

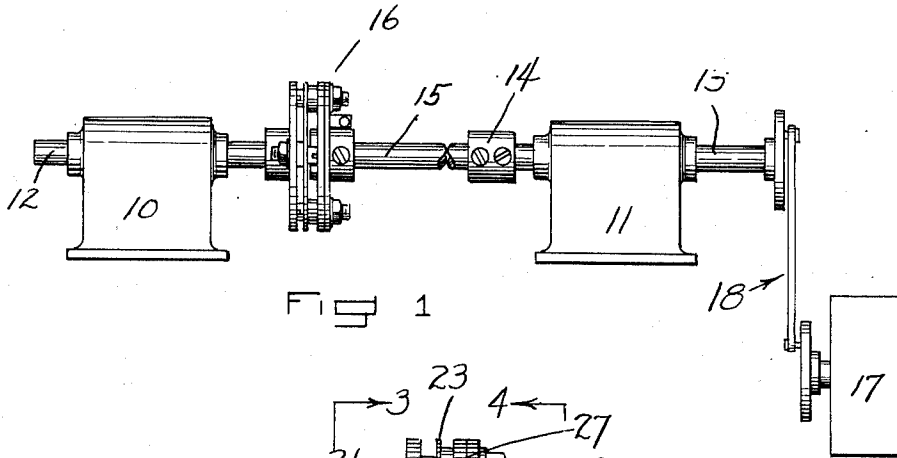
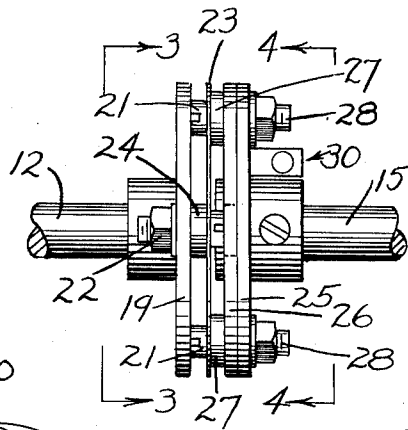
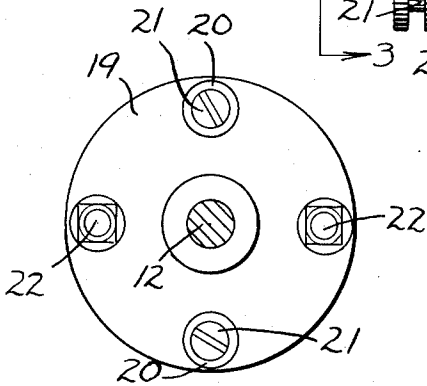
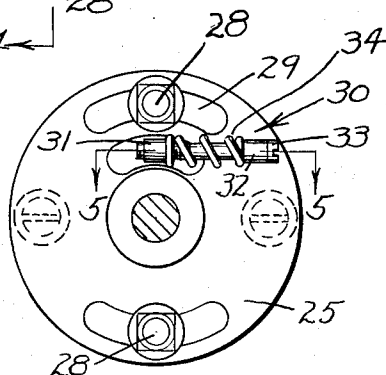
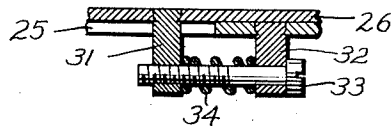
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ADJUSTABLE SHAFT CONNECTOR

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ADJUSTABLE SHAFT CONNECTOR

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4 Claims. (Cl. 287—130)

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The present application relates to a multi-engine control system, and more particularly to an adjustable shaft connector that may be utilized to insure synchronous operations of the governor controlled butterfly valves and the synchronous operation of the manually controlled carburetor valves in a plurality of separate internal combustion engines which are interconnected for unitary operation. In a particular embodiment, the present invention has been utilized to synchronize the operation of two separate internal combustion engines which are interconnected for synchronous operation as a stationary power unit. The invention may, however, be applied to other installations where a plurality of separate internal combustion engines are interconnected for unitary operation.

It is common practice when connecting a plurality of separate internal combustion engines for unitary operation to provide a governor control therefor. It is desirable to operate all of the interconnected engines by a single governor mechanism which will operate the butterfly valve mechanisms provided in the carburetor of each engine. Where the use of a single separate governor is impractical and it is necessary to use a governor on each engine, beneficial results are obtained when the several governors can be interconnected for unitary operation. The improvement in such interconnection results from the partial or complete elimination of differences in individual governor characteristics by the collective action of the several interconnected governors.

Likewise it is desirable to assure a synchronous operation of all of the manually actuated carburetor butterfly control valves by the actuation of the manual carburetor control means which may be either a throttle, accelerator, or the like. Prior to the present invention it has not been feasible to interconnect the respective control shafts of the butterfly control valves of the governor and the butterfly valves of the carburetor so as to compensate in an effective and practical manner for variations in the operating characteristics of the particular engines, or of the particular carburetor or governor control mechanism, because of the lack of a positive connector device which permits positive and precise adjustments between the connected control shafts.

It is, therefore, an object of the present invention to provide a multi-engine control system which may be employed to interconnect spaced control shafts of the engine controlling mechanisms of a plurality of separate internal combustion

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engines interconnected for operation as a unit and in which provision is made to permit an accurate and positive angular or phase adjustment of the connected shafts with relation to each other, thereby to compensate for any differences in operating characteristics of the interconnected internal combustion engine, the governor controlled valves, or the carburetor control valves, the connector being of a novel construction and relatively inexpensive to manufacture but positive in operation and assuring a precision adjustment of the connected shafts.

The present invention will be described as applied for connecting the governor controlled butterfly valve shafts of two engines forming a dual engine unitary power plant. It is to be understood, however, that any desired number of engines, more than two, may be similarly connected by providing similar adjustable connector members between the shafts whose rotary motion it is desired to synchronize.

Other objects of this invention will appear in the following description and appended claims, reference being had to the accompanying drawings forming a part of this specification wherein like reference characters designate corresponding parts in the several views.

Referring to the drawings:

Fig. 1 is an elevation showing the adjustable connecting device of the present invention connecting the governor controlled butterfly valve shafts of the carburetors of two spaced internal combustion engines which are interconnected for operation as a unit. Only the carburetor butterfly housings are indicated.

Fig. 2 is an enlarged side elevation of the coupling shown in Fig. 1.

Fig. 3 is a view taken substantially on the line 3—3 in the direction of the arrows of Fig. 2.

Fig. 4 is a view taken substantially on the line 4—4 in the direction of the arrows of Fig. 2.

Fig. 5 is a fragmentary section taken substantially on the line 5—5 in the direction of the arrows of Fig. 4.

Before explaining in detail the present invention it is to be understood that the invention is not limited in its application to the details of construction and arrangement of parts illustrated in the accompanying drawings, since the invention is capable of other embodiments and of being practiced or carried out in various ways. Also it is to be understood that the phraseology or terminology employed herein is for the purpose of description and not of limitation.

Referring to the drawings, housings 10 and 11

are shown in outline. Each contains a butterfly valve (not shown) whose position controls the fuel input to the engines (not shown). The shafts 12 and 13 are connected with said butterfly valves and extend through said housings and are interconnected by the coupling 14, the connector shaft 15 and the adjustable coupling 16. Shaft 13 of housing 11 is shown connected to any desired conventional type of governor 17 by a suitable linkage mechanism indicated generally at 18. For purposes of clarification the remaining portion of the carburetors and engines to which the butterfly housings 10 and 11 and the governor 17 are attached have not been indicated in the drawing as they are well understood to those skilled in this art. It is to be understood however that the construction shown in the drawing is by way of example only and is not to be construed as a limitation upon the field of application of the invention. Whereas the present invention is discussed as applied to separate conventional internal combustion engines and separate carburetors operated as a unit by synchronized controls, it is to be understood that the present invention finds application wherever a high precision adjustable phase flexible coupling is required between shafts.

In order to assure synchronous operation of the separate internal combustion engines connected for unitary operation, the present invention provides an adjustable connection between the shafts 12 and 13.

The adjustable connection indicated generally by 16 in Fig. 1 is shown enlarged in Fig. 2. Corresponding numbers in all figures refer to the same portions of the mechanism.

Referring to Figs. 2 and 3, the flange 19 is secured to shaft 12 and is provided with four holes, two of which 20 provide access to the heads of bolts 21 and two of which are used with bolts 22 to secure the flange 19 to the thin circular disc 23, spaced therefrom by spacers 24.

The flange 25 shown in side view in Fig. 2 and in front elevation in Fig. 4 is attached to flange 26 and through spacers 27 to the disc 23 by bolts 28. The bolts 28 which may be loosened to permit a rotation between flanges 25 and 26, pass through circumferentially elongated holes 29 in flange 25. This arrangement permits an adjusted relative angular movement between the flanges 25 and 26.

Accurate and minute angular adjustment between flanges 25 and 26 is obtained through the use of the mechanism indicated generally at 30. The construction of this mechanism is shown in section in Fig. 5. The pillars 31 and 32 are rotatably mounted on flanges 26 and 25 respectively. A bolt 33 is slidably inserted through pillar 32 and through the compression spring 34 and threaded through a suitable screw threaded hole in pillar 31. Movement of the bolt 33 through pillar 31 causes the pillars 31 and 32 to move relative each other and produces an adjusted relative angular displacement of flanges 25 and 26.

From the preceding description it will be understood that the flange 19 and the flanges 25 and 26 are securely fastened to the disc 23. The disc 23, comprising a thin flexible sheet of high tensile strength material which permits no relative angular movement between the connecting shafts 12 and 15 except that provided by the adjustment mechanism 30, but does permit a limited relative longitudinal motion or limited relative deviation from spatial or angular coincid-

ence of the line of centers of the connected shafts.

Thus the shafts 12 and 13 will be operatively connected and adjusted as may be required to insure synchronous operation of the plurality of separate internal combustion engines interconnected for operation as a unit. This permits the use of a single governor means or a single manual carburetor control means to govern or control the unitary operation of both engines. The rotatable adjustment 30 permits very precise accurately controlled movement of the shaft 12 relative to the shaft 13. This adjustment is preferably made while the engines are running. When the adjustment has been made, the flanges 25 and 26 are locked in their adjusted positions by tightening the bolts and nuts assembly 28.

I claim:

1. An adjustable shaft connector adapted for use between a pair of movable shafts, including a pair of flanges disposed adjacent each other, one on each of the shafts, the said flanges having interacting portions adapted to allow relative rotational movement of the said flanges during adjustment and to secure the said flanges together in an adjusted position to prevent relative movement thereof, a pair of pillars extending one from each of said flanges, an adjusting member disposed between said pillars in sliding engagement through one of said pillars and screw-threaded engagement with the other, and resilient means disposed between said pillars to space them under tension.

2. An adjustable shaft connector including a pair of shafts each having a flange thereon, the said flanges having interacting portions adapted to allow relative rotational movement of the said flanges during adjustment and to secure the said flanges together in an adjusted position to prevent relative movement thereof, a pair of pillars extending one from each of said flanges, an adjusting member disposed between said pillars in sliding engagement through one of said pillars and screw-threaded engagement with the other, and resilient means disposed between said pillars to space them under tension.

3. An adjustable shaft connector adapted for use between a pair of movable shafts, including a flange having arcuate slots therein and secured substantially perpendicular to one of the shafts, a pillar extending from said flange and having a hole through its lateral axis, a second flange secured to the other of the shafts, a plurality of fastening members extending from said second flange and adapted to fit within corresponding arcuate slots in said first-named flange, a pillar having a screw threaded hole through its lateral axis extending from said second flange and adapted to fit through a corresponding arcuate slot in said first-named flange, an adjusting screw member extended through the hole in the first-named flange, an adjusting screw member extended through the hole in the first-named pillar and disposed in screw threaded relation within the hole in said second pillar, and resilient means disposed between said pillars to space them under tension.

4. An adjustable shaft connector adapted for use between a pair of movable shafts, including an annular flange having a pair of diametrically opposed outer arcuate slots near the circumference of said flange and an inner arcuate slot disposed between the said two outer slots, a pillar extending at substantially a right angle from said

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flange adjacent said inner slot and having a hole through its lateral axis, a second annular flange secured to the other of the shafts, a pair of diametrically opposed fastening members near the circumference of said second flange adapted to fit through the corresponding outer slots in the first-named flange and secure the two flanges together in an adjusted position to prevent relative movement thereof, a pillar having a screw threaded hole through its lateral axis and extending at substantially a right angle from said second-named flange and adapted to fit through said inner slot in said first-named flange, an adjusting screw member extended in a slip fit through the hole in the first-named pillar and disposed in screw threaded relation within the hole in said second-named pillar, and a coil

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spring disposed around said adjustable screw member between said pillars.

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