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CONTROL MEANS FOR DIESEL-ELECTRIC LOCOMOTIVES

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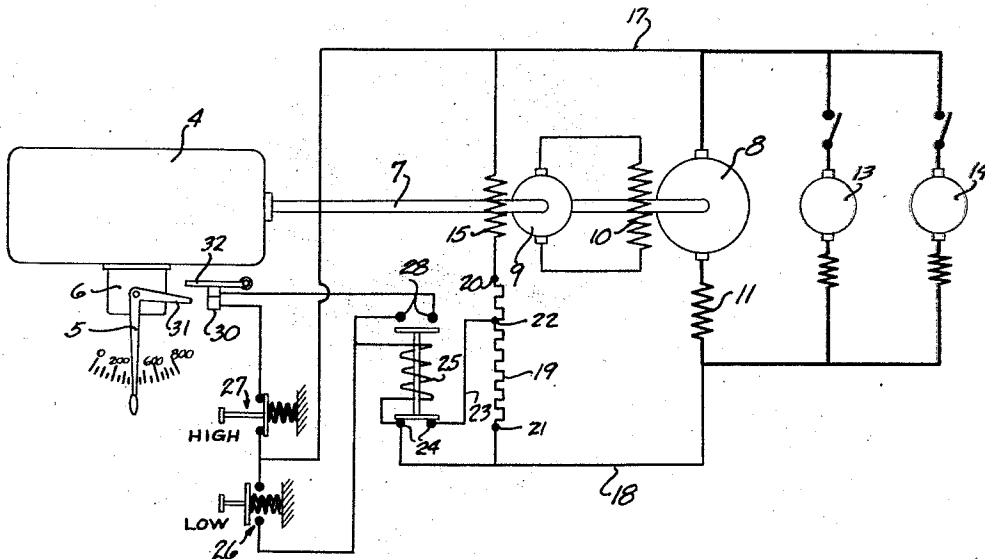


FIG. 1.

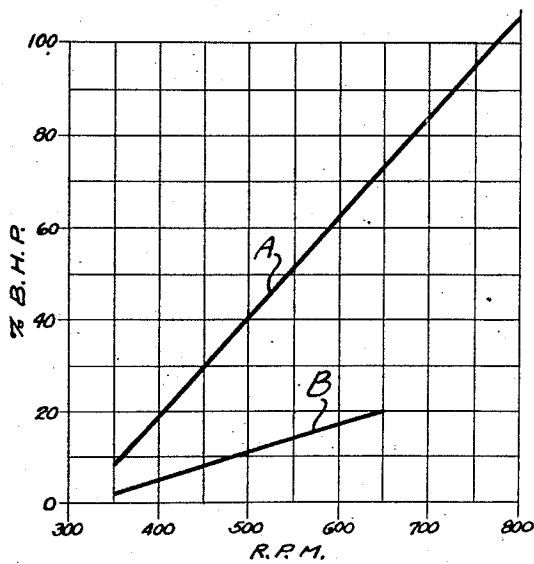


FIG. 2.

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CONTROL MEANS FOR DIESEL-ELECTRIC
LOCOMOTIVES

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1 Claim. (Cl. 290—17)

1

My invention relates to Diesel-electric locomotives, and has particular reference to improvements in control means for such locomotives.

The principal object of the invention is to improve the operating characteristics, the control facilities and the efficiency of Diesel-electric locomotives. The means of the invention are applied with special advantage to locomotives of the mentioned type which are used for switching and yard service. The foregoing object is achieved by certain adjunctive control provisions which greatly enhance the performance of this type of vehicle when operating at slow speeds or under low power requirements.

The object of my invention is to provide an arrangement whereby the main control throttle for the engine is employed to control the power supplied to the propulsion motors in either one of several power ranges. That is to say, with the means of my invention the operation of certain control instrumentalities results in a proportionate reduction in power output for each position of the throttle. Accordingly, when functioning in this low power range a three-quarter open position of the throttle, for example, results in only a 20 percent of capacity supply of power. Thus, as the throttle is being opened the tractive power increases at a much lower rate than results when the unit is operating in the high power range.

The foregoing provisions enable the locomotive to be controlled with great precision, and to be accelerated smoothly and evenly. These are advantages having particular significance and importance in connection with switch locomotive operation, for the nicety of control afforded by the means of my invention enables the locomotive to be advanced at "creeping" speed toward a car so that a coupling may be made without noticeable impact. Moreover, a car can be spotted with great accuracy at a particular location, at a weighing or loading station for example.

A further important object resides in the provision, in connection with supplementary control measures of the character described, of means for automatically shifting the control agencies from "low" to "high" operation when the throttle or other control lever is advanced to a predetermined point above which "low" power operation is inefficient and inexpedient.

These objects and advantages will be more fully explained in the following description of my invention and in the accompanying drawing to which reference is made.

In the drawing,

Fig. 1 is a diagrammatic showing of the princi-

2

pal components of the power plant of a Diesel-electric locomotive, and the control provisions and circuit connections which embody my invention, and

Fig. 2 is a chart exhibiting the load curves that represent high power and low power operation of the locomotive, and wherein brake horsepower, in terms of percentage of full load horse power (% B. H. P.) of the engine is plotted against engine speed.

Referring now to the drawings by characters of reference, a locomotive of the kind to which the control means of my invention is especially applicable includes an internal combustion engine 4 of the Diesel type, having a control throttle 5 which acts in conjunction with a governor 6. In association with the throttle lever there is represented, for purposes of explanation, a scale bearing indicia of engine speed in terms of revolutions per minute, corresponding to the different angular positions of the throttle.

The engine 4 is connected by means of its shaft 7 to the main generator 8, and is also connected in driving relation to a smaller, auxiliary generator 9 which provides excitation current for the field winding 10 of the main generator. The main generator is of compound type and includes a series field winding 11. The drive or propulsion motors for the locomotive are designated 13 and 14, these being connected through suitable circuits and control agencies and supplied with electrical energy from main generator 8.

The auxiliary or exciter generator 9 is provided with a field winding 15, in addition to other field windings (not shown), and the terminal voltage of generator 9, and hence the strength of the main generator field 10, is controlled by varying the strength of exciter 15. Field 15 derives its energizing current from the main generators 8 through conductors 17 and 18 leading from the line terminals thereof. The principal agency for controlling current flow in the exciter field 15 is a resistor 19 having end terminals 20 and 21 and an intermediate terminal 22. Terminal 21 is connected to the supply line 18, and intermediate terminal 22 is connected to supply line 18 through a shunt circuit consisting of conductor 23 and the contacts 24 of an electro-magnetic contactor switch 25. It will appear that when the contacts 24 are "closed" that portion of resistor 19 between terminals 21 and 22 is shunted, and the field strength is relatively high. When contacts 24 are open excitation of the main generator is reduced and the terminal voltage diminishes, proportion-

ately diminishing the speed of the propulsion motors.

It will be understood then, that the "open" or "closed" condition of switch contacts 24 determines whether the locomotive will operate in the low or the high power range. When the entire resistance 19 limits the excitation current to the exciter generator 9, as results when contacts 24 are open, the terminal voltage of generator 9 at a particular engine speed will be reduced as compared to the voltage generated at the same engine speed where contacts 24 are closed. Consequently, the power output of the main generator for a particular engine speed is similarly varied by opening or closing contacts 24.

In the chart of Fig. 2, A designates a load curve for the high power range of operation of a locomotive equipped with the controls of the present invention and is correlated with the closed condition of contacts 24, and curve B represents the low power range obtained when contacts 24 are opened. It will appear that when the engine throttle is adjusted to obtain an engine speed of 500 R. P. M., when operating in the high power range the locomotive driving unit will develop 40 percent of its full load capacity, whereas, when operating in the low power range the same engine speed produced approximately 10 percent of the power capacity of the unit. Moreover, it will be observed that the rate of increase or decrease of power between successive steps of throttle movement is much less in the low power range of operation, and hence the operator is able to control the locomotive with nicety and to spot a car for example, in a particular location with great precision.

Remote operation of contactor 25 is had by means of two push button switches 26 and 27 which are preferably located near the throttle lever 5. Push button switch 26 is normally open and is connected to the actuating coil of the contactor 25 so that the contacts 24 are caused to be opened when the button of switch 26 is pressed. Contactor 25 is provided with auxiliary contacts 28 connected in a "holding" circuit for the contactor, which functions to provide energizing current for the contactor coil after the push button 26 is released so that contact 24 will remain open until the holding circuit is broken. The holding circuit includes the normally closed push button switch 27 and also the normally closed contacts of a switch 30 which is adapted to be opened when the throttle lever 5 is advanced such that engine speed exceeds a predetermined value. In the drawing the throttle lever is shown as being provided with an arm extension 31 which is arranged to engage an actuating finger 32 of switch 30 and to open said switch when the throttle lever is moved to a point corresponding to engine speed in excess of 650 R. P. M. It will be understood that the holding circuit for contactor 25 may be broken, causing the system to return to high power operation, either by manual operation of the "high" push button switch 27, or by the opening of switch 30 when the throttle is advanced to a point that indicates a demand for high power. The purpose of the switch 30, which automatically shifts the system from low to high power operation, is to prevent operating in the

low power range at high engine speed when the power can be obtained more efficiently in the high power range at lower engine speed.

To illustrate this point, let it be assumed that after a string of cars have been coupled to the locomotive, which has been operated in its low power range, the engineer desires to move the cars rapidly, and accordingly advances the throttle lever to effect this purpose. Thereupon the switch 30 is opened which interrupts the holding circuit, closes contacts 24 and causes the voltage of the main generator to be increased so that desired power may be obtained to better advantage at a lower engine speed.

Having described my invention, what I claim and desire to secure by Letters Patent is:

In a locomotive including an engine having throttle control means, a generator driven by said engine and a motor for propelling the locomotive, connected to said generator, an excitation system for said generator, including a resistor, a normally closed contactor adapted, when closed, to short-circuit a portion of said resistor whereby to effect an increase in generator excitation, a manual switch operable to open said contactor to decrease generator excitation, a second manual switch operable to close said contactor, and a switch automatically operated by said throttle control means to open said contactor when said throttle control means is conditioned to obtain engine speed in excess of a predetermined value.

JAMES E. JUSTUS.

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