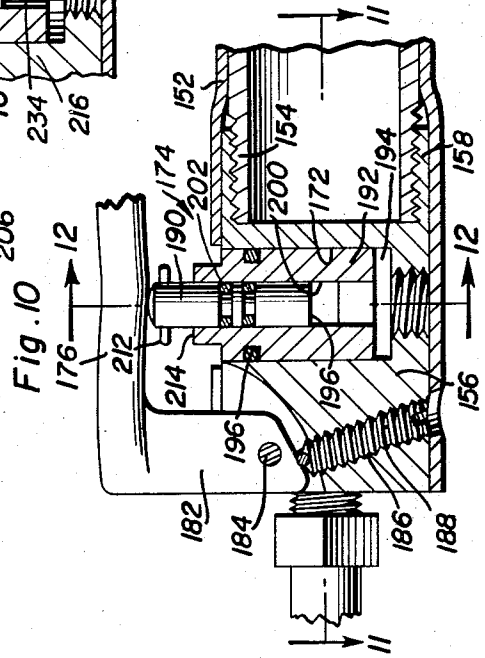

Fig. 10

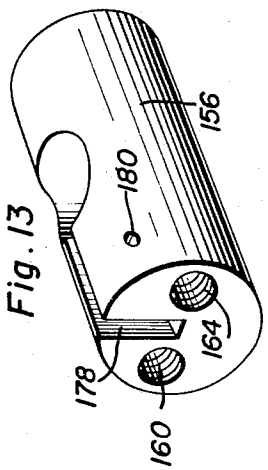

Fig. 13

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3,343,613

POWER OPERATED TOOL

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Filed Aug. 1, 1966, Ser. No. 569,540
12 Claims. (Cl. 173—169)

ABSTRACT OF THE DISCLOSURE

A power operated tool mounted at one end of an elongated tubular housing driven by a fluid operated motor connected to the other end of the tubular housing. The fluid motor and a flow control valve is connected to a handle through which the entire tool assembly is manually supported. A trigger mounted on the handle actuates the valve against a continuous fluid bias to control bi-directional flow of fluid under pressure to the fluid motor the output of which is transmitted by a drive shaft through the tubular housing.

This application is a continuation-in-part of prior co-pending application U.S. Ser. No. 224,631, filed Sept. 19, 1962, and relates to power operated tools. More particularly, the present invention pertains to improvements in fluid power operated tools employing cutting elements such as saw chains and pruning shears.

One of the important improvements of the present invention, is to provide a power operated tool assembly which features a handle portion carrying both a fluid motor and a trigger operated valve mechanism connected to remotely located cutting elements of the tool assembly by means of an elongated support housing. The construction and arrangement of the tool assembly is such as to enable interchange of parts in order to change the length of the support housing for example or the type of valve.

Another important object of the present invention is to provide a fluid power operated tool assembly having a valve mechanism which is continuously urged to a released position without the use of any springs. Further, the valve mechanism is such as to control operation of the fluid motor whether it be of the piston type or the rotary type in a smooth, vibrationless manner avoiding coasting without use of any expensive and cumbersome brake mechanisms. Operation of the fluid motor is also made possible from any source of fluid under pressure available for example on a tractor, loader or hydraulic orchard lift. The need for expensive air compressors is thereby eliminated.

As a further object of the present invention, the tool assembly is light in weight, simple in construction and easy to maneuver and adjust. In one form of the tool assembly, handling of the tool is facilitated by an arcuate grip portion mounting the trigger actuating mechanism from the valve assembly and a conduit guide through which the fluid conduits connected to the valve assembly are relieved of any stress at the connector fittings.

Additional objects of the present invention include the use of an elongated support housing the length of which is selected as required including a drive transmitting shaft assembly featuring detachable connectors and intermediate support facilities.

These together with other objects and advantages which will become subsequently apparent reside in the details of construction and operation as more fully hereinafter described and claimed, reference being had to the accompanying drawings forming a part hereof, wherein like numerals refer to like parts throughout, and in which:

FIGURE 1 is a top plan view of one form of power operated tool constructed in accordance with the present invention.

FIGURE 2 is a side elevational view of the tool assembly shown in FIGURE 1.

FIGURE 3 is an enlarged partial sectional view taken substantially through a plane indicated by section line **3—3** in FIGURE 2.

FIGURE 4 is an enlarged partial sectional view taken substantially through a plane indicated by section line **4—4** in FIGURE 1.

FIGURE 5 is a partial sectional view taken substantially through a plane indicated by section line **5—5** in FIGURE 4.

FIGURE 6 is a partial sectional view taken substantially through a plane indicated by section line **6—6** in FIGURE 4.

FIGURE 7 is an enlarged partial sectional view taken substantially through a plane indicated by section line **7—7** in FIGURE 2.

FIGURE 8 is a transverse sectional view taken substantially through a plane indicated by section line **8—8** in FIGURE 2.

FIGURE 9 is a side elevational view of another form of power operated tool assembly.

FIGURE 10 is an enlarged side sectional view of a portion of the tool assembly shown in FIGURE 9.

FIGURE 11 is a top sectional view taken substantially through a plane indicated by section line **11—11** in FIGURE 10.

FIGURE 12 is a transverse sectional view taken substantially through a plane indicated by section line **12—12** in FIGURE 10.

FIGURE 13 is a perspective view of a portion of the handle assembly associated with the power operated tool assembly shown in FIGURE 9.

FIGURE 14 is a perspective view of the valve body associated with the valve assembly shown in FIGURES 10, 11 and 12.

FIGURE 15 is a partial side sectional view showing another form of valve assembly.

FIGURE 16 is a partial sectional view taken substantially through a plane indicated by section line **16—16** in FIGURE 15.

FIGURE 17 is a perspective view of the valve body associated with the valve assembly shown in FIGURES 15 and 16.

Referring now to the drawings in detail, FIGURES 1 and 2 illustrates one form of power operated tool assembly in its entirety, which is generally referred to by reference numeral **10**. The tool assembly includes a handle portion generally referred to by reference numeral **12** and a cutting tool portion **14** adjustably supported by an elongated support housing **16** connected to the handle portion **12**. Fluid is conducted to and from the tool assembly for operation thereof by means of a pair of conduits **18** and **20**. It will therefore be apparent that the tool assembly is held by the operator at the handle portion **12** thereof while the cutting operation is performed at a location remote therefrom by means of the cutting tool portion **14** which is of the endless chain saw type as shown in FIGURES 1 and 2.

Referring now to FIGURES 1, 2 and 3, it will be observed that the cutting tool portion **14** includes an elongated guide blade **22** removably mounted on a swivel head **24** by means of the spaced fasteners **26** and **28** and the slot **30**. An endless saw chain **32** is entrained about the guide blade **22** and a drive sprocket wheel **34** splined to a shaft section **36** projecting from an end portion **38** of the support housing **16**. The end portion **38** includes a transversely projecting journal **40** on which the swivel head **24** is rotatably mounted for 360° angular movement

about an axis extending through the shaft section **36**. The swivel head is held assembled on the journal **40** by means of the thrust discs **42** and **44** and is angularly adjustable as shown for example by dotted line in FIGURE 2. Also, the swivel head encloses therewithin a lubricant reservoir for lubricating the saw chain **32** as it passes about the drive sprocket **34**.

The shaft section **36** to which the drive sprocket **34** is connected, is driven through a right angle drive including the bevel gear **46** connected to the shaft section **36** and journaled within the end portion **38** of the support housing by means of the bearing assembly **48**. The bevel gear **46** meshes with a bevel gear **58** journaled by the spaced bearing assembly **60** within the end portion **38** of the housing at right angles to the shaft section **36**. The bevel gear **58** is connected by the coupling **62** to one end of a power transmitting drive shaft assembly **64** which extends through the tubular housing portion **66** associated with the support housing.

The drive shaft assembly **64** and the tubular portion **66** of the support housing are both replaceable so that different lengths thereof may be utilized in accordance with different requirements and desires. Where an extremely long drive shaft assembly **64** is utilized, it is composed of at least two tubular sections **68** and **70** as shown in FIGURES 3, 4, 5 and 7. The tool end of the tubular shaft section **70** is internally threaded so as to threadedly receive the threaded portion **72** of the coupling **62**. A ball bearing **74** is held assembled between the tool end of the shaft section **70** and a shoulder **76** on the coupling **62** for rotatably supporting the drive shaft assembly at one end within the end portion **38** of the support housing. The bearing **74** is held in concentric relation within the tool end of the tubular portion **66** of the housing by means of an annular, channel-shaped seating element **78**. Similarly, the opposite drive end of the drive shaft assembly is rotatably supported within the tubular housing portion **66** by the ball bearing **80** seated within an annular seating element **82**. The bearing **80** is held assembled between the shoulder **84** of a connector **86** and the drive end of the tubular shaft section **68** which threadedly receives the connector **86**. Intermediate support is also provided for the drive shaft assembly by means of a ball bearing **88** as shown in FIGURE 7 seated within an annular seating element **90** of resilient material such as rubber, externally ribbed and frictionally held in engagement with the internal surface of the tubular housing by the metallic sleeve **89**. The bearing **88** is held assembled between the adjacent ends of the tubular shaft sections **68** and **70** by means of the externally threaded connector **90**. Where a single shaft is used, the shaft may be externally knurled to hold the inner race of bearing **88** thereon with a force fit.

The drive end of the shaft assembly **64** is connected by the connector **86** to the output shaft **92** of a rotary type of fluid motor **94** as shown in FIGURES 4 and 5. The fluid motor is enclosed within a motor body portion **96** carried by the handle assembly and an end plate portion **98** having an axial extension **100** clamped to the end of the tubular portion **66** of the support housing **16**.

Also carried by the handle assembly, is a valve assembly generally referred to by reference numeral **102**. The valve assembly is enclosed by a housing portion **104** of the handle assembly on the side of the fluid motor **94** opposite the support housing **16**. An arcuate grip portion **106** is connected to the housing portion **104** and extends forwardly from the fluid motor **94** to a conduit guide portion **108**. The conduit guide portion therefore receives therethrough the fluid conduits **18** and **20** as shown in FIGURE 8. The conduits are clamped to the guide portion **108** by means of the clamp section **110** and the fastener **112** secured to the forward end of a spacer portion **114** connected to the housing portion **104** of the handle assembly. The conduits **18** annd **20** are thereby aligned with the inlet and outlet passages **116** and **118** in the handle assembly which communicate with the fluid motor **94** as shown in FIGURE 6.

Fluid flow to and from the motor is controlled by means of the valve assembly **102** as aforementioned and toward this end a cylindrical opening **120** is formed in the handle assembly overlapping the inlet and outlet passages **116** and **118** as shown in FIGURE 6 in order to establish fluid communication therebetween in bypass relation to the fluid motor. The valve assembly includes a valve body **122** sealingly received within the opening **120** to form a cavity **124** therewithin as shown in FIGURE 4 to which the lower end of a reciprocable valve element **126** is exposed. The valve element **126** is displaceable within the bore **128** of the valve body between a release position wherein a bypass passage is formed between the fluid inlet and outlet passages **116** and **118** and an operating position in which the bypass passage is blocked so that fluid under pressure is routed through the fluid motor for operation thereof.

The valve element **126** is displaced from its release position to the motor operating position against the bias of fluid pressure in cavity **124** by means of an actuating trigger element **130** pivotally mounted on the arcuate grip portion **106** of the handle assembly, the trigger element being connected to the valve element by the link element **132**. The trigger element **130** is pivotally mounted by the pivot pin **134** as shown in FIGURE 2 so that it may extend forwardly therefrom below the handgrip covering **136** on the arcuate grip portion **106** for convenient manipulation by the operator. To operate the tool, the trigger element **130** is angularly displaced in a clockwise direction as viewed in FIGURE 2 so as to downwardly displace the valve element **126** within the bore **128** to the operating position blocking the bypass passage between the inlet and outlet passages **116** and **118**. Recirculation of fluid in bypass relation to the motor is thereby interrupted in order to operate the motor by routing the fluid therethrough causing rotation of the motor output shaft **92**. The tool is thereby driven by the torque transmitted through the drive shaft assembly **64** and the right angle drive. When the trigger element **130** is released, fluid under pressure displaces the valve element **126** upwardly to its release position re-establishing fluid communication through the bore **128** of the valve body between the inlet and outlet passages **116** and **118** in bypass relation to the motor. The motor is thereby abruptly stopped without coast.

FIGURE 9 illustrates another power operated tool assembly constructed in accordance with the present invention which is generally referred to by reference numeral **138**. This tool assembly also includes a handle portion **140** connected by the disconnectible connector assembly **142** to an elongated support housing portion **144** which mounts a pruning shears **146** including the stationary blade **148** and the pivoted cutter blade **150**. An elongated piston rod assembly (not shown) is therefore enclosed within the support housing **144** and is connected to a piston type motor enclosed within the handle assembly **140**.

As shown in FIGURES 10, 11, 12 and 13, the handle assembly includes an outer tubular casing **152** within which the fluid piston motor is housed having externally threaded chamber portion **154**. The motor chamber is thereby connected to a cylindrical handle body **156** by means of an internally threaded end section **158**. The handle body also includes a fluid inlet passage **160** connected by the connecting passage **162** to the fluid chamber within the piston motor and an outlet passage **164**. Inlet and outlet conduits **166** and **168** are respectively connected to the inlet and outlet passages by means of the fittings **170**. Also formed in the handle body **156** is a cylindrical opening **172** in fluid communication with both the inlet and outlet passages **160** and **164**. Thus, a bypass between the inlet and outlet passages is established under control of the valve assembly **174**. Valve actuating means consisting of a trigger lever element **176** is pivotally

mounted by the handle body **156**. Toward this end, the handle body is provided with a slot **178** intersected by a bore **180** so that the mounting portion **182** of the trigger element may be received in the slot and be pivotally anchored to the body by a pin **184** received through the bore **180**. A threaded bore **186** is also formed in the handle body intersecting the slot **178** as shown in FIGURE 10 so as to threadedly receive an adjusting stop element **188** by means of which the trigger element is limited in a counterclockwise direction to a position corresponding to the release position of the valve element **190** associated with the valve assembly **174**.

The valve assembly **174** is similar in construction and operation to the valve assembly **102** associated with the tool assembly **10** of FIGURES 1 through 8. The valve assembly **174** therefore also includes a valve body **192** received within the cylindrical opening **172** so as to form a cavity **194** therebelow to which the end **196** of the valve element is exposed. Accordingly, fluid under pressure supplied to the cavity **194** will exert an axial bias on the valve element **190** tending to displace it toward its release position. The cavity **194** is therefore sealed by means of the O-ring seal **196** received within the annular groove **198** of the valve body while the bore **200** extending through the valve body is sealed by the O-rings **202** within the axially spaced grooves **204** formed in the valve element. The valve body is also formed with an inlet port or cutout **206** which establishes communication between the bore **200** and the inlet passage **160**. An outlet port or cutout **208** is also formed in the valve body establishing fluid communication between the bore **200** and the outlet passage **164**. It will be observed from FIGURES 12 and 14, that the axial length of the inlet port **206** is greater than that of the outlet port **208** so that when the valve element **190** is displaced downwardly to its operating position, only the exhaust port **208** is closed and fluid communication between the bore **200** and the outlet passage **164** interrupted. Thus, fluid under pressure supplied to the inlet passage **160** will always be available to pressurize the cavity **194**. Toward this end, a passage **210** establishes fluid communication between the inlet port **206** and the cavity **194** in order to assure that fluid under pressure will be exerted at the lower end of the valve element in all positions thereof. Thus, when the valve element **190** is displaced by the trigger element **176** to its operating position as defined by the limit pin **212** engaging the upper end **214** of the valve body, the exhaust port **208** is closed so that fluid supplied to the inlet passage **160** will pressurize the piston chamber. The piston (not shown) within the chamber is thereby displaced causing movement of the pruning cutter blade **150** toward the end of its stroke. When movement of the piston is retarded or stopped by a load engaged with the blade **150**, pressure increases. Since fluid communication is established between the inlet passage and the cavity **194**, any increase in pressure is communicated to the cavity so that when overload conditions occur, the force exerted on the piston element **190** will be sufficient to displace it toward its release position. The bypass passage through the bore **200** is thereby opened so as to unload the fluid piston motor.

It will be apparent from the description of the valve assembly **174** illustrated in FIGURES 10, 11, 12 and 14, that it will control the flow of fluid for operation of either a piston type of fluid motor as described in connection with FIGURES 9 through 14 or a rotary type of gear pump motor such as described in connection with FIGURES 1 through 8 utilizing a continuously circulating fluid type of circuit. The power operated tools may however also be operated from a closed fluid circuit by replacing the valve assembly with a type such as illustrated in FIGURES 15, 16 and 17. For such an arrangement, the handle body **216** within the tubular casing **218** of the handle assembly is provided with inlet and outlet passages **220** and **222** in fluid communication with the cylindrical opening **224** within which the valve body **226** is received. A connecting passage **228** is also formed in the handle body between the cylindrical opening **224** and the piston chamber **230**, axially spaced from the inlet passage **220**. A spool type of valve element **232** is received within the bore **234** of the valve body so as to either interrupt or establish fluid communication between the inlet port **236** and the cylinder pressure port **238** formed in the valve body in axially spaced, right angle relation to each other. The inlet port **236** is therefore in communication with the inlet passage **220** while the pressure port **238** is in registration with the passage **228**. Also formed on the valve body in 180° relation to the inlet port **236**, is an exhaust recess **240** in communication with the outlet passage **222**. Thus, in the release position of the spool valve element **232** as shown in FIGURE 15, the cylinder chamber **230** is exhausted through the port **238**, bore **234**, recess **240** and outlet passage **222**. When the valve element **232** is displaced to its operating position, fluid communication is then established through the bore **234** between the inlet passage **220** and the pressure passage **238** for supplying fluid under pressure to the cylinder chamber. The valve body **226** is also provided with an annular groove **242** for receiving the sealing ring **244**. This type of valve assembly could also be utilized in conjunction with a closed fluid circuit for tool assemblies having a rotary type of fluid motor.

The foregoing is considered as illustrative only of the principles of the invention. Further, since numerous modifications and changes will readily occur to those skilled in the art, it is not desired to limit the invention to the exact construction and operation shown and described, and accordingly all suitable modifications and equivalents may be resorted to, falling within the scope of the invention as claimed.

What is claimed as new is as follows:

1. In combination with a fluid pressure operated device, a handle assembly having inlet and outlet passages connected to said device and valve means mounted by the handle assembly for controlling circulatory flow of fluid under pressure to said device comprising, a valve body being mounted by the handle assembly having a bore through which continuous fluid communication is established between said inlet passage and the fluid pressure operated device, a valve element mounted for movement within said bore of the valve body, actuating means mounted by the handle assembly and engageable with the valve element for displacement thereof from a release position to an operating position establishing bidirectional flow of fluid under pressure to and from the fluid pressure operated device, and fluid pressure means connected to the bore of the valve body for continuously urging the valve element toward said release position preventing said bidirectional flow.

2. In combination with a fluid pressure operated device, a handle assembly having inlet and outlet passages connected to said device and valve means mounted by the handle assembly for controlling flow of fluid under pressure to said device comprising, a valve body having a bore extending therethrough, said valve body being received within an opening formed in the handle assembly communicating with said inlet and outlet passages, a valve element mounted for movement within said bore of the valve body, actuating means mounted by the handle assembly and engageable with the valve element for displacement thereof from a release position to an operating position producing flow of fluid under pressure to the fluid pressure operated device, and fluid pressure means for urging the valve element toward said release position, said valve body including inlet and outlet ports establishing fluid communication between the inlet and outlet passages through said bore, only the outlet port being closed by the valve element in the operating position thereof, said fluid pressure means including a cavity formed in said opening by the valve body to which the valve element is

exposed through the bore, and passage means in the valve body continuously connecting the inlet passage to the cavity for pressurization thereof.

3. The combination of claim 2 including means engageable with the valve body for limiting movement of the valve element to said operating position.

4. The combination of claim 3 wherein said actuating means comprises a trigger element pivotally mounted by the handle assembly in alignment with the valve element, and adjustable stop means limiting displacement of the trigger element by the valve element to the release position.

5. The combination of claim 1 wherein said handle assembly includes an arcuate grip portion connected to the fluid pressure operated device, and guide means mounted by the grip portion in spaced alignment with the valve body for supporting a pair of conduits connected to the inlet and outlet passages.

6. The combination of claim 2 wherein said fluid pressure operated device includes, a fluid motor connected to the handle assembly, a power operated tool, tubular support means connected to the fluid motor for mounting the tool remotely spaced from the handle assembly, and power transmitting means enclosed within the tubular support means for drivingly connecting the fluid motor to the tool.

7. The combination of claim 6 wherein said tubular support means includes a transversely extending end portion, and swivel means rotatably mounting the tool on the end portion for 360° angular movement, said power transmitting means including an angle gear drive mounted in the end portion of the support means and connected to the tool and an elongated drive shaft connecting the fluid motor to the angle gear drive.

8. The combination of claim 7 wherein said elongated drive shaft includes at least two tubular sections having adjacent, internally threaded portions, bearing means axially spacing said sections in concentric relation to each other, an annular seating element within the tubular support means positioning the bearing means therewithin, and connector means threadedly received in the internally threaded portion locking the bearing means in assembled relation between the tubular sections.

9. In combination with a fluid pressure operated device, a handle assembly connected to said device, valve means mounted by the handle assembly for controlling the flow of fluid under pressure to said device, actuating means mounted by the handle assembly and engageable with the valve element for displacement thereof from a release position, a power operated tool, tubular support means connected to the fluid operated device for mounting the tool remotely spaced from the handle assembly and an elongated drive shaft enclosed within the tubular support means drivingly connecting the fluid operated device to the tool, including at least two tubular sections having adjacent internally threaded portions, bearing means axially spacing said sections in concentric relation to each other, an annular seating element within the tubular support means positioning the bearing means therewithin, and connection means threadedly received in the internally threaded portion locking the bearing means in assembled relation between the tubular sections.

10. In combination with a fluid pressure operated device, a handle assembly having inlet and outlet passages connected to said device and valve means mounted by the handle assembly for controlling the flow of fluid under pressure to said device comprising, a valve body having a bore extending therethrough, said valve body being

received within an opening formed in the handle assembly communicating with said inlet and outlet passages, a valve element mounted for movement within said bore of the valve body, actuating means mounted by the handle assembly and engageable with the valve element for displacement thereof from a release position, said fluid pressure operated means including a fluid motor connected to the handle assembly, a power operated tool, tubular support means connected to the fluid motor for mounting the tool remotely spaced from the handle assembly and power transmitting means enclosed within the tubular support means for drivingly connecting the fluid motor to the tool, said tubular support means including a transversely extending end portion, and swivel means rotatably mounting the tool on the end portion for 360° angular movement, said power transmitting means including an angle gear drive mounted in the end portion of the support means and connected to the tool, and an elongated drive shaft connecting the fluid motor to the angle gear drive, said elongated drive shaft including at least two tubular sections having adjacent, internally threaded portions, bearing means axially spacing said sections in concentric relation to each other, an annular seating element within the tubular support means positioning the bearing means therewithin, and connector means threadedly received in the internally threaded portion locking the bearing means in assembled relation between the tubular sections.

11. The combination of claim 9 wherein said handle assembly includes an arcuate grip portion mounted by the fluid pressure operated device, and guide means connected to the grip portion in spaced alignment with the valve body for supporting a pair of conduits connected to the inlet and outlet passages.

12. In a fluid pressure operated device having an inlet and an outlet passage, a flow controlling valve assembly comprising, a valve body having a bore extending therethrough, said valve body being received within an opening formed in the device and communicating with said inlet and outlet passages, a valve element mounted for movement within said bore of the valve body, actuating means mounted by the handle assembly and engageable with the valve element for displacement thereof from a release position to an operating position producing flow of fluid under pressure to the fluid pressure operated device, fluid pressure means for urging the valve element toward said release position, said valve body including inlet and outlet ports establishing fluid communication between the inlet and outlet passages through said bore, only the outlet port being closed by the valve element in the operating position thereof, a cavity formed in said opening by the valve body to which the valve element is exposed through the bore and passage means in the valve body continuously connecting the inlet passage to the cavity for pressurization thereof.

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