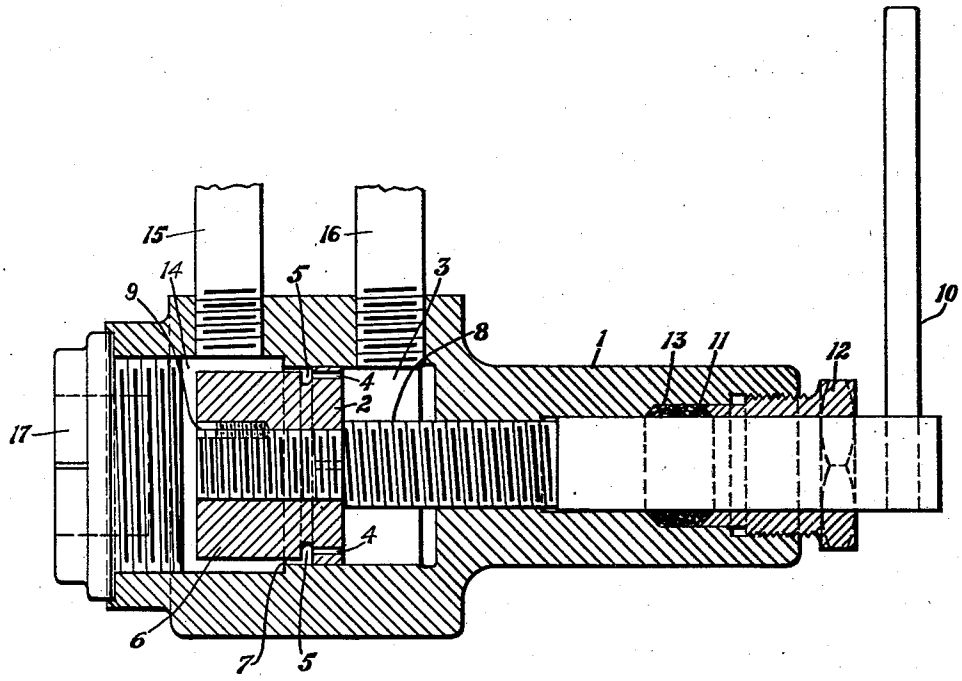
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HYDRAULIC ESCAPEMENT DEVICE

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HYDRAULIC ESCAPEMENT DEVICE

Application filed August 23, 1930. Serial No. 477,374.

My invention relates generally to damping valves for hydraulic devices and more particularly to devices employing a fluid, the viscosity of which varies with changes in temperature.

An object of my invention is to provide for compensating for the changes in viscosity of a fluid in a hydraulic device which are caused by changes in temperature.

A more specific object of my invention is to provide a means which is inherent in the device to compensate for viscosity changes due to temperature changes in a fluid used in hydraulic escapement devices.

A device of this type is desirable for hydraulic devices such as are disclosed in my copending application No. 324,444 filed December 7, 1929, and assigned to Westinghouse Electric and Manufacturing Company.

In the operation of electrical locomotives provided with motors of the commutating type, it is essential that means be provided for allowing the commutator cylinders to partially rotate during the starting period before the train coupled to the locomotive is moved. If this motion of the commutator cylinders is not permitted, the commutator bars under the brushes will be overheated and likewise the windings associated with them.

A detailed description showing how the commutator and windings are protected is given in my copending application hereinbefore mentioned. In general, this is accomplished by providing a hydraulic escapement mechanism on the drawbar of the locomotive which permits the locomotive to move forward or creep slowly, relative to the train, during the starting period. The rate of the creeping movement can be regulated to provide for the rotation of the commutator cylinder of the propelling motor, relative to the brushes, to limit the time during which any commutator bar carries the whole starting current taken by the motor.

The rate of creeping is controlled by a hydraulic escapement device which allows a given volume of fluid to flow through it under given conditions of temperature and pressure.

It is essential that the flow of the liquid through the escapement device be maintained constant under conditions of constant pressure. This is necessary when it is desired to rotate the commutator cylinder to a predetermined position under given conditions of loading at a given rate to secure the desired timing.

The greatest change in timing is caused by changes in temperature. It is the purpose of my invention to provide a hydraulic system, the operation of which does not vary with the changes in tempenature.

The foregoing objects of my invention may be attained by means of the apparatus described in the following specification and shown in the accompanying drawing, in which the single figure is a view, partially in side elevation, partially in section, of a compensated hydraulic escapement device.

The hydraulic escapement device comprises a casing 1 in which are formed coaxial cylinders of different diameters. Slidably mounted in the casing, is a plunger 2 of nearly the same diameter as the plunger chamber 3 containing openings 4 therethrough and a circumferential groove 5 for permitting the flow of a fluid through the plunger. A flow restrictor 6 is formed integrally with the plunger 2 and is of such diameter that there is a clearance space 7 between it and the wall of the plunger chamber 3. The distance between the flow restrictor member and the chamber wall will depend upon the operating conditions to be met.

While the diameter of the plunger 2 appears in the drawing to be substantially the same as the internal diameter of the plunger chamber 3, in fact it is less than this diameter by an amount sufficient to allow the plunger to slide freely under all operating conditions.

In order to more clearly set forth the invention, the diameter of the flow restrictor 6, as shown in the drawing, is decreased an exaggerated amount. In practice, the diameter of the flow restrictor 6 is more nearly equal to the internal diameter of the chamber 3 than is the diameter of the plunger 2

for a purpose that will be hereinafter described.

The length of clearance space 7 may be varied by the adjusting screw 8 which has complementary threads in the plunger 2 and in the flow restrictor 6 and also in the casing 1. To insure cooperating movement of the flow restrictor 6 and adjusting screw 8, a set screw 9 is provided. The adjusting screw 8 may be readily rotated by means of the handle 10. Leakage past the adjusting screw 8 is prevented by the stuffing box 11, together with the gland 12 and gland packing 13.

Liquid may be admitted to the flow restrictor chamber 14 through the inlet pipe 15 and exhausted from the plunger chamber 3 through exhaust pipe 16. Convenient access for inspection and cleaning of the valve is provided by the cap member 17.

The operation of the hydraulic escapement device is as follows: The locomotive, on starting, forces the fluid through the inlet pipe 15 into the chamber 14, past the flow restrictor element 6, through the clearance space 7, into the groove 5, through the holes 4 in the plunger 2, into the plunger chamber 3 and out through the exhaust pipe 16.

The clearance space 7 may be so adjusted that a predetermined time is required for a given volume of fluid to pass through the hydraulic escapement device at a given pressure. The increase in length of space 7 increases the friction which retards the flow of the fluid through the clearance space and thereby increases the time required for the passage of a predetermined volume of the fluid subjected to a given pressure.

A slight change in the thickness of clearance space 7 will produce a different timing.

A change in temperature changes the cross-sectional area of clearance space 7, when the flow restrictor 6 and casing 1 have different coefficients of expansion. The clearance space will be decreased with increase in temperature if the casing has a coefficient of expansion which is less than that of the flow restrictor.

Since the viscosity of fluids changes with changes in temperature and in order to meet operating conditions, such as met with in operating trains, it is necessary to compensate for changes in viscosity.

This compensating effect for viscosity changes, due to temperature changes, may be obtained by making the flow restrictor of such material that its coefficient of expansion is greater than that of the casing. A decrease in the cross-sectional area of clearance space 7 will result when the viscosity of the oil decreases because of an increase in temperature.

The compensating effect will be obtained if the flow constrictor is made of manganese bronze, which has a coefficient of expansion of ö.0000206 per inch per degree C. and the case is made of steel which has a coefficient of ö.0000126 per inch per degree C. This gives a difference of ö.0000080 per inch per degree centigrade.

If a difference of temperature from twenty degrees to seventy degrees C. is assumed, and the diameter of the valve element is assumed to be three inches, a decrease of ö.0006 is obtained in the thickness of the clearance space 7.

Considering the flow of the fluid at twenty degrees C. to be one hundred per cent, there will be under certain conditions an increase in the flow, due to change of viscosity, of seventy per cent at seventy degrees C. through an opening of constant cross-sectional area. This increase in flow will be decreased approximately twenty per cent at seventy degrees C. in the hydraulic escapement device, when the flow restrictor and casing have the before-mentioned coefficients of expansion.

The pressure on the flow restrictor when three locomotives are pulling a train will be approximately twenty one hundred pounds per square inch. It is readily seen that considerable heat will be developed in the casing and flow restrictor at clearance space 7 because of friction between the fluid and the valve. This will necessitate the compensation accomplished by making the casing of a material having a coefficient of expansion which is less than that of the flow restrictor.

It is obvious that, by proper change of design, more nearly perfect compensation may be secured, whereby the time for the hydraulic escapement mechanism will be nearly constant, regardless of changes in temperature.

Although I have described a specific embodiment of my invention, it will be obvious to those skilled in the art, that various modifications may be made in the details of the hydraulic escapement mechanism without departing from the spirit and scope of the invention, as defined in the appended claims.

I claim as my invention:

1. In a hydraulic-escapement device for controlling the flow of fluids at high pressures, in combination, a casing having sections of different internal diameters, a plunger slidably mounted therein and having a circumferential groove and openings therethrough, an adjusting screw, a flow restrictor carried by the plunger and cooperative with the casing, said flow restrictor having a coefficient of expansion greater than that of the casing to compensate for changes in the viscosity of the fluid with changes in temperature and of such diameter as to permit the flow of a fluid at a predetermined rate, and means for admitting a fluid to the device and exhausting it therefrom.

2. In a hydraulic-escapement device for controlling the flow of fluids at high pressures, in combination, a casing having co-

axial sections of different internal diameters, a plunger slidably mounted in the casing and having substantially the same diameter as the cooperating section of the casing and also having a circumferential groove and openings extending therethrough, a flow restrictor carried by the plunger, the diameter of which is appreciably less than the diameter of its co-operating casing section and having a greater coefficient of expansion than that of the casing, means for adjusting the flow restrictor relative to its cooperating casing walls, means for admitting a fluid to the valve chamber and for exhausting the fluid from the plunger chamber, means for confining the fluid within the casing surrounding the adjusting screw, and means for providing access to the valve element and valve chamber for cleaning.

3. In a hydraulic-escapement device for controlling the flow of fluids at high pressures, in combination, a casing having co-axial sections of different internal diameters, a plunger having a circumferential groove and openings extending therethrough, and having substantially the same diameter as the co-operating section of the casing to slide therein, a flow restrictor having a diameter which is appreciably less than the cooperating section of the casing and located in juxtaposition to the plunger, said flow restrictor having a greater coefficient of expansion than that of the casing, an adjusting screw mounted in the plunger and flow restrictor and adjustably mounted in the casing, a handle mounted on the adjusting screw, a gland and gland packing mounted in a stuffing box surrounding the adjusting screw, an inlet pipe to the valve chamber, an exhaust pipe from the plunger chamber, and a cap mounted adjacent to the valve chamber.

In testimony whereof, I have hereunto subscribed my name this 22nd day of August, 1930.

CHARLES C. WHITTAKER.