Aug. 22, 1939. W. RIEGER 2,170,766

APPARATUS FOR SPINNING PREVENTION OF TRACTION WHEELS

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Fig. 1.

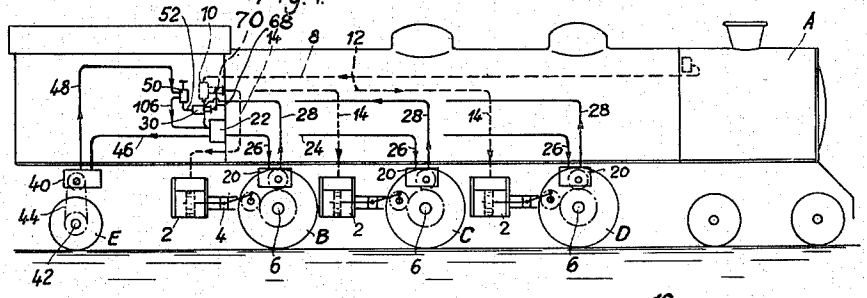


Fig. 2.

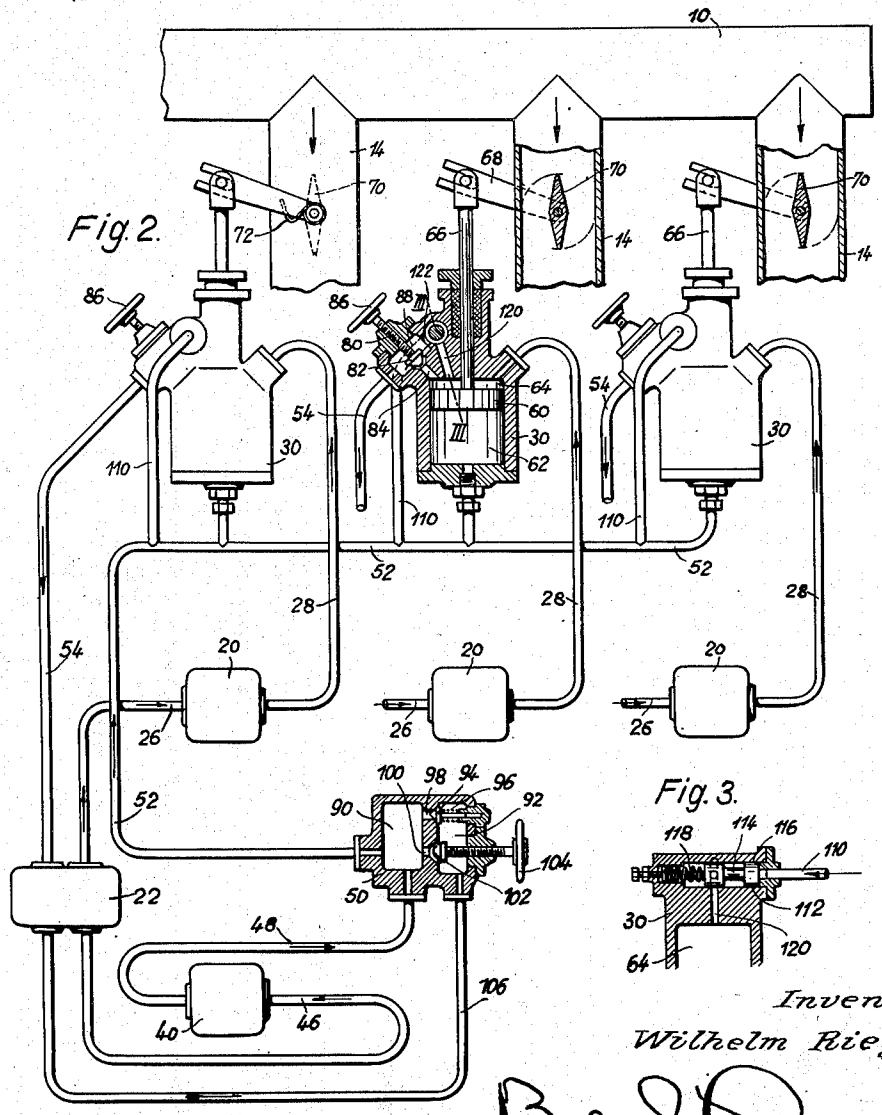


Fig. 3.

Inventor:
Wilhelm Rieger,

Bailey & Carson
Attorneys

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APPARATUS FOR SPINNING PREVENTION OF TRACTION WHEELS

Wilhelm Rieger, Kassel-Wilhelmshohe, Germany

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10 Claims. (Cl. 105—48)

This invention relates to an apparatus for preventing the driving wheels of a locomotive from spinning, the invention being used in locomotives wherein the driving axles corresponding to the driving wheels are each driven independently of the other axles.

An object of the invention is to control the rotational rate of the driving wheels and their axles of a locomotive by means automatically affecting the power supply, as by throttling the steam passage to the steam cylinders for driving the axles.

Another object of the invention is to provide a hydraulic system, which reacts to proportional differences in speed between revolving axles, for throttling the power supply to maintain the driving axles at the same rotational rate.

A further object of the invention is to control the power supply to the driving axles from a non-driving axle.

A further object of the invention is to control the rotational rate of the driving wheels and their axles by means of a non-driving wheel having a different diameter and a different rotational rate from the driving wheels.

A further object of the invention is to provide a hydraulic system held in equilibrium between driving and non-driving axles, and means for automatically controlling the driving axles when said equilibrium is upset.

A further object of the invention is to provide a hydraulic system between driving and non-driving axles, and means for releasing excess pressures in said system developed above predetermined speeds of said axles.

In the prior art, various means have been devised for regulating the speed of locomotive driving wheels, where each set of driving wheels connected by a single axle is independently driven from another set, to prevent at least one set of wheels from spinning, or, in other words, from going faster than the linear speed of the locomotive warrants. Prior art means for preventing such spinning have been dependent upon the difference in speed between a driving axle and another driving axle, or a freely rotating axle, which difference is through mechanical, electrical, or hydraulic means, translated into a control impulse to exert an influence on the driving axle which is spinning. In hydraulic control means, use has been made of a differential drive connected between two driving axles, said differential drive actuating an oil pump only upon a great inequality of the two axle speeds, said oil pump producing a throttling of the steam passage to the spinning or faster-running axle and it driving wheel. These prior art devices were not readily usable because they involved a mechanical connection between two driving axles and necessitated auxiliary control devices, as, for example, centrifugal governors, which could not be regulated readily from the cab of the locomotive.

The instant invention provides a means by which the control of the speeds of the various driving wheels and their axles can be regulated by the engineer from the cab of a locomotive, and thus, the spinning of the driving wheels can be prevented through means readily adjustable according to immediate needs.

Generally, the invention consists in that each each of the driving axles, and one of the non-driving axles of the locomotive is provided with an oil pump, and the pressure generated by the pump on the non-driving axle serves as a relative standard against which the pressure developed from the pumps of the driving axles is operatively compared. A differential in fluid pressure between the driving and non-driving axle pumps operates a piston which, through connections, throttles or opens a steam valve in the steam passage to the respective steam cylinders for the driving axles. As the rotational rate of the non-driving axles is always directly proportional to the linear velocity of the locomotive, the pump connected thereto maintains a fluid pressure against which the fluid pressure developed by a pump on an axle of any of the driving wheels can be balanced for all speeds of the locomotive.

In the drawing, Fig. 1 is a diagrammatic side elevational view of a locomotive showing the control system.

Fig. 2 is a detailed elevational view, partly in section, showing the construction and arrangement of the oil pumps and throttling valves; and

Fig. 3 is a cross sectional view on the line III—III of Fig. 2.

In Fig. 1, a locomotive is shown at A, said locomotive having independently driven driving wheels B, C, and D, and a non-driving wheel E. Each of the wheels B, C, and D has, respectively, a steam cylinder 2 by which, through conventional connecting rods and gears 4, joined to axle 6, each wheel is driven. Steam for the steam cylinders 2 is taken from the boiler of the engine through steam pipe 8 into a steam manifold 10, and thence through steam line 12 and connecting passageways 14 to the cylinders 2 of the driving wheels B, C, and D, respectively. Only the steam line to cylinder 2 for wheel B is shown completed, the remaining lines to wheels C and D being similar, but being broken in the drawing for purposes of clarity. Upon each of the driving axles 6 is mounted an oil pump 20, which pump is driven by any conventional means, as by gears, from either the axle or the drive wheel. Oil is supplied to this pump from oil reservoir 22 through pipe 24 and connecting branch pipes 26. Oil leaving each oil pump 20 passes through return pipe 28 through a control device 30 comprising a piston in a cylinder, and from there

through pipe 54 back to oil reservoir 22. In Fig. 1, oil pipes 24 and 28 to the pumps 20 for wheels C and D are broken for purposes of clarity. As shown in Fig. 2, one control device 30 is provided for each of the oil pumps 20, respectively. That is, for the three driving wheels, B, C, and D, there are three oil pumps 20, and three control devices 30.

An oil pump 40 is connected to the non-driving wheel E or its axle 42 by any conventional means, such as the pulley 44 shown. It is noted that non-driving wheel E is of different diameter, and therefore has a different rotational rate than the driving wheels B, C, and D, this merely indicating the applicability of the apparatus, and not being critical to the functioning of the same.

Oil for pump 40 is supplied from oil reservoir 22 through pipe 46, said oil leaving the pump 40 through pipe 48, and passed into a regulating device 50, and from there, through pipe 52 into each of the cylinders of control device 30 in a manner to be later described. From regulating device 50, oil from pump 40 may be by-passed and returned to oil reservoir 22 through pipe 106.

As shown in Fig. 2, each of the control devices 30 consists of a cylinder having a piston 60 therein, forming on opposite sides thereof a first oil chamber 62 and a second oil chamber 64. Connecting rod 66 is joined to the piston 60 and through link 68 is connected to throttle valve 70 located in the steam passage 14. Spring 72 is connected to valve 70 to hold the same in normally open position.

Oil from pump 20 is forced through pipe 28 into oil chamber 64 and out from there through pipe 54. The outlet passage from oil chamber 64 is controlled by a valve 80, said valve having a tapered head 82 by which the opening in outlet port 84 from chamber 64 can be varied. Manipulation of this valve can readily be made by means of hand wheel 86. It is noted that between outlet port 84 and pipe 54, there is a chamber 88 through which the oil passes. It is thus seen that a rise in oil pressure from pump 20 will cause an increased oil pressure in chamber 64, and a downward movement will be given to piston 60, and the valve 70 will be closed. The effective oil pressure in chamber 64 is, of course, regulated by the opening of port 84 by the setting of the valve 82.

Oil pressure in chamber 62 is created as follows: Oil passes from pump 40 through pipe 48, regulating device 50, pipe 52 to chamber 62. Device 50 functions as a pressure regulating means. In such device, the oil from pipe 48 is passed into an oil chamber 90. Adjacent this oil chamber and separated therefrom by a wall, is a pressure release chamber 92. A valve 94, pressed by a spring 96, engages a port 98 and acts as an automatic relief valve, depending upon the strength of the spring 96. Manual pressure release means is given through a second port 100 engaged by a valve 102 operated through hand wheel 104. Oil from the chamber 92 is returned through pipe 106 to oil reservoir 22.

It is apparent that as the speed of the engine increases, an increase in oil pressure from both the pumps 20 and 40 will take place, thus causing a corresponding increase in pressure in the chambers 62 and 64. As spinning of the wheels is not likely to take place at speeds of 25 miles an hour and upward, this increased oil pressure is relieved as follows: Connected with the pipe 52 from oil pump 40 are by-pass pipes 110 which lead to a valve located adjacent the chambers 64 and 88 in the control device 30 (note Fig. 3). This valve consists of a piston 112 having a reduced center portion 114 and located in a chamber 116. The piston 112 is pressed by an adjustable spring 118 to a normally closed position. Chamber 116 communicates with chamber 64 through bore 120, and with chamber 88 through bore 122. As oil pressure in line 52 rises above the pressure of spring 118 against piston 112, this piston is moved to establish communication between cylinders 64 and 88 through bores 120 and 122, thus relieving the oil pressure in chamber 64 by by-passing the same around valve 82, and forcing piston 60 upwardly in device 30, and maintaining valve 70 in open position.

The operation of the entire apparatus is as follows: Each of the driving wheels B, C, and D normally turns at the same rate, and this rate is proportional to the rotational rate of the non-driving wheel E. As each of the wheels B, C, and D is independently driven, a spinning of one or the other of the wheels independently of the other wheels is likely to occur, especially when the engine is accelerating from a stationary position. As soon as the wheels begin to turn, the fluid pumps 20 and 40 are operated and oil is pumped to both sides of the piston 60, it being remembered that one piston 60 exists for each driving axle. Oil from pump 20 is led through pipe 28 to chamber 64, the pressure of the oil in the chamber being determined by the setting of the valve 82. Oil from pump 40 is led through pipes 48 and 52 to chamber 62, and the pressure therein is determined by the setting of the valve 102. The pressure in these two chambers 62 and 64 is equalized in order to keep the wheels turning at the same rate, and valve 70 in steam passage 14 is open. When one of the axles and its driving wheel starts spinning, the corresponding pump 20 for such spinning axle will immediately cause a rise in oil pressure in chamber 64 and a consequent downward movement of piston 60, said piston movement effecting immediately a throttling of the steam passage by closure of valve 70, and as the power to the spinning axle is cut off, the axle will drop to the speed of the axles as determined by the linear speed of the engine. With a cessation of the spinning of the axle, the oil pump 20 slows down, and an equalization of oil pressure is reestablished on both sides of piston 60. Spring 72 overcomes this balance, and, in returning valve 70 to open position, also raises piston 60 to the position shown in Fig. 2. In place of spring 72, or supplementary thereto, the pressure in chamber 62 can be maintained at a slightly higher pressure than that in chamber 64, this being effected by valve 102 in regulating device 50.

In undesirable increase in pressure from pump 40 is prevented by automatic release valve 94 in regulating device 50. Furthermore, after a predetermined speed has been reached, for example, 25 miles per hour, the oil pressure from pump 40 acts upon valve 112 to provide a by-pass opening around valve 82 so that the rise in oil pressure from pump 20 is relieved, and no increased force is exerted upon the piston 60 in chamber 64. This relief in oil pressure also acts to prevent an undesirable heating of the oil and leakage under pressure.

As soon as the speed of the engine drops with the corresponding reduction in rotational rate of the wheels, the oil pressure will drop so that valve 112 is closed and the equilibrium of oil pressure on both sides of the piston 60 is maintained.

until the driving wheels should start spinning again.

The apparatus described has many advantages. As the rotational rate of the wheel E is dependent upon the linear speed of the engine, an oil pressure is established in the chamber **62**, which is a criterion of the linear speed of the engine translated into terms of rotational rate of speed. If the driving wheels exceed this speed, the increased pressure in the cylinders **64** immediately reacts to effect a closing of the valve **70** for a resultant throttling of the steam passage supplying steam to the spinning wheels. The various control and regulating devices, for example, devices **20** and **50**, can all be located in the cab of the engine, and there be adjusted to various operating conditions. This enables a constant supervision to be made by the engineer at all times.

For the purpose of observing the functioning of the apparatus, the control and regulating devices are preferably provided with indicating instruments, such as pressure gauges. Furthermore, the apparatus is very simple, as only small oil pumps are needed, and the arrangement enables supervision, inspection, and repair to be made easily. Again, should some factor render the apparatus inoperable, the same can be placed out of commission by opening valve **82**, which will, of course, keep the steam valves **70** in their normal open position.

Having now described the means by which I obtain the objects of my invention, what I claim is:

1. In a locomotive, an apparatus for preventing the spinning of independently driven driving axles comprising a plurality of independently powered driving axles, a non-driving axle turnable in response to linear movement of said locomotive, a fluid pump for each of said driving axles and said non-driving axle and operable, respectively, thereby, a piston control device for each of said driving axles, means for applying fluid pressure from said non-driving axle pump against one side of the piston in each control device, means for applying fluid pressure from a driving axle pump to the opposite side of the piston in the control device corresponding to that pump, and means controllable by a differential in fluid pressure on opposite sides of said piston for varying the power supply to its corresponding driving axle.

2. In a locomotive, an apparatus as in claim 1, and a pressure regulating valve in each control device for adjusting the fluid pressure from its driving axle pump.

3. In a locomotive, an apparatus as in claim 1, said means for supplying fluid from said non-driving axle pump including a fluid supply reservoir, and a regulating device comprising means for receiving fluid from said reservoir, means for supplying fluid to each control device, and pressure release means for returning fluid to said reservoir.

4. In a locomotive, an apparatus as in claim 1, a pressure regulating valve in each control device, and means operable in response to pressure from said non-driving axle pump by-passing said pressure regulating valve for relieving an excess of fluid pressure upon said opposite side of said piston.

5. An apparatus for stopping spinning of locomotive axles each of which has an independent power supply comprising a fluid pump operable by each independently powered driving axle, a non-driving axle, a fluid pump operable by said non-driving axle, a fluid reservoir, a control device for each driving axle pump, a regulating device for said non-driving axle pump, means for conveying fluid from said reservoir through each driving axle pump to its control device and back into said reservoir, means for conveying fluid from said reservoir to said non-driving axle pump to its regulating device and back to said reservoir, means for conveying fluid under pressure developed from said non-driving axle pump from said regulating device to each control device, means in each control device for comparing fluid pressure from said non-driving axle pump with fluid pressure from the driving axle pump, and means responsive to a rise in fluid pressure from a driving axle pump as compared with fluid pressure from said non-driving axle pump for diminishing the power supply to the respective axle and thereby slowing said driving axle pump.

6. An apparatus as in claim 5, an adjustable valve in each control device for varying the fluid pressure in said control device from its driving axle pump, and valve means responsive to a predetermined fluid pressure from said non-driving axle for by-passing said adjustable valve.

7. An apparatus as in claim 5, the power supply for said powered axles comprising a steam engine for each driving axle, a steam pipe for each engine, said comparing means comprising a piston movable under differential fluid pressure in said control device and said responsive means comprising a valve in said pipe, means joining said valve to said piston, and a spring holding said valve in normally opened position.

8. In a locomotive, an apparatus for preventing the spinning of independently driven driving axles comprising a plurality of independently powered driving axles, a non-driving axle turnable in response to linear movement of said locomotive, a fluid pump for each of said driving axles and said non-driving axle and operable, respectively thereby, a device operable by hydraulic pressure for each of said driving axles, means for applying fluid pressure from said non-driving axle pump to each device, means for applying fluid pressure from a driving axle pump to that device corresponding to that pump, and means controllable by a differential in fluid pressure in each of said respective devices for reducing the speed of the corresponding driving axle.

9. A hydraulic system for preventing the spinning of independently powered driving axles of a vehicle comprising a separate control device responsive to changes in differential hydraulic pressure for each individual driving axle, means connecting each control device to the power supply for the corresponding axle for varying said power supply on a change in differential pressure in said device, means for producing in each control device a first hydraulic pressure in proportion to the speed of the corresponding driving axle for that control device, and means for producing a second hydraulic pressure opposed to said first hydraulic pressure in each control device, said second pressure being proportional to the linear velocity of said vehicle.

10. A hydraulic system as in claim 9 further including means for rendering each control device inoperable in response to a predetermined value of said second hydraulic pressure.

WILHELM RIEGER.