March 9, 1943. J. H. PRATT ET AL 2,313,359

HYDRAULIC CONTROL MECHANISM

Filed June 19, 1941 3 Sheets-Sheet 1

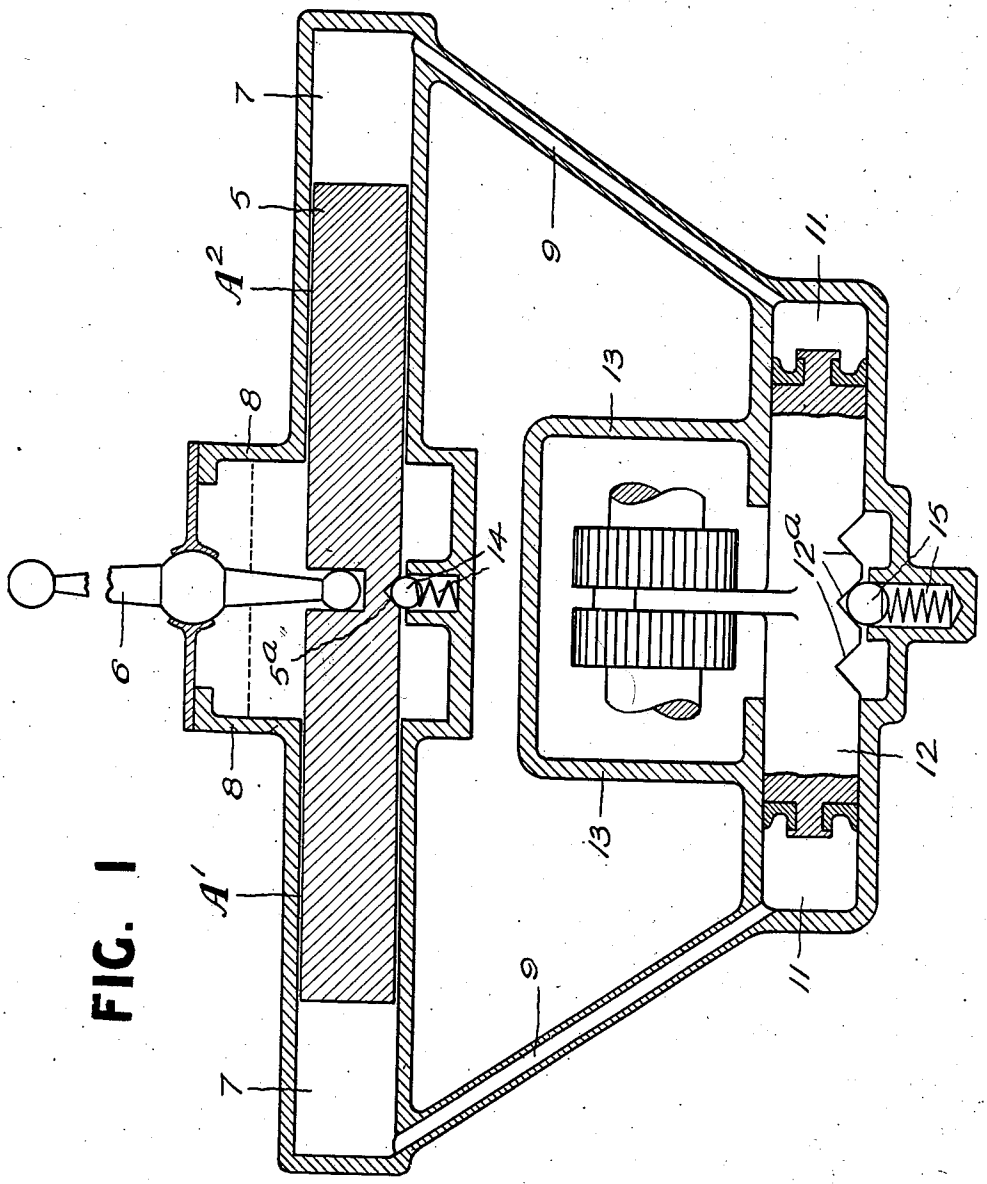

FIG. 1

JAMES HENRY PRATT
GILBERT EDGAR MANLEY
ALBERT HENRY GODFREY GIRLING
INVENTORS

BY Marshall & Marshall
ATTORNEYS

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FIG. 2

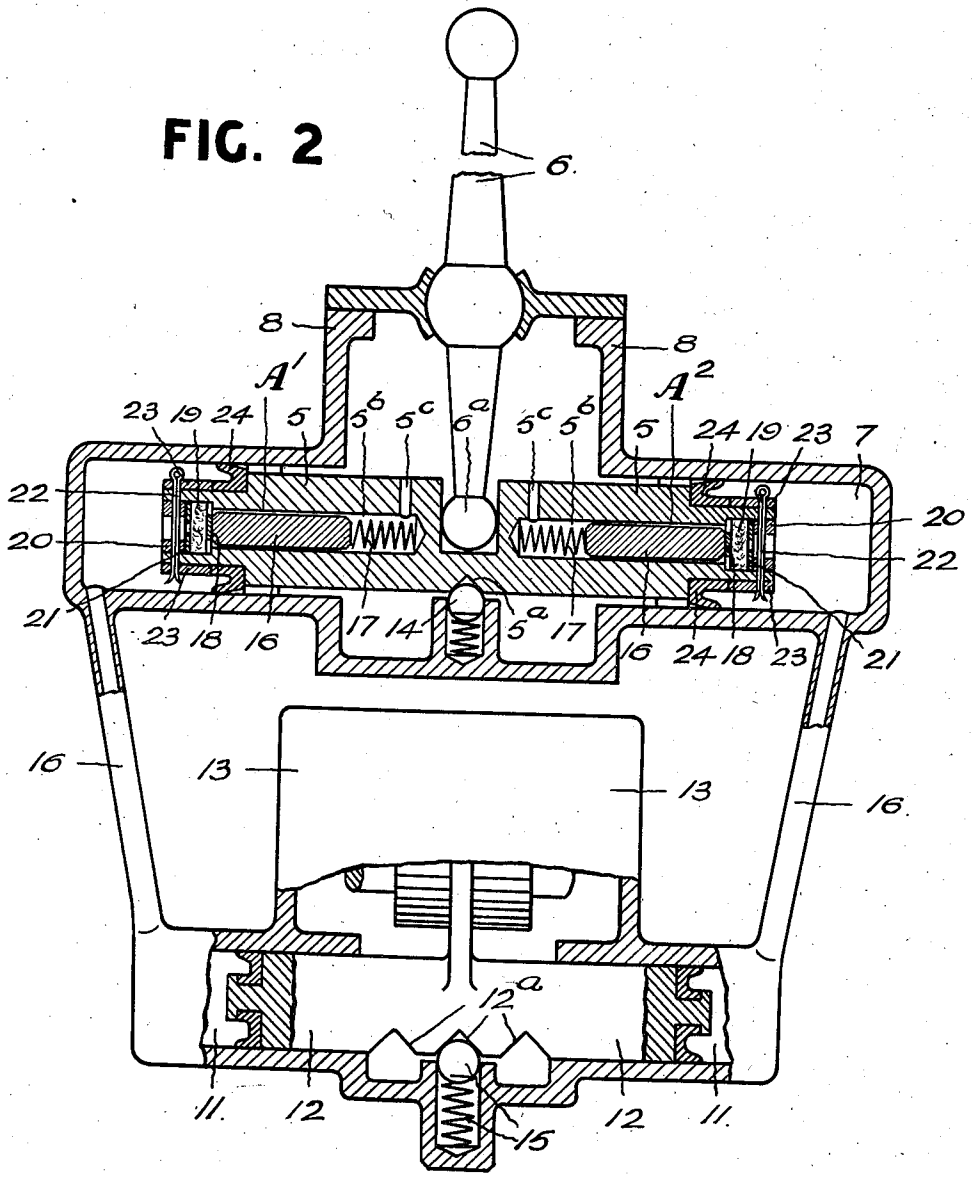

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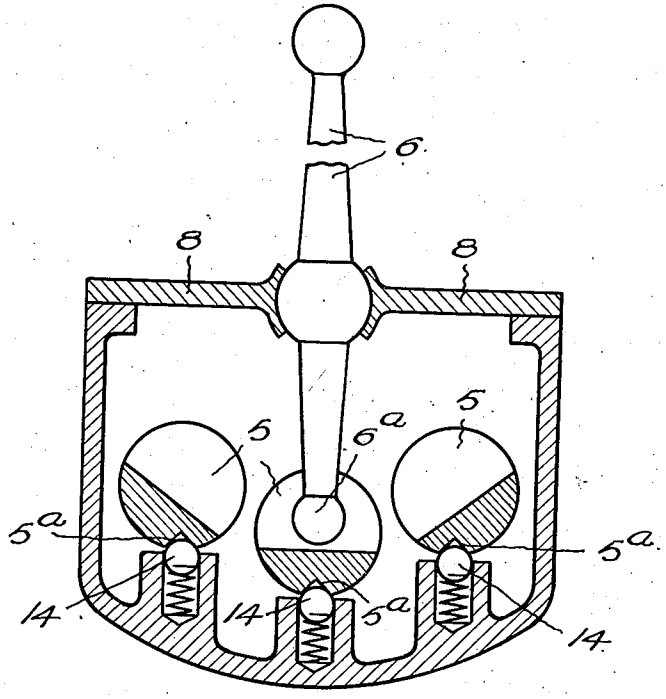
FIG. 3



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GILBERT EDGAR MANLEY
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ATTORNEYS

Patented Mar. 9, 1943

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UNITED STATES PATENT OFFICE

2,313,359

HYDRAULIC CONTROL MECHANISM

James Henry Pratt, Birmingham, Gilbert Edgar Manley, Earlswood, and Albert Henry Godfrey Girling, Edgbaston, Birmingham, England

Application June 19, 1941, Serial No. 398,806
In Great Britain July 26, 1940

2 Claims. (Cl. 60—54.5)

This invention has reference to improvements in hydraulic control mechanisms and is concerned with hydraulic control mechanisms of the kind wherein an actuating member is required to be responsive through hydraulic agency to the movements of a directly operable controlling member.

With hydraulic control mechanisms of the aforesaid kind it is found in practice that there is a tendency for the actuating member to become out of phase with the controlling member owing to losses in the hydraulic system due to leakage or owing to variations in the volume of the hydraulic medium due to temperature changes and means have already been proposed for overcoming the aforesaid tendency. Such means as have been proposed heretofore however have in our opinion and generally speaking been unsatisfactory from one cause or another and the present invention has for its object the provision of an improved and simplified means for use in conjunction with hydraulic control mechanisms of the aforesaid kind which ensures that the actuating member and the controlling member shall always remain in phase.

According to the invention the improved hydraulic control mechanism of the kind hereinbefore referred to is characterised by the interposition, between a liquid reservoir and a part of the hydraulic system which is subject to pressure when the control mechanism is in use, of a leakage passage the leakage capacity of which is negligible or non-existent during the period of time required for the performance of a controlling operation but which nevertheless permits of the requisite passage of liquid between the said liquid reservoir and part of the hydraulic system during the comparatively long periods of time when the control mechanism is at rest.

The invention also resides in the details of the hydraulic control mechanisms to be described hereinafter.

Convenient embodiments of the invention will now be described with particular reference to the accompanying drawings which illustrate the invention in its application to a hydraulic control mechanism for a change speed gear box for use with vehicles.

In the drawings:

Fig. 1 is a longitudinal vertical section of the simplest form of the improved hydraulic control mechanism.

Fig. 2 is a longitudinal vertical section of an elaborated form of the improved hydraulic control mechanism and

Fig. 3 is a transverse vertical section of the upper portion of the control mechanism illustrated in Fig. 2.

Like numerals of reference indicate similar parts in the several views.

According to the simplest embodiment of the invention as illustrated in Fig. 1 the improved control mechanism incorporates a controlling member in the form of a double ended piston 5 which is adapted for displacement by means of a ball-mounted centrally disposed operating member 6 and the end portions whereof are displaceable within cylinders 7 which project from opposite sides of a centrally disposed body 8 the interior of which serves as a fluid reservoir. The closed ends of these cylinders 7 are connected by pipe lines with the ends of oppositely disposed cylinders 11 within which are disposed the end portions of a double ended piston 12 constituting the actuating member and which serves as a selector bar for one of the particular speeds provided by the change speed gear box 13.

A spring and ball locating means 14 co-operates with a conical recess 5a in the underside of the controlling piston 5, for effecting the centralisation of the said controlling piston 5. In a like manner a spring and ball locating means 15 co-operates with three symmetrically arranged conical recesses 12a for locating the actuating piston 12 in its desired operating positions.

The acting portions of the controlling piston 5 are of a plain cylindrical formation and have the usual machined fit within their respective cylinders 7. Since it is not possible by ordinary manufacturing methods to secure a liquid-proof association between a piston 5 as aforesaid and the walls of its associated cylinder 7 leakage passages denoted A1, A2 obtain between the cylinders 7 and the fluid reservoir 8.

These leakage passages however have a leakage capacity which is negligible during the very short period of time required for the performance of a controlling operation but they are of sufficient capacity to permit of a flow between the fluid reservoir 8 and the pipe lines 9 which is sufficient to make up leakage losses and to permit of making up or relief due to a variation of volume of the liquid owing to temperature changes.

It will be understood that the unit is constructed so that each half of the unit is similar in dimensions and location to the other half so that a balanced system obtains.

In the more elaborate form of the invention illustrated in Figs. 2 and 3 three double ended

controlling pistons 5 are provided one for each speed ratio and each controlling piston is furnished with a centrally disposed recess within which is located a ball portion 6a which is formed at the end of the lower arm of an operating lever 6 which is fulcrumed intermediate its ends in the body 8 constituting the liquid reservoir. Each end portion of a controlling piston 5 is formed with an axially arranged bore 5b which is in communication by radial passages 5c with the fluid reservoir 8. Within the outer portion of each bore 5b is disposed a short length of rod 16 of slightly lesser diameter than the bore 5b, said rod 16 also being of a metal having a higher co-efficient of expansion than the metal of which a controlling piston 5 is composed, the reason to be set forth hereinafter. Thus if the controlling pistons 5 are made of steel the rods 16 may be made from aluminium. Between the inner end of each rod 16 and the closed end of its respective bore 5b is a relatively stiff coil spring 17, said coil springs 17 maintaining the outer ends of the rods 16 in contact with washers 18 the peripheral portions of which are notched. Each washer 18 also abuts felt filter pads 19 which are held in position within axially disposed tubular extensions of the acting ends of the pistons 5 by means of a ferrule 20, washer 21 and a cotter pin 22 passed transversely through the walls of each of the said tubular extensions. The cotter pins 22 also serve as abutments for sleeves 23 which serve to clamp to the respective ends of the controlling piston 5 recuperating cap rubbers 24 of a known kind.

The controlling pistons 5 are each provided on the underside with a centrally disposed conical recess 5a which co-operates for location purposes with the upper portion of a spring ball locating means 14.

The selector bar constituted by an actuating piston 12 is provided in the underside of the central portion thereof with three similar symmetrically disposed recesses 12a which co-operate for location purposes with a single centrally disposed spring pressed ball locating means 15, the spring in this case however being stronger than the spring employed for the locating ball locating means 14 for the controlling piston 5.

It will be understood that there is a selector bar also for each speed provided by the gear box 13.

In this last described embodiment of the invention the pressure system is always in communication with the liquid reservoir 8 by way of the leakage passages A1, A2 between the rods 16 and their respective bores 5b but here again the leakage capacity is negligible during the period of time required for the performance of a controlling operation. Recuperation takes place past the peripheries of the cup rubbers 24 and leakage for pressure relief due to an increase in volume of the liquid due to a rise in temperature takes place by way of the leakage passages denoted A1, A2.

During each controlling operation the varying liquid pressure tends to cause the rods 16 to reciprocate in conjunction with their associated springs, thus tending to keep the leakage passages A1, A2 free from clogging, any tendency to which is minimised by the employment of the filter pads 19.

The difference in the co-efficients of expansion of the metals from which the rods 16 and the controlling piston 5 are made entails a variation in the volume of the leakage passages A1, A2 thus compensating for viscosity changes also due to temperature variation.

In the event of a controlling piston 5 tending to become out of phase with its selector bar 12, when these bars are centralised this defect is automatically corrected by the leakage from the leakage passage A1, or A2 under greater pressure enabling the spring pressed locating ball 14 associated with the respective controlling piston 5 to operate on the conical wall of the complementary recess 5a and thereby automatically to centralise this piston 5. This centralising operation is permitted as the selector bar is held meantime owing to the greater strength of the spring associated with its locating ball means 15.

If desired the rods 16 may be grooved longitudinally or formed with a fine screw thread in order to provide leakage passages in the event of the rods expanding sufficiently to fill the bores.

Having now described our invention what we claim and desire to secure on Letters Patent is:

1. A hydraulic control mechanism comprising a liquid reservoir, a hydraulic system comprising a controlling member, and a controlled member hydraulically actuated thereby, a leakage passage extending between the reservoir and a point in the hydraulic system between said members, a tapered receiver in the controlled member, a locating detent having a spring for urging it into said tapered receiver when the controlled member is in one position, a tapered receiver in the controlling member, and a second locating detent having a weaker spring for urging it into the latter tapered receiver to force liquid through said leakage passage and thereby locate the controlling member in the proper position whenever it has become out of phase with the controlled member.

2. A hydraulic control mechanism comprising a liquid reservoir, a hydraulic system comprising a controlling member, and a controlled member hydraulically actuated thereby, a leakage passage extending between the reservoir and a point in the hydraulic system between said members, and a body inserted in and substantially obstructing the leakage passage, for accurately restricting the leakage capacity of the passage, said body being longitudinally reciprocable in the passage with variations in pressure, to prevent clogging of the portion of the passage that is restricted by said body.

JAMES HENRY PRATT.
GILBERT EDGAR MANLEY.
ALBERT HENRY GODFREY GIRLING.