(No Model.) 2 Sheets—Sheet 1.

F. A. HAUGHTON.

LOCOMOTIVE.

No. 536,623. Patented Apr. 2, 1895.

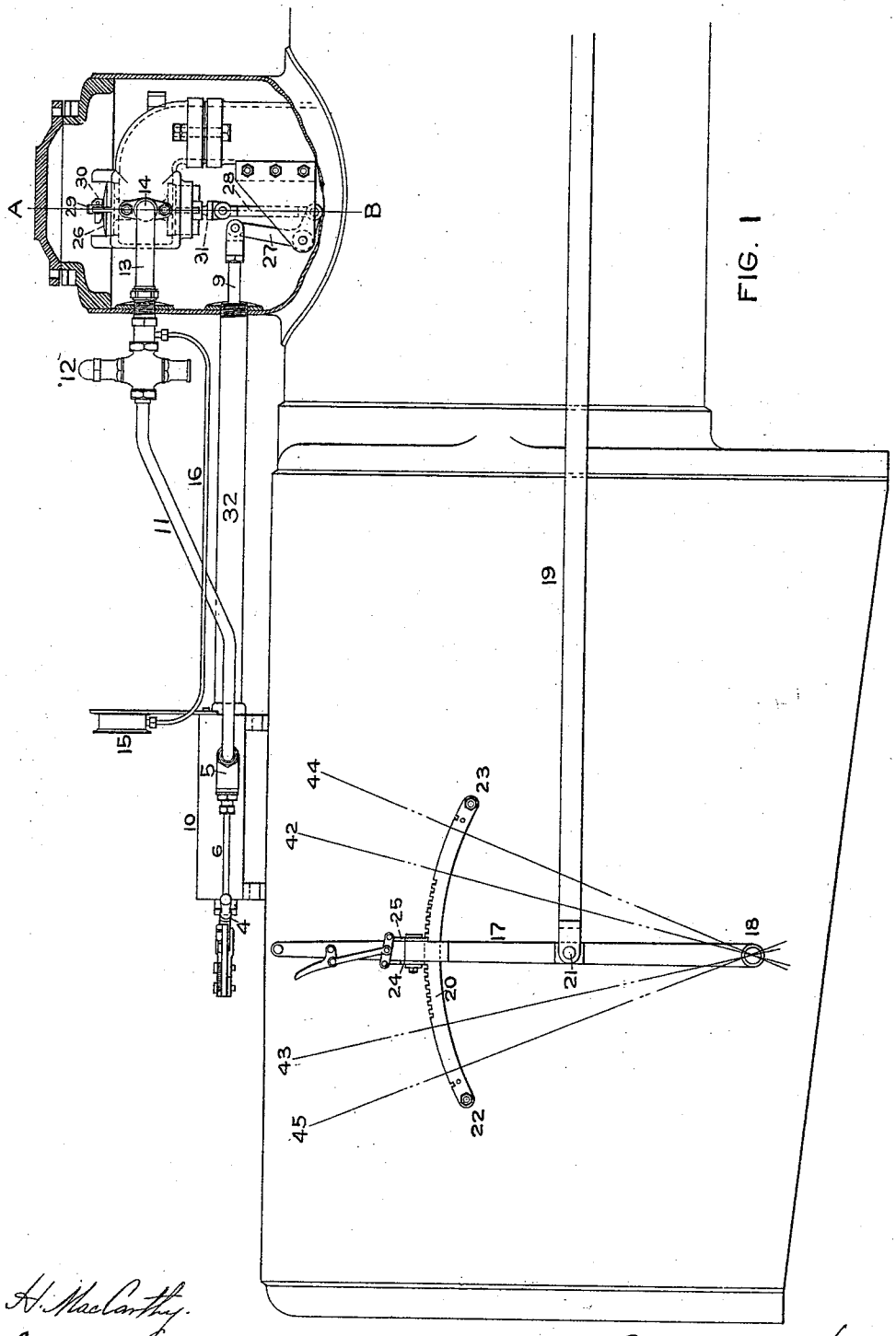

FIG. 1

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(No Model.) 2 Sheets—Sheet 2.

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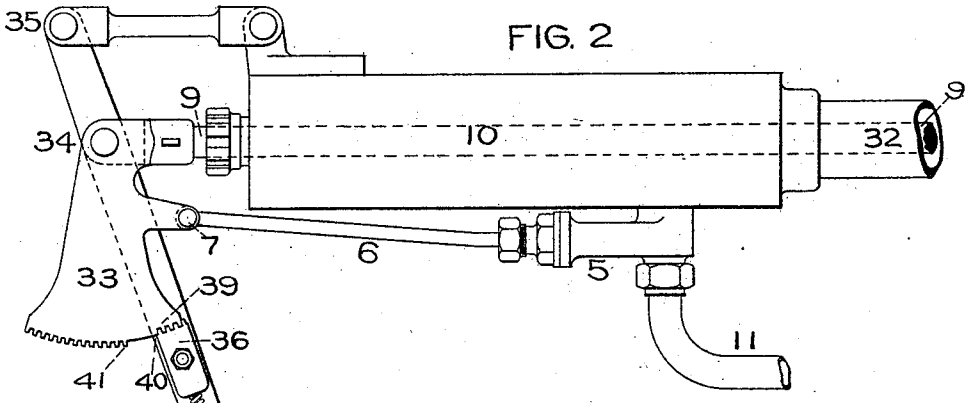
FIG. 2



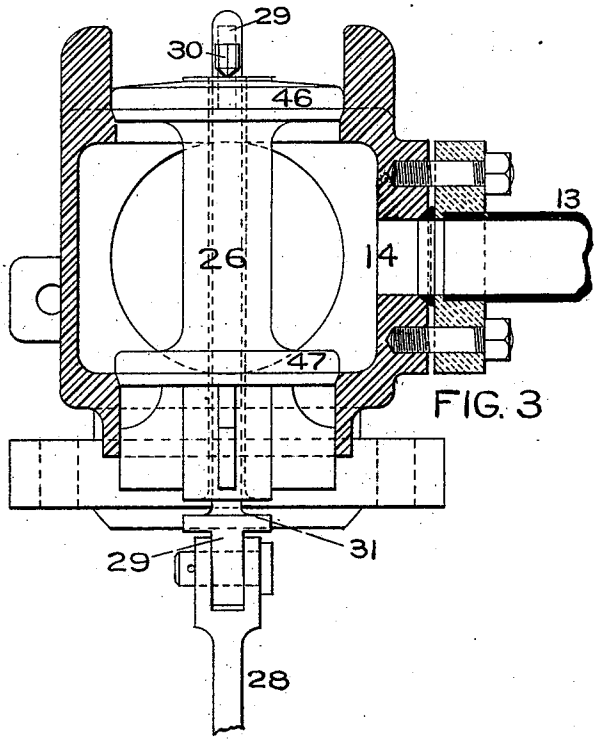


FIG. 3

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UNITED STATES PATENT OFFICE.

FRANK A. HAUGHTON, OF BALTIMORE, MARYLAND.

LOCOMOTIVE.

SPECIFICATION forming part of Letters Patent No. 536,623, dated April 2, 1895.

Application filed December 5, 1894. Serial No. 530,888. (No model.)

To all whom it may concern:

Be it known that I, FRANK A. HAUGHTON, a citizen of Great Britain, and a resident of Baltimore city, in the State of Maryland, have invented certain new and useful Improvements in Locomotives, of which the following is a specification.

My invention relates to an improvement in locomotives. Its object is to utilize an increased tractive force or effort at the drawbar for a given rate of expansion of steam in the cylinders in a locomotive having a given weight transmitted to the rails by the driving wheels.

Expressed differently, my object is to afford a means to successfully apply a turning power to the driving wheels which will fully utilize their adhesion to the rails while working at the usual cut-off of steam or the usual rate of expansion of steam in the cylinders.

Somewhat differently expressed, the object is to fully utilize the adhesion of the driving wheels to the rails under favorable conditions at cut-offs considerably less than full stroke of the piston.

In locomotives of the usual design which depend for their power of traction upon the adhesion of their driving wheels to the rails the power of the cylinders is so arranged that the turning power on the driving wheels at a nearly full stroke cut-off is just sufficient not to slip the wheels under favorable conditions and thus to utilize the full adhesion of the driving wheels with full boiler pressure supplied to the cylinders.

In running a locomotive after it gets under way it is customary to reduce the cut-off thus cutting off the steam from the cylinders earlier than nearly full stroke cut-off, but when the cut-off is reduced below the nearly full stroke cut-off the adhesion of the driving wheels to the rails is not fully utilized and the hauling power of the engine is correspondingly reduced. If the turning power of the driving wheels at the usual point, (considerably less than nearly full stroke cut-off) be made great enough to fully utilize their adhesion to the rails, at a full stroke cut-off at which the power is greater, the turning power will exceed the adhesion unless some provision be made to supply steam to the cylinders at such a reduced pressure as will bring the turning power of the driving wheels within the limit of adhesion. This difficulty presents itself in locomotives which are termed "over-cylindered," that is, their turning power at a nearly full stroke cut-off is so great as to cause excessive slipping of the driving wheels upon the rails thereby making it difficult to start a train, as even with great care the pressure cannot be regulated with any degree of certainty by the ordinary throttle valve when starting and while running at slow speed.

In locomotives of my design, I make the turning power of the driving wheels at the usual point of cutting off, that is to say, the usual cut-off employed while running, such that it is just within their limit of adhesion to the rails under favorable conditions, and when working at a nearly full stroke cut-off provides a means of admitting steam to the cylinders through an automatic reducing valve, which is adjusted to supply steam to the cylinders at such a pressure that at the nearly full stroke cut-off, the turning power of the driving wheels does not exceed their limit of adhesion to the rails under favorable conditions.

In the drawings Figure 1 is an elevation of the rear portion of a locomotive boiler showing the steam dome in section cut by a vertical plane passing through its axis, displaying the throttle valve and connections; also showing below, the reverse lever and its connections. Fig. 2 is a plan of the throttle lever and connections. Fig. 3 is an enlarged sectional elevation of the throttle valve box, formed by a vertical plane cutting it on the line A—B, Fig. 1.

Referring to Fig. 1 which shows a side elevation of a portion of the boiler with the reverse lever mounted on its side the steam dome being in section having the reducing valve on one side of it and a steam gage connected thereto, a manifold is mounted on the boiler and connected by a steam pipe with the steam dome and having a throttle lever pivoted to the manifold.

The manifold and throttle lever are shown in enlarged plan in Fig. 2, and the throttle valve and its connections in section are shown in Fig. 3.

Referring to Fig. 1, 10 is a manifold mounted on the boiler and connected by a steam pipe

32 with the steam dome. Through the center of the manifold 10 and the pipe 32 passes a rod 9 which protrudes from the end of the manifold 10 at one end and from the interior of the pipe 32 on the other end.

To the extremity of the rod 9 is secured throttle lever 4. The throttle lever is pivoted at its extremity 35 to a link which is pivoted at its other end to the side of the manifold. The throttle rod 9 is connected to the throttle lever at 34 and on its extremity is the segment 33, rigidly connected to the end of the rod 9 and provided at its periphery with teeth 40 and 41.

36 is a latch on the throttle lever engaging the segment and held in place by the spring 38.

37 is a hand trigger by which the latch is released.

5 is a gate valve consisting of a small valve tapped into the side of the manifold 10 and provided with a stem 6 by which the valve is operated. The stem 6 is connected at its extremity with a lug 7 on the side of the segment 33.

11 is a pipe connecting the gate valve 5 with a reducing valve 12. The reducing valve is of the usual construction and can be set to admit any desired pressure of steam. On the other side it is connected by a pipe 13 with the steam pipe at 14.

15 is a steam gage mounted on the side of the manifold or in any other desired position and connected by the pipe 16 with the pipe 13 beyond the reducing valve. This steam gage is designed for the purpose of testing the steam pressure in the pipe 13 beyond the reducing valve 12.

Referring to Fig. 1, 27 is a bell crank lever suitably pivoted and connected at one end to the rod 9 and at the other end to a link 28 which at its other extremity is connected to a rod 29 passing through the throttle valve and in which it has some play or lost motion.

30 is a pin passing through a slot in the end of the rod 29 by which it is held within the throttle valve 26.

31 is a shoulder at the lower extremity of the rod 29 which, when the rod 29 is raised, will bear against the under side of the throttle valve and lift it. The play thus afforded to the rod 29 will permit a certain amount of motion in this rod without affecting or moving the throttle valve. This play is designed for the purpose of allowing the rod 9 to be moved sufficiently to open the gate valve 5 before the throttle valve is opened.

17 is the reverse lever having its fulcrum at 18 and pivoted to the reach rod 19 at 21.

20 is the rack or quadrant attached rigidly to the side of the boiler at 22 and 23.

24 and 25 are the two latches which engage alternately in the slots of the rack in order to secure the reverse lever in any desired position.

In the position of the throttle lever shown in Figs. 1 and 2, both the gate valve 5 and the throttle valve 26 are closed and the throttle lever 4 is secured in this position by the latch 36 engaged in teeth of the rack 33 at 39. Between the points 40 and 41 on the periphery of the rack or segment the rack is without teeth. Below this surface are cut teeth at 39 and above the surface the remaining teeth are cut so that when the latch is raised and the lever 4 withdrawn slowly from the position shown, the teeth of the latch will ride on that portion of the rack without teeth between the points 40 and 41.

In Fig. 1, the reverse lever 17 is shown in the out-of-gear position, that is, in the middle of its movement on the rack 20. Now, in the locomotive of my design the most desirable cut-off is chosen at which the full adhesion of the driving wheels is to be utilized with full boiler pressure supplied to the cylinders, which is represented by the angular positions of the reverse lever for running forward and backward by the broken lines 42—43, respectively. While in either of these positions the full boiler pressure is admitted to the cylinders to obtain the maximum tractive force possible for the given weight transmitted to the rails by the driving wheels, and the throttle valve 26 is opened wide. When it is desired to start either forward or backward the reverse lever is placed in the position 44 or 45, respectively. The throttle lever 4 is moved backward until the latch 36 reaches the tooth in the rack at 41, the said tooth preventing a farther backward movement without additional withdrawal of the latch 36 by the trigger 37, and the steam in the boiler tending to press out the throttle stem 9 holds the latch securely against the said tooth 41, thus holding the throttle lever 4 in the desired position. The amount of withdrawal of the stem 9 by the lever 4 caused by a movement of the latch 36 from 40 to 41, opens the gate valve 5 by the stem 6, and thus admits steam to the cylinders, of the desired pressure, by means of the reducing valve 12, and the amount of movement of the stem 9 not being sufficient to bring the shoulder 31 of the rod 29 in contact with the bottom of the valve 26, the latter remains closed, being held so by the steam outside pressing on the upper disk 46 of the valve 26, which has a larger area than the lower disk 47 of the valve 26. Now, as soon as a start is effected or as soon as desired, the reverse lever is moved from 44 or 45 to 42 or 43, respectively, after which the throttle valve 26 is opened as wide as desired by an additional movement of the lever 4, when the locomotive continues to work, utilizing its full adhesion to the rails and at an increased rate of expansion of steam in the cylinders.

The rack 20 is without notches between the full gear positions 44 and 45, and the positions 42 and 43, respectively as shown; the positions 42 and 43 being the extreme positions at which full boiler pressure can be supplied to the cylinders with advantage, or, for all positions of the reverse lever included be-

tween 42 and 43 full boiler pressure may be admitted to the cylinders, and for the positions beyond these, as 44 and 45, steam is supplied to the cylinders at a reduced pressure by means of the reducing valve 12.

Under some circumstances the steam gage 15 might be employed to ascertain the pressure supplied to the cylinders, and by skillfully manipulating the throttle lever the pressure supplied to the cylinders might be kept within the proper limit while starting or running, with the reverse lever beyond the positions 42 and 43, without the use of the reducing valve 12, but this would require close attention fixed upon these parts which cannot always be given at such times and the employment of the reducing valve greatly increases the convenience.

This system is applicable to compound locomotives as well as single or simple expansion locomotives.

In existing compound locomotives I am aware that steam is admitted into the receiver and low pressure cylinder direct from the boiler through a reducing valve when starting in order to supply the low pressure cylinder with steam of the proper pressure until the high pressure cylinder has exhausted sufficient steam to supply the low pressure cylinder, but in my system steam is supplied to the high pressure cylinder as well, through a reducing valve, when working at a nearly full stroke cut-off as at starting, and after the cut-off is reduced to the desired point the full boiler pressure is supplied to the high pressure cylinder, when the low pressure cylinder will get its supply only from the high pressure cylinder exhaust as usual, the full boiler pressure at the reduced point of cut-off being made sufficient to cause a turning force of the driving wheels sufficient to utilize their full adhesion to the rails under favorable conditions.

If desired, the gate valve 5 instead of being coupled to the throttle lever rack, may be operated by a separate handle attached to its stem 6, in which case the rack 33 would be made of the usual form, and the lever 4 only employed when it is desired to supply steam to the cylinders by the main throttle valve 26.

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

1. In a steam engine the combination of a cylinder, a steam pipe and throttle valve directly connected together for admission of steam to cylinder and a reducing valve, the reducing valve arranged to admit steam to the same cylinder independently of the throttle valve, and means for admitting steam to the reducing valve.

2. In a steam engine the combination of a cylinder, steam pipe, and throttle valve with a reducing valve connected to the steam passage between the throttle valve and the cylinder and admitting steam thereto independently of the throttle valve.

3. In a steam engine the combination of a cylinder, steam pipe and throttle valve with a reducing valve, and means for admitting steam thereto, the throttle valve being provided with an actuating mechanism having a suitable amount of play or lost motion, and a throttle lever suitably connected to open and close the throttle and reducing valve, said throttle lever first actuating means to admit steam to the reducing valve before opening the throttle valve.

4. In a steam engine the combination of a cylinder, steam pipe and throttle valve with a reducing valve arranged to admit steam to the cylinder while the throttle valve is closed, means for admitting steam to the reducing valve, and a throttle lever so connected to the steam inlet device for the reducing valve that when the throttle lever is first moved through a specified distance steam will be admitted to the cylinder at a reduced pressure through the reducing valve, and the further motion of the throttle lever will open the throttle valve and admit full boiler pressure to the cylinders.

5. In a steam engine the combination of a cylinder, steam pipe and throttle valve with a reducing valve and means for admitting steam thereto, the reducing valve being connected to the steam passage in such position as to admit steam to the cylinder while the throttle valve is closed, the throttle valve stem or operating mechanism having a predetermined amount of lost motion, a throttle lever connected to the actuating mechanism of the throttle valve and also to the steam admission device of the reducing valve and acting when operated to admit steam to the reducing valve before opening the throttle valve in consequence of the lost motion of the throttle valve actuating mechanism, substantially as described.

6. In a steam engine the combination of a cylinder, steam pipe and throttle valve with a reducing valve admitting steam to the cylinder while the throttle valve is closed, the actuating mechanism of said throttle valve being constructed with a predetermined amount of lost motion, a gate valve connected to the boiler and also to the reducing valve for admitting steam to the reducing valve, the throttle valve actuating mechanism and the gate valve actuating mechanism both being connected to a throttle lever in such a manner that when the throttle lever is operated the gate valve will be open and steam admitted to the reducing valve while the throttle valve is not moved in consequence of the lost motion in its operating mechanism.

7. In a steam engine the combination of a cylinder, steam pipe and throttle valve with a reducing valve admitting steam to the cylinder while the throttle valve is closed, the actuating mechanism of said throttle valve being constructed with a predetermined amount of lost motion, a gate valve connected to the boiler and also to the reducing valve for admitting steam to the reducing valve, a throttle

lever suitably pivoted, a throttle valve actuating mechanism consisting of a rod connected thereto, and a gate valve actuating mechanism consisting of a segment 33 rigidly connected to the extremities of the throttle valve actuating rod and connected by a suitable rod with the gate valve actuating mechanism, said segment 33 being provided on its periphery with two sets of teeth and a portion intermediate between them having no teeth, and a latch mounted upon the throttle lever and engaging the teeth on the periphery of the segment 33, as and for the purpose specified.

Signed at Baltimore, in the State of Maryland, this 26th day of November, A. D. 1894.

FRANK A. HAUGHTON.

Witnesses:
JOHN L. HEBB,
H. MACCARTHY.