Feb. 28, 1956 W. M. KENNEDY 2,736,305

HYDRAULIC GOVERNOR

Filed April 16, 1953 2 Sheets-Sheet 1

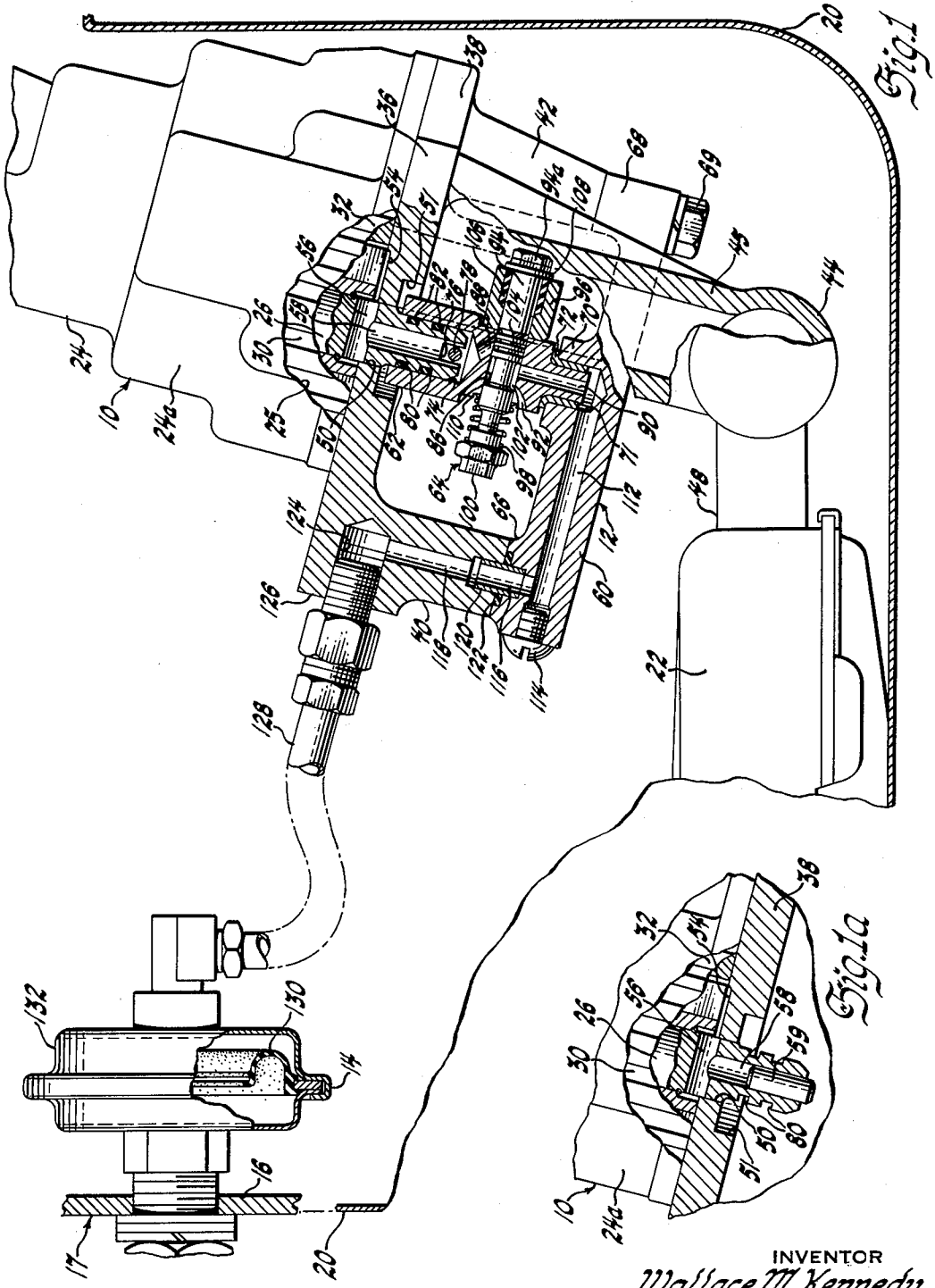


Fig. 1

Fig. 1a

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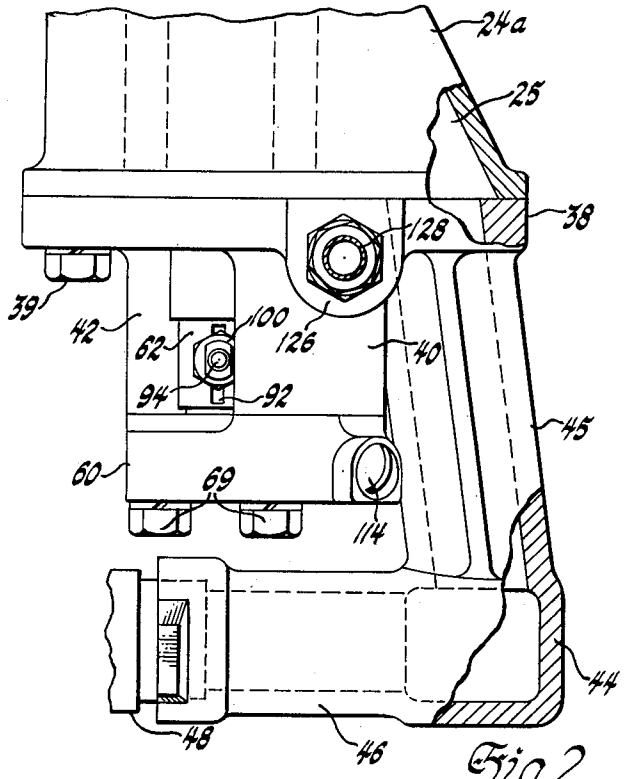


Fig. 2

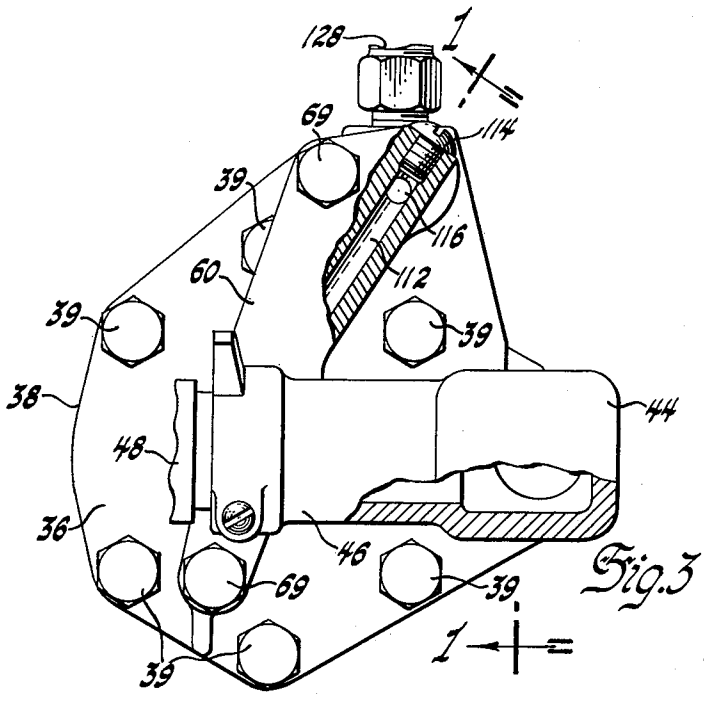


Fig. 3

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HYDRAULIC GOVERNOR

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Application April 16, 1953, Serial No. 349,291

15 Claims. (Cl. 123—103)

This invention relates to engine governors particularly of the hydraulically actuated variety. The invention aims generally toward effecting improvements in governor control units as are used in over-speed control systems in which a source of engine developed fluid pressure is regulatively applied through a centrifugally unbalanced control valve to a pressure responsive servo device that is operatively connected to adjust the engine throttle in the carburetor system of the engine.

In such apparatus the centrifugal governor control valve is carried by a governor shaft portion that may be integral with or a separable part rotatatively driven by the shaft of an engine accessory, usually the engine distributor. In prior art governor installations the manner of adapting the engine accessory and the construction of the governor control unit accommodated thereby have been such as to require disassembly of the accessory and of the governor unit and to require calibration or adjustment of the speed setting of the governor for installation thereof.

Accordingly, it is the principal object of the present invention to provide a novel construction for a governor control unit such that the unit may be pre-adjusted and packaged in the factory ready to be installed in the field or service garage as a working unit without requiring disassembly and adjustment or setting thereof. Another object is to adapt an existing engine accessory to accommodate a governor control unit of this character in such a manner that extensive modification of the accessory and disassembly thereof for installation of the governor unit is not required. Other objects are to provide an improved hydraulic over-speed governor which is of simple and inexpensive construction, which is positive and reliable in operation, which employs a minimum number of parts and is possessed of a high degree of sensitivity and stability over a wide range of operating conditions.

Fig. 1 is a front elevation view with parts broken away and in section illustrating a governor installation on an engine lubricating oil pump in accordance with the present invention;

Fig. 1*a* illustrates the manner in which the oil pump may be adapted to receive the governor control unit shown thereon in Fig. 1;

Fig. 2 is a fragmentary side elevation view with parts broken away and in section illustrating the governor adaptor structure installed on the engine lubricating oil pump of Fig. 1; and

Fig. 3 is a bottom plan view with parts broken away and in section of Fig. 2.

Referring to the drawings, the present invention is illustrated in an hydraulic speed controlling system which comprises, in general, an engine lubricating oil pump **10**, a centrifugal governor control unit **12** and a pressure responsive servo device **14**, which may be mounted on a wall **16** of the engine crankcase **17** and is operatively connected to effect an adjustment of the throttle valve associated with the carburetor system of the engine. An oil pan **20** detachably connected to the engine crankcase

forms an oil sump containing a quantity of lubricating oil, which is supplied to the pump inlet through a float type oil strainer **22** of conventional design.

The oil pump **10**, which is mounted in an opening in the engine crankcase communicating with the oil sump, may be of the commonly employed high capacity gear type developing substantially full engine pressure at about ⅓ engine speed and comprises a generally one piece housing **24**, which is formed with an enlarged open-ended lower portion **24***a* having a pump chamber **25** (Fig. 2) therein and an axially extending shaft **26** mounted in the pump chamber of the pump housing, and a driver gear **30** which meshes with and drives an idler gear **32** mounted on a stub shaft in the pump housing. The driver shaft **26**, which extends axially through the pump housing and is rotatable therein, is adapted to be driven at its upper end from a gear on the cam shaft within the crankcase of the engine.

The pump cover **36** may be a one-piece casting having a plate or cover portion **38**, a pair of axially downwardly extending spaced legs **40** and **42**, which support the governor unit, and an integrally formed generally L-shaped intake conduit **44** having an arm **45** that communicates with the inlet or low pressure side of the pump through the cover plate portion **38** and another arm **46** that is suitably connected to the outlet **48** of the strainer **22** in the oil pan **20**. The cover plate portion **38**, which is detachably connected from the pump housing as by bolts **39**, is bored and counterbored, as shown at **50** and **51**, coaxially with the pump shaft **26**, and has a pressure pocket **54** formed therein on the high pressure side of the pump chamber.

The pump shaft **26** extends through the pump cover portion **38** and has a fluid pressure supply path therein constituted by a diametrically transverse passage **56**, which communicates with the pressure pocket **54** in the pump cover portion **38**, and an axially extending passage **58** extending between the transverse passage **56** and the end of the pump shaft, substantially as shown. The end of the shaft passage **58** may be capped or plugged as by a pin **59** (Fig. 1*a*) which is removed when the governor control unit of the invention is installed. With the pump cover and pump shaft formed as described above, the governor control unit may be combined therewith after the pump has been installed on the engine without necessitating disassembly of the pump.

The governor control unit **12** comprises an adaptor plate **60**, a governor shaft portion **62** and a centrifugally unbalanced control valve assembly **64** carried by the governor shaft **62**. The governor adaptor plate **60** is a one-piece irregularly shaped casting having a plurality of upwardly extending bosses integrally formed thereon including a pair of end bosses **66** and **68**, which are respectively aligned with the legs **40** and **42** of pump cover plate portion **38** and are detachably secured thereto as by bolts **69**, and a third boss **70** which is disposed between the said end bosses and is axially aligned with the pump shaft **26**. The boss **70** has a shaft bore **71** therein which receives a bronze bushing **72** and provides a journal for supporting one end of the rotatable governor shaft element **62**.

The governor shaft element **62** is of reduced diameter at its lower end journaled in the adaptor plate **60** and is enlarged at its opposite or upper end which has an axial end bore **74** extending therein to form a walled receptacle or socket that telescopically receives the pump shaft extension therein without the pump chamber. A separable rotative drive connection is provided between the adjacent telescoped ends of the pump shaft **26** and governor shaft **62** in the form of a slot **76** in the end of the pump shaft extension and a pin **78** which is received in the slot **76** and

extends through the governor shaft. The pump shaft **26** may have a pair of spaced annular grooves **80**, therein for a pair of O-rings **82**, that serve to prevent leakage of fluid supplied to the governor from the pump shaft. The governor shaft has a diametrically extending cross-bore **86** intermediate the ends thereof and contains a plurality of staggered fluid passages therein branching from the cross-bore including an inclined pressure inlet passage **88** communicating with the axial end bore **74**, an axially extending outlet passage **90** communicating with the bore **71** in adaptor plate **60** and a pressure relief passage **92** formed by a notch in the side of the governor shaft at one end of the cross bore **86** whereby the pressure inlet passage **88** and the pressure outlet passage **90** may communicate with atmosphere, as will appear below.

The control valve assembly **64** comprises a valve spool or stem **94**, a centrifugal fly-weight **96**, a balance spring **98** and a spring tensioning nut **100**. The valve spool or stem **94** is slidably fitted in the cross-bore **86** in the governor shaft and has an annular groove **102** between the ends thereof which serves to establish fluid communication between the pressure outlet passage **90** and the pressure relief passage **92**, the pressure inlet passage **88** and the pressure outlet passage **90** or all three of said passages depending upon the position of the valve which is determined by the speed of the engine. A portion of the valve spool normally closing the inlet branch passage **90** may be provided with a plurality of spaced circumferential grooves **104** that serve to reduce the friction of the valve spool and cause a relatively free and positive valve movement by providing somewhat of a floating action to the spool within the cross-bore **74**.

The centrifugal fly-weight **96** is bored and counterbored to accommodate a bushing **106** of synthetic rubber or the like, which serves as a torsional vibration damper, and is retained on the valve stem or spool **94** by a spring clip or washer **108** and an enlarged integrally formed head **94***a* on one end of the spool. The tensioning spring **98**, which is located at the end of the valve spool opposite the fly-weight **96**, is seated at one of its ends in a spotfaced groove or slot **110**, which is formed in the surface of the governor shaft coaxial with the cross-bore **86** therein, and is seated at its other end against the spring tensioning nut **100**, which is threaded on a reduced end portion of the valve spool, substantially as shown.

The governor adaptor plate **60** has a pressure discharge passage **112** therein, which communicates at one end with the bore **71** in boss **70** and is capped with a core plug **114** at its opposite end in the side of boss **66**. A counterbored branch passage **116** communicating with passage **112** is provided in boss **66**, substantially as shown, and is connected to a counterbored passage **118** in the leg **40** of the pump cover through a nipple **120** in the adjacent counterbored ends of the passages **116** and **118**. An O-rong **122** is provided in a shallow counterbore in the end boss **66** in the face thereof adjacent the end face of the leg **40** to prevent fluid leakage therebetween. The connecting passage **118** communicates with an opening **124** formed in a side boss **126** at the upper end of the leg **40** adjacent the pump cover portion **38**, which opening forms a discharge port from the governor and threadably receives one end of a length of connecting line or tubing **128** the other end of which is connected to the pressure responsive servo device **14**. By connecting the tubing to the outer end of the discharge passage **112** in the adaptor plate, the construction of the pump cover may be somewhat simplified and the core plug **114** eliminated.

The device **14** may be a conventional pressure diaphragm structure, one side of the diaphragm **130** of which forms a flexible wall for a pressure chamber within the housing **132** of the device and is adapted to be exposed to the fluid pressure regulatably applied thereto through the governor control unit. The other side of the diaphragm may be exposed to atmosphere and is operatively connected to the engine throttle valve. The servo device **14** is shown mounted interiorly of the engine from a wall of the engine crankcase, but may be mounted at the intake manifold adjacent the engine throttle valve, if desired. In either event only a single short length of hydraulic connecting tube is employed in the entire speed control system. It will be further noted that the inaccessible interior location of the governor control unit within the engine presents unauthorized personnel from tampering with the governor speed setting.

The weight of the governor fly-weight **96**, the adjusted compressive strength of the balance or tensioning spring **98**, and the speed of revolution of the governor shaft **62** determines the extent that the valve spool **94** moves to govern the flow of fluid under pressure from the oil pump to the pressure responsive device **14**.

With the parts of the control system in the normal position shown, starting of the engine causes rotation of the pump shaft **26** and causes engine lubricating oil pressure to be supplied in an hydraulic path or circuit from the pressure side of the pump chamber **25** to the pressure pocket **54** in the pump cover, the pressure supply passages **56** and **58** in the pump shaft, the axial end bore **74** and diagonal pressure inlet passage **88** in the governor shaft and then to the crossbore **86** in which the valve stem **94** is normally positioned to block the inner end of the pressure inlet branch passage. With the valve stem in the normal position shown, the annular groove **102** therein registers with the pressure relief slot or passage **92** and the pressure outlet branch passage **90**, so as to relieve fluid pressure on the pressure diaphragm **14** and thus to reference the system to atmosphere.

Upon an increase in the speed of the pump shaft **26** to a value sufficient to cause the centrifugal flyweight **96** and valve stem **94** to move radially outwardly of the governor shaft against the force of the balance spring **98** on the valve stem, the valve stem groove **102** will be moved initially into momentary registry with the inner end of all three passages **88**, **90** and **92** in the governor shaft, and then will be finally moved into registry with the pressure inlet and outlet branch passages **88** and **90**, when substantially full lubricating oil pressure will be applied through the pressure outlet passage to the diaphragm pressure chamber in the pressure operated throttle actuating device **14**. The momentary application of pressure from the pressure inlet passage **88** to both the pressure relief slot or passage **92** and the pressure outlet passage **90** limits the sudden increase of pressure in the diaphragm chamber so as to prevent over-shooting and consequent hunting that otherwise would obtain.

What is claimed is:

1. In combination with an engine accessory having a housing and an engine driven shaft rotatable in the housing, a support having a journal in a portion thereof detachable from said housing, a rotatable governor element having a plurality of passages therein, one end of said rotatable governor element being journaled in said support, a separable rotative drive connection between the other end of said rotatable governor element and said shaft and a centrifugally unbalanced spring biased valve slidably mounted in said rotatable governor element between the said passages therein for controlling communication therebetween.

2. In combination with an engine accessory having a housing, a cover for said housing and an engine driven rotatable shaft extending through said cover without said housing, a support having a journal in a portion thereof detachable from said housing cover, a rotatable governor element journaled at one end in said support, a separable rotative drive connection between the other end of said rotatable governor element and said shaft and a centrifugally unbalanced spring biased governor valve in said governor element.

3. In combination with an engine accessory having an

engine driven shaft rotatably mounted therein, a governor control unit comprising a centrifugally unbalanced spring biased control valve and a rotatable shaft-like body portion for said valve, said valve body portion being coaxial and telescopically connected with said rotatably driven by said accessory shaft.

4. In combination with an engine accessory having a housing and an engine driven shaft rotatably mounted in said housing, a support having a journal in a portion thereof detachable from the said housing, a rotatable governor element being journaled in said support and its other end coaxial and telescopically connected with said shaft, a separable rotative drive connection between said governor element and said shaft and a centrifugally unbalanced spring biased cross-valve slidably mounted in said rotatable governor element between the said passages therein for controlling communication therebetween.

5. In combination with an engine accessory having a housing, a pressure chamber in said housing and an engine driven shaft rotatably mounted in said housing, said shaft having a passage therein communicating with said pressure chamber, a support having a journal in a portion thereof detachable from said housing, a rotatable governor element journaled at one end in said support, a separable rotative drive connection between the other end of said rotatable governor element and said shaft, said rotatable governor element having a cross-bore therein and a plurality of passages branching from said bore including a pressure inlet passage communicating with said shaft passage and a pressure outlet passage, and a centrifugally unbalanced spring biased cross-valve slidably mounted in the said cross-bore of said rotatable governor element for controlling communication between the said passages therein.

6. In combination with an engine accessory having a housing, a pressure chamber in said housing and an engine driven shaft rotatably mounted in said housing, said shaft having a passage therein communicating with said pressure chamber, a support having a journal in a portion thereof detachable from said housing, a rotatable governor element journaled at one end in said support, a separable rotative drive connection between the other end of said rotatable governor element and said shaft, sealing means between adjacent ends of said rotatable governor element and said shaft, said rotatable governor element having a cross-bore therein and a plurality of passages branching from said bore including a pressure inlet passage communication with said shaft passage and a pressure outlet passage, and a centrifugally unbalanced spring biased cross-valve slidably mounted in the said cross-bore of said rotatable governor element for controlling communication between the said passages therein.

7. In combination with an engine driven pump having a housing, a pump chamber in said housing and an engine driven shaft rotatably mounted in said housing, said housing having a separate inlet passage and outlet passage therein communicating with said pump chamber, said shaft having a fluid passage means therein communicating with said pump chamber, a support having a journal in a portion thereof detachable from said housing, a rotatable speed governor element journaled at one end in said support and telescopically receiving said shaft at its other end, a separable rotative drive connection between the adjacent ends of said rotatable governor element and said shaft, said rotatable governor element having a cross-bore extending therethrough and a plurality of fluid pressure passages branching from said cross-bore including a fluid pressure inlet passage communicating with said pressure inlet passage and said pressure outlet passage, a centrifugally unbalanced spring biased control valve slidably mounted in the said cross-bore of said rotatable governor element for controlling fluid communication between said passages therein, said support having a discharge port therein connecting with said fluid pressure outlet passage in said rotatable governor element, the said outlet passage of said governor element being independent of said inlet passage and outlet passage of said pump housing.

8. In combination with an engine lubricating oil pump and an oil sump, said pump having a housing, a pump chamber in said housing, said housing having a separate fluid inlet and pressure outlet passage communicating with the pump chamber a fluid intake conduit extending between said oil sump and communicating with said fluid inlet passage of said pump housing and an engine driven shaft rotatably mounted in and having an end portion extending without said housing, said shaft having a fluid pressure supply passage therein communicating with said pump chamber, a governor adaptor member detachable from said pump housing and having a journal therein spaced from the end of said housing, a rotatable speed governor element journaled at one end in said adaptor member and telescopically receiving the extension of said shaft in its other end, fluid sealing means and a separable rotative drive connection between the telescoped ends of said rotatable governor element and said shaft, said rotatable governor element having a cross-bore therein and a plurality of fluid passages branching from said cross-bore including a fluid pressure inlet passage communicating with said pump shaft passage and a fluid pressure outlet passage, and a centrifugally unbalanced spring biased control valve slidably mounted in the said cross-bore in said rotatable governor element for controlling fluid communication between the said passages therein, said adaptor member having a discharge passage therein communicating with said fluid pressure outlet passage in said rotatable governor element, the said outlet passage of said governor element being independent of said inlet passage and outlet passage of said pump housing.

9. In combination with an engine lubricating oil pump and an oil sump, said pump having a housing, a pump chamber in said housing, said housing having a separate fluid inlet and pressure outlet passage communicating with the pump chamber a fluid intake conduit extending between said oil sump and communicating with said fluid inlet passage of said pump housing and an engine driven shaft rotatably mounted in and having an end portion extending without said housing, said shaft having a fluid pressure supply passage therein connecting with said pump chamber, a governor adaptor member detachable from said pump housing and having a journal therein spaced from the end of said housing, a rotatable speed governor element journaled at one end in said adaptor member and telescopically receiving the extension of said shaft in its other end, sealing means and a separable rotative drive connection between the telescoped ends of said rotatable governor element and said shaft, said rotatable governor element having a cross-bore therein and a plurality of fluid passages branching from said cross-bore including a fluid pressure inlet passage communicating with said pump shaft passage, a fluid pressure outlet passage and a pressure relief passage and a centrifugally unbalanced spring biased control valve slidably mounted in the said cross-bore in said rotatable governor element for controlling fluid communication between the said passage therein, said adaptor member having a discharge passage therein communicating with the said fluid pressure outlet passage in said rotatable governor element, the said outlet passage of said governor element being independent of said inlet passage and outlet passage of said pump housing.

10. In combination with an engine lubricating oil pump and an oil sump, said pump having a housing, a pump chamber in said housing, said housing having a separate fluid inlet passage and outlet passage therein communicating with said pump chamber, a pump cover having an intake conduit extending between said oil sump and communicating with said fluid inlet passage of said pump housing, a pair of spaced support legs depending from each cover and a pump shaft rotatably mounted in said housing, said shaft having an end portion extending with-

out said pump cover and a fluid pressure supply passage in said end portion communicating with said pump chamber, a governor adaptor member detachably connected to said legs of said pump cover and having a journal therein, a rotatable speed governor shaft journaled at one end in said adaptor member and having an axially formed opening in its other end for receiving the extension of said pump shaft therein, sealing means on said shaft extension in said governor element, a pin and slot rotative drive connection between the adjacent ends of said rotatable governor element and said shaft, said rotatable governor element having a cross-bore therein and a plurality of fluid passages branching from said cross-bore including a fluid pressure inlet passage connecting with said shaft extension passage through said end opening in said rotatable governor element, a fluid pressure outlet and a pressure relief passage between said cross-bore and the exterior of said rotatable governor element, and a centrifugally unbalanced spring biased control valve slidably mounted in the said cross-bore in said rotatable governor element for controlling fluid communication between said passages, said adaptor member having a pressure discharge passage therein communicating with said fluid pressure outlet passage in said rotatable governor element, the said outlet passage of said governor element being independent of said inlet passage and outlet passage of said pump housing.

11. In combination with an engine accessory having a housing, a pressure chamber in said housing and an engine driven shaft rotatably mounted in said housing, said shaft having fluid passage means in an end thereof in communication with said pressure chamber and extending without said housing, support means having a journal in a portion thereof adapted to be attached to said housing, a rotatable speed governor element journaled in said attachable portion and adapted to receive the extension of said accessory shaft and to be rotatively driven thereby, said governor element having a pressure inlet passage therein adapted to communicate with said shaft passage means, a pressure outlet passage and a centrifugally unbalanced spring biased control valve disposed between said passages for controlling communication therebetween.

12. In combination with an engine driven accessory having a housing, a pressure chamber in said housing, a cover for said housing and a shaft in said housing rotatively driven at one end from said engine and having fluid passage means in the other end thereof communicating with said pressure chamber, the said other end of said shaft extending through said housing cover and being adapted to receive and rotatively drive a centrifugally unbalanced spring biased speed governor control valve unit, and a plug adapted to seal the said fluid passage means in the extension of said shaft and to be removed therefrom when said governor control valve unit is connected to be driven by said shaft.

13. In combination, an engine having a throttle, a fluid pressure hydraulic system including a fluid sump and an engine driven pump having a housing with a pump chamber and a separate inlet passage and outlet passage therein communicating with the pump chamber and a pump shaft rotatable in the housing, a support having a journal in a portion thereof detachable from said housing, a rotatable speed governor element having an inlet passage communicating with the pump chamber and an outlet passage, one end of said rotatable governor element being journaled in said support, a separable rotative drive connection between the other end of said rotatable governor element and said pump shaft, and a centrifugally unbalanced spring biased control valve slidably mounted in said rotatable governor element between the said passages therein controlling fluid communication therebetween, a fluid pressure responsive device having a part operatively connected to said engine throttle and a fluid carrying part connected to the outlet passage of said governor element, the said outlet passage of said governor element being independent of said inlet passage and outlet passage of said pump.

14. The combination, with a pump having a housing defining a pump chamber therein, of a governor adaptor structure including a first part forming a detachable cover for said pump chamber and having a pair of spaced support legs depending therefrom and a second part detachably connected to said legs of said first part, said first part having a shaft bore therein and a depressed portion on the chamber side thereof adjacent said shaft bore, said second part having an opening extending part way into a portion thereof forming a journal therein coaxial with said shaft bore in said first part and an outlet passage communicating with said journal opening.

15. A governor control unit adapted to be driven by the shaft of a rotating agency comprising, in combination, a rotatable valve body having an axially extending opening in one end thereof adapted to receive the shaft of a rotating agency, a cross-bore extending generally transversely therethrough, an inlet passage extending between the said axially extending end opening and said cross-bore and an outlet passage communicating with said cross-bore; and a centrifugally unbalanced control valve including a valve stem extending through and in slidable contact with said cross-bore and having an annular groove between the ends thereof controlling communication between said inlet passage and outlet passage of said valve body, a weight on one end of said stem without said cross-bore and a balance spring on the other end thereof contacting said stem and said valve body.

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