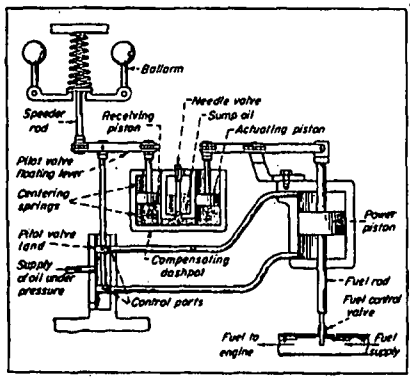
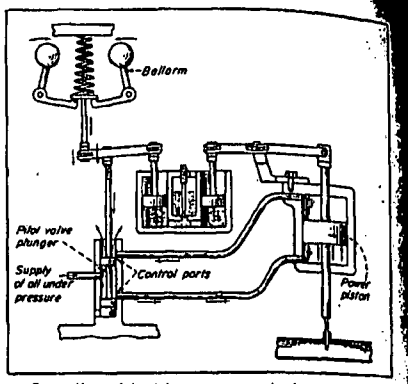
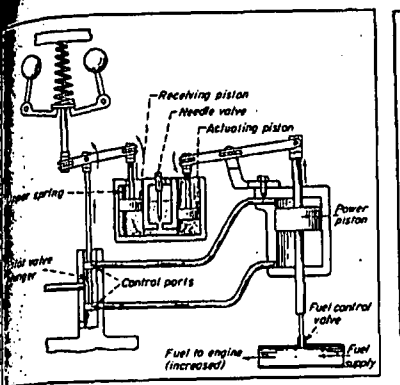


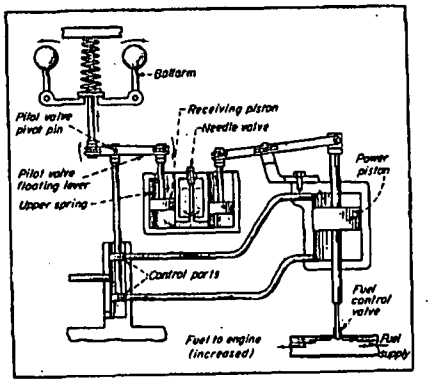
1 Arrangement of the parts of an isochronous hydraulic governor. Note the actuating, receiving and power pistons



2 First effect of load increase on an isochronous hydraulic governor. Ballarms move in and lower pilot-valve plunger



3 Second effect of load increase on isochronous governor. Power piston moves up, recenters pilot-valve plunger



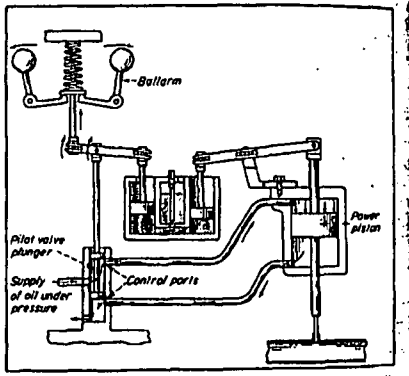
4 Final effect of load increase on governor. As speed of engine rises to normal, ballarms become vertical again

DIESEL GOVERNORS—IV

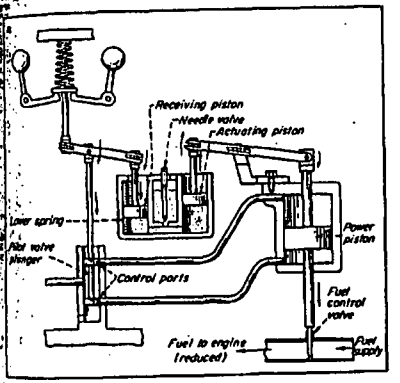
Isochronous Hydraulic Governors For Exact Engine Speed Control

Temporary speed droop prevents over-correction of fuel flow, permits maintaining engine at exactly constant speed without hunting

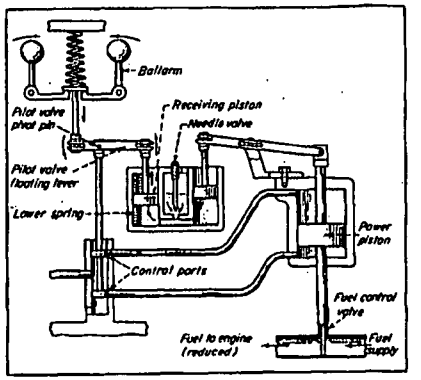
By EDGAR J KATES, *Consulting Engineer, New York, N. Y.*



5 First effect of load decrease on isochronous hydraulic governor. Ballarms move out and lift pilot-valve plunger



6 Second effect of load decrease on isochronous governor. Power piston moves down, recenters pilot-valve plunger



7 Final effect of load decrease on governor. As speed of engine falls to normal, ballarms become vertical again

► HYDRAULIC GOVERNOR, described in MAY POWER, pp 98-100, cannot maintain engine at exactly constant speed regardless of load because it employs permanent speed droop to prevent hunting. In other words, it is not isochronous.

An isochronous hydraulic governor maintains exactly constant speed without hunting. It does this by employing temporary speed droop to give stability while fuel flow is being corrected, and then gradually removing the droop as engine reacts to fuel correction and returns to its original speed. Use of temporary speed droop to prevent over-correction of fuel is called *compensation*.

Compensation requires two actions: (1) a droop applicator, as fuel flow is changed (2) a droop remover as engine responds to fuel change and returns to its original speed.

These actions can be accomplished by a combination of two hydraulic pistons and a needle valve. Droop action is applied by the two pistons, which are connected by an oil passage. Droop is removed by allowing oil to escape from the connecting passage through the needle valve. The oil goes to a sump after leaving passage. Centering springs return the droop-applying piston to its original position.

Parts needed in a governor to apply and remove temporary speed droop (compensation) are shown in Fig. 1. These are: (1) a transmitting or *actuating piston* to transfer motion of fuel-changing mechanism to (2) a spring-loaded responding or *receiving piston*, which acts on parts of the governor to cause speed droop, and (3) an adjustable needle valve in the connecting oil passage of the two pistons, which allows oil to leak off to governor sump.

Load Steady. With engine running at normal speed under steady load the ballarms are vertical and pilot-valve floating lever is horizontal, Fig. 1. Control ports in pilot-valve bushing are covered by lands on pilot-valve plunger. Receiving compensating piston is in normal position. Power piston and fuel rod are stationary. Position shown corresponds to about one-half fuel.

Load Increase. When load is applied to engine its speed decreases, Fig. 2. Ballarms move in, lowering pilot-valve plunger to admit oil pressure under power piston. Oil pressure moves power piston up, Fig. 3. This pushes actuating piston down, which displaces oil to the receiving piston, forcing this piston up to compress upper spring and lift pilot-valve plunger. Plunger lands close the control ports to stop further movement of power piston.

This action is rapid, and the small opening of the needle valve prevents appreciable leakage. Therefore, oil displaced by the actuating piston causes a corresponding movement of the receiving piston.

As power piston moves up it increases fuel supply to bring engine speed back to normal. As engine responds to the fuel change, its speed gradually returns to the original, and the ballarms gradually resume their vertical position. At the same time, the upper spring starts pushing the receiving piston down to its normal position and the floating lever tilts about the pilot-valve pivot pin.

Rate at which receiving piston moves down is determined by needle-valve opening, which is adjustable. If opening is correct, rate of return of re-

(Continued on page 232)