Dec. 3, 1929. C. A. FRENCH ET AL 1,737,581

APPARATUS FOR CONTROLLING AUTOMOTIVE STEAM VEHICLES

Filed Jan. 12, 1925 2 Sheets-Sheet 1

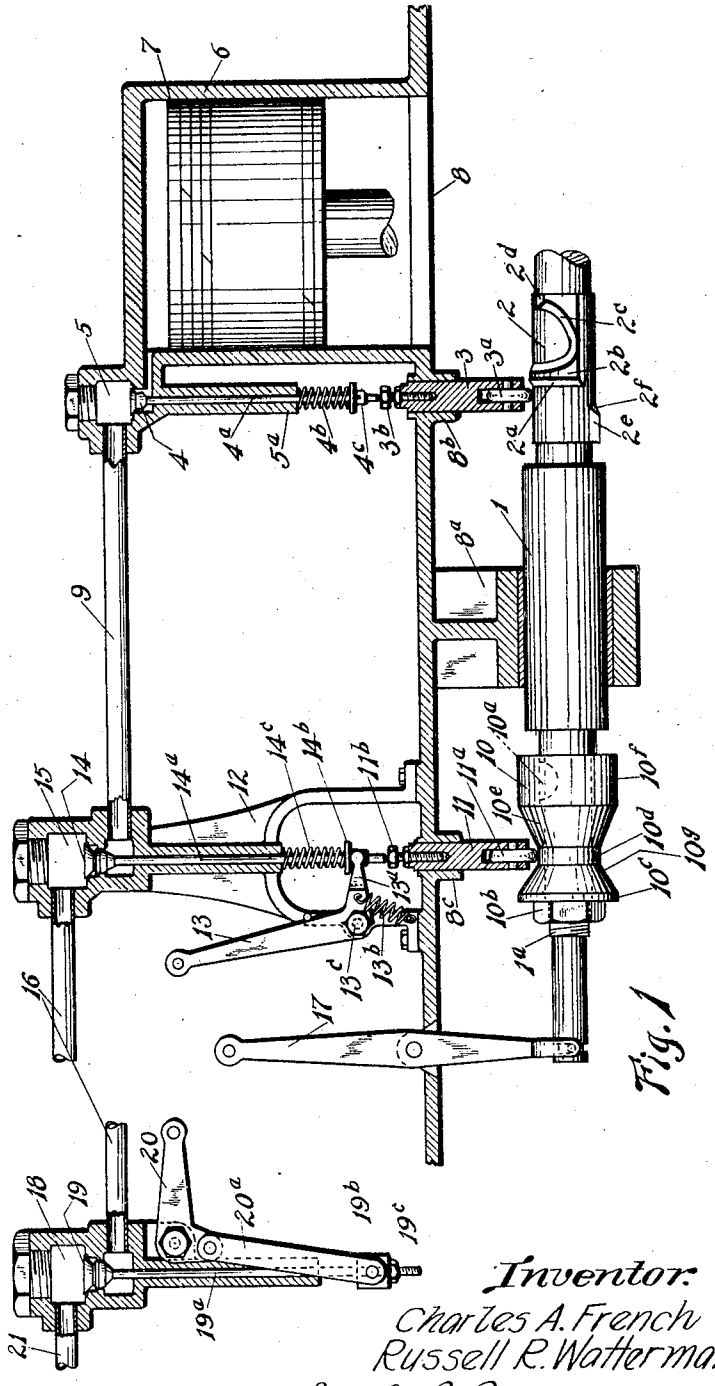


Fig. 1

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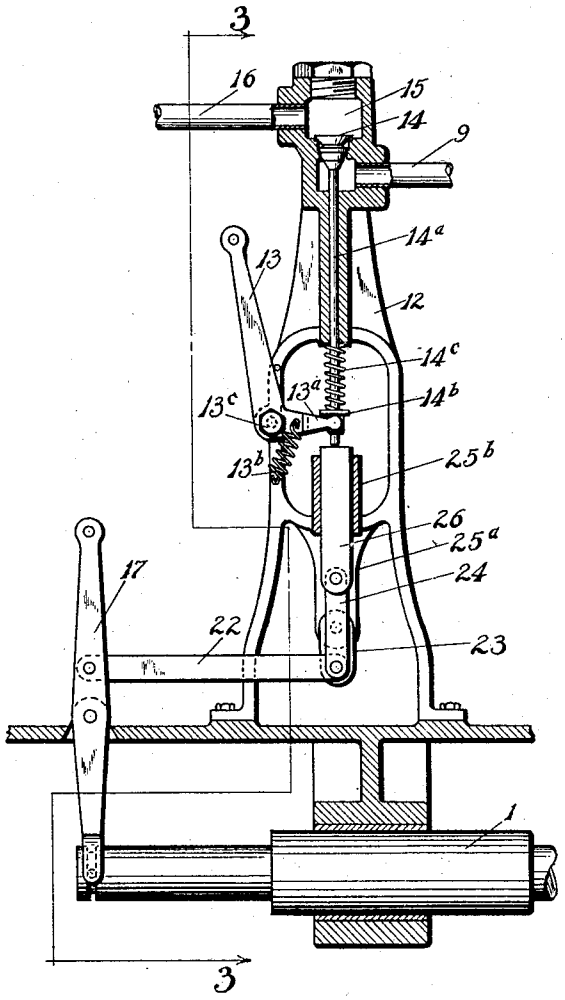


Fig. 2

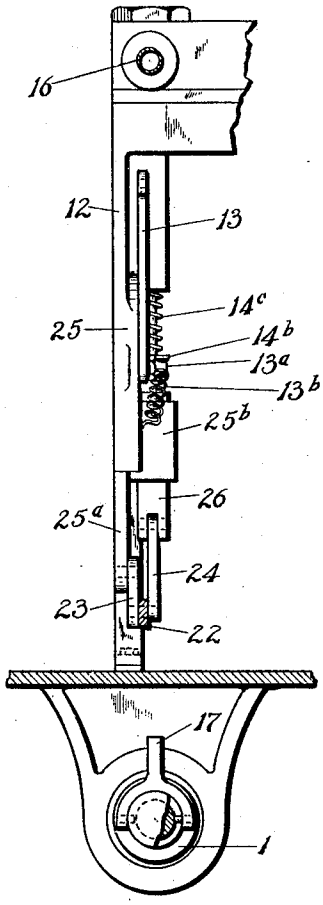


Fig. 3

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UNITED STATES PATENT OFFICE

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APPARATUS FOR CONTROLLING AUTOMOTIVE STEAM VEHICLES

Application filed January 12, 1925. Serial No. 1,853.

Our invention relates to an apparatus for regulating the steam to automotive steam vehicle engines.

The best possible thermal efficiency has not been realized in connection with automotive steam vehicles because the steam has been generated at a high pressure, usually 600 lbs. per square inch, and throttled down to much lower pressures before it is admitted to the engine cylinders which results in serious loss of possible expansion. Attempts have been made to shorten the cut-off at low or moderate engine speeds which has resulted in a jerky, irregular turning movement. The average operator of vehicles of this class does not exercise sufficient vigilance or judgment to secure the best results when using the ordinary manual control of the cut-off.

With high steam pressures and temperatures, a multi-cylinder unaflow steam engine in an automotive steam vehicle can realize a better thermal efficiency under the average conditions than can the present gasoline engines, provided the unaflow steam engine is driven by the cut-off rather than the throttle.

The principal object of this invention is to remedy the defects as hereinbefore set forth and provide for the greatest possible expanse of the steam consistent with good maneuvering. Another object of the invention is to provide an apparatus of this class whereby the cam shaft of the engine carries fixed intake or cutoff valve cams and throttle valve cams which cam shaft is shiftable longitudinally so that there is unitary action between the control of the intake or cutoff valve and the throttle valve. Another object of the invention is to provide a unitary action between the intake or cutoff and throttle valves. Another object of the invention is to provide also independent control of the throttle valve so as to permit greater flow of steam, or flow of steam at greater pressure, to the intake or cutoff valve than is ordinarily admitted, particularly during the long cutoff when starting the engine, or when the engine is otherwise under extraordinary load, such greater opening of the throttle valve instead of the cutoff valve providing more continuous or uniform power distribution. Another object of the invention is to provide an apparatus of this class which is simple and economical of construction, durable, easy to operate, efficient and which will not readily deteriorate or get out of order.

With these and other objects in view as will appear hereinafter, our invention consists of certain novel features of construction, combination, and arrangement of parts and portions as will be hereinafter described in detail and particularly set forth in the appended claims, reference being had to the accompanying drawings and to the characters of reference thereon which form a part of this application in which:—

Figure 1 is a fragmentary side elevational and sectional view of our control apparatus shown in connection with the crank case, one cylinder and piston of a steam engine.

Figure 2 is a fragmentary side elevational and sectional view of the throttle control mechanism in a slightly modified form to that of Figure 1.

Figure 3 is a view through 3—3 of Figure 2.

Similar characters of reference refer to similar parts and portions throughout the views of the drawings.

The cam shaft 1, intake cam block 2, intake valve lifter 3, intake valve 4, steam chest 5, engine cylinder 6, piston 7, crank case 8, steam conductor 9, throttle cam block 10, throttle valve lifter 11, supporting yoke 12, auxiliary control lever 13, throttle valve 14, valve chamber 15, conductor 16, main control lever 17, valve chamber 18, emergency throttle valve 19, operating lever 20, and steam conductor 21, constitute the principal parts and portions of our control apparatus in its preferred form.

The cam shaft 1 is preferably provided with an enlarged portion mounted in the support 8^a and adapted to be longitudinally shifted in said support 8^a. Fixedly positioned on this cam shaft 1 is the intake cam block 2 which is provided with an intake cam forward motion section consisting of the inclined section 2^a, long cut-off starting section 2^b, driving range section 2^c and maximum driving cut-off section 2^d. This block 2 is

also provided with an intake reverse cam portion 2^e which is the reverse driving section and which is provided with a shift incline section 2^f. Reciprocably mounted in the crank case in the journal 8^b is the intake valve lifter 3 which is provided with a roller 3^a which is adapted to roll on the cam block 2 and be engaged by the various cam sections dependent upon the position of the cam shaft when shifted longitudinally. This lifter 3 is provided with an adjusting bolt 3^b which provides for the proper adjustment of the lifter relatively to the valve stem. Communicating with the interior of the engine cylinder 6, is the steam chest 5 and mounted in the inlet port is the inlet valve 4 which is provided with a stem 4^a reciprocably mounted in the support 5^a and mounted on the one end of this valve stem is a valve spring 4^b which engages the lower end of the support 5^a, and is adapted to close the valve 4. The spring 4^b is supported on the valve stem by means of a spring retainer 4^c. Communicating with the steam chest 5 is a steam conductor 9 which communicates with the throttle valve chamber 15. The throttle cam block 10 is mounted on the shaft 1 by means of a key 10^a which prevents torsional movement and is supported by nut 10^b on the threads 1^a. The throttle block cam is provided with an open throttle section for reverse 10^c, throttling section for reverse 10^g, closed throttle section 10^d, throttling section opening 10^e, and open throttle section 10^f. Reciprocably mounted in the journal 8^c of the casing 8, is the throttle valve lifter 11, which is provided with a roller 11^a which is adapted to roll on the cam block 10 in various positions with the longitudinal movement of the shaft 1. This valve lifter is also provided with an adjusting bolt 11^b in its upper end. Secured on the casing 8 is the supporting yoke 12 and in its upper end is provided the valve chamber 15 in which is reciprocably mounted the valve 14. This valve 14 is provided with a stem 14^a which is reciprocably mounted in the supporting yoke 12 and secured on the lower end of the valve stem 14^a is a retainer 14^b and between this retainer and a portion of the yoke 12 is the valve spring 14^c tending to hold the valve closed at all times.

Pivotally connected to the member 14^b is the arm 13^a on the lever 13 so that the valve 14 may be operated by the lever 13. Mounted on this arm 13^a is a tension spring 13^b, the opposite end of which is secured to the yoke 12. This spring 13^b assists the spring 14^c in holding the valve 14 closed, and balancing the lever 13. Lever 13 is pivotally mounted upon the yoke 12 by means of a bolt 13^c. Communicating with the valve chamber 15 is a steam conductor 16 which communicates with the valve chamber 18 which is the emergency valve chamber. Also communicating with this valve chamber 18 is another steam conductor 21, the other end of which communicates with a source of steam supply not shown.

Mounted in the valve chamber 18 is the emergency valve 19 which is provided with a valve stem 19^a and on the lower end of this valve stem 19^a is mounted a block 19^b which is supported on the valve stem by means of a nut 19^c. Pivotally connected with this block 19^b is a link member 20^a, the upper end of which is pivotally connected with the bell crank lever 20 which is the emergency lever. It will be noted that when the emergency lever 20 is moved, the link 20^a is shifted causing the valve 19 to open or close depending upon the way the lever 20 is shifted.

In the modified form of construction shown in Figures 2 and 3, the structure is the same throughout as that in Figure 1 except that the throttle block and throttle valve lifter are omitted, and the structure operated directly by the control lever 17. Pivotally connected with the lever 17 above its pivotal mounting is a link member 22 which is interposed between link members 23 and 24 to which it is pivotally connected at its opposite end. The link member 22 is pivotally connected at one end through the link 23 with the support 25 which is similar to the yoke 12 at its upper end and is provided with the valve, etc. in the same manner as the yoke 12, and with the lever 13 and 13^a, spring 13^b, bolt 13^c, spring 14^d and retainer 14^b. These members 25 are provided with downwardly extended portions 25^a to which the link 23 is pivotally connected. It is also provided with a journal portion 25^b in which is reciprocably mounted the plunger 26 to which one end of the link member 24 is pivotally connected. Thus it will be noted that by the shifting of the lever 17, the link 22 is shifted, thereby shifting the links 23 and 24, and reciprocating the plunger 26 which engages the end of the valve stem 14^a and opens and closes the valve 14.

The operation of our apparatus for controlling automotive steam vehicle engines is as follows:

The steam is admitted through the conductor 21, valve chamber 18, conductor 16, valve chamber 15, conductor 9, steam chest 5 to the cylinder 6. The valve 4 is the intake or cutoff valve to the cylinder. The valve 14 is a throttle valve and the valve 19 is an emergency valve. The sole object of the valve 19 is to provide for cutting off the steam entirely independent of the throttle and intake valves so that there is provided a positive cut-off of the steam when desired. In the preferred form as shown in Figure 1 of the drawings, the valve blocks 2 and 10 are in fixed relation with each other so that when one is moved longitudinally or revolubly, the other is moved; in other words, when the cam shaft

1 is moved, both of the valve blocks are moved with the shaft.

In Figure 1 of the drawings these blocks are shown in neutral position relative to the valve lifters 3 and 11. If the shaft is moved to the left, the throttle is opened as well as the intake valve. When the throttle is opened a sufficient distance so that the section 2^b of the cam blocks 2 engages the roller 3^a there is provided a long cut-off, long enough to start the engine under all circumstances and is of such width as to permit a more or less complete driving throttle opening depending upon the average loads to be handled. The right hand side of the section 2^b has a rather sudden graduation from the longest to the shortest cut-off which permits passing smoothly from the longest cut-off to the shortest. The left side of the section 2^c is the shortest cut-off and at the same time the section 10^f of the throttle cam block holds the throttle wide open admitting full boiler pressure to the engine intake valve 4. The section 2^c is graduated to permit any cut-off needed in the normal operation of the engine at high or low driving speed. By moving the cam shaft 1 to the right, the reverse throttling section 10^g opens the throttle and at the same time the reverse cam 2^e opens the intake valve, thus reversing the engine.

The lever 13 permits the opening of the throttle valve 14 independently of the intake valve. Thus it will be noted in the preferred construction the throttle valve and intake valves are operated simultaneously with the one control lever 17. The shape of the two cam blocks permit ready control of the steam to the cylinder through both the throttle and intake valve.

It will be noted that in the modified form of construction shown in Figures 2 and 3, the intake valve is operated by the cam block 2 through the lever 17 while the throttle valve is operated by means of the links 22, 23 and 24, and plunger 26, providing simultaneous action of the throttle valve with the intake valve.

Though we have shown and described a particular construction, combination and arrangemen of parts and portions and certain modifications thereof, we do not wish to be limited to this particular construction, combination and arrangement nor to this modification thereof, but desire to include in the scope of our invention, the construction, combination and arrangement substantially as set forth in the appended claims.

Having thus described our invention what we claim as new and desire to secure by Letters Patent is:

1. In an apparatus for controlling automotive steam vehicles, a steam inlet valve, a throttle valve communicating therewith, a cam shaft provided with an intake cam operating portion and a throttle cam operating portion in fixed relation to each other on the same shaft, means adapted to connect said cam portion with said valves and means for shifting the cam shaft longitudinally.

2. In an apparatus for controlling automotive steam vehicles, the combination with the intake valve and throttle valve communicating therewith, of cam shaft means having separate cams for separately and simultaneously operating said intake valve and said throttle valve.

3. In an apparatus for controlling automotive steam vehicles, the combination with the intake valve and throttle valve communicating therewith, of cam shaft means for simultaneously operating said intake valve with said throttle valve, and means for independently operating said throttle valve.

4. In an apparatus for controlling automotive steam vehicles, the combination with the cylinders of a steam engine, of a throttle valve, an intake valve, communicating means between said throttle valve and said intake valve, communicating means between said intake valve and the cylinder of the engine and cam shaft means having separate cams for separately and simultaneously operating said throttle valve and said intake valve.

5. In an apparatus for controlling automotive steam vehicles, the combination with the cylinders of a steam engine, of a throttle valve, an intake valve, communicating means between said intake valve and the cylinder of the engine, cam shaft means for simultaneously operating said throttle valve and said intake valve, and independent means for operating said throttle valve.

6. In an apparatus for controlling automotive steam vehicles, the combination with the cylinders of a steam engine, of a throttle valve, an intake valve, communicating means between said throttle valve and said intake valve, communicating means between said intake valve and the cylinder of the engine, cam shaft means for simultaneously operating said throttle valve and said intake valve, independent means for operating said throttle valve, and independent means for shutting off the steam to both said throttle valve and said intake valve.

7. In an apparatus for controlling automotive steam vehicles, the combination with the cylinder and piston of a steam engine, of a longitudinally shiftable cam shaft, an intake cam member provided with a long section permitting long cut-off to start the engine, and longitudinally shiftable for variations of intake opening and cam operated means operated simultaneously with the shifting of said cam shaft for opening the throttle valve.

8. In an apparatus for controlling automotive steam vehicles, the combination with the cylinder and piston of a steam engine, of a longitudinally shiftable cam shaft, an intake cam member provided with a long section

permitting long cut-off to start the engine, and longitudinally shiftable for variations of intake opening, cam operated means operated simultaneously with the shifting of said cam shaft for opening the throttle valve, and independent means for operating said throttle valve.

9. In an apparatus for controlling automotive steam vehicles, the combination with the cylinder and piston of a steam engine, of a longitudinally shiftable cam shaft, an intake cam member provided with a long section permitting long cut-off to start the engine, and longitudinally shiftable for variations of intake opening, cam operated means operated simultaneously with the shifting of said cam shaft for opening the throttle valve, independent means for operating said throttle valve and independent means for closing the steam to both said throttle valve and said intake valve.

10. In an apparatus for controlling automotive steam vehicles, the combination with the cut-off valve and throttle valve communicating therewith, of means for simultaneously operating said valves, and means for independently operating the throttle valve.

In testimony whereof, we have hereunto set our hands at Los Angeles, California, this 31st day of December, 1924.

CHARLES A. FRENCH.
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