April 5, 1932. N. T. McKEE 1,852,326

THROTTLE

Filed Dec. 2, 1927 2 Sheets-Sheet 1

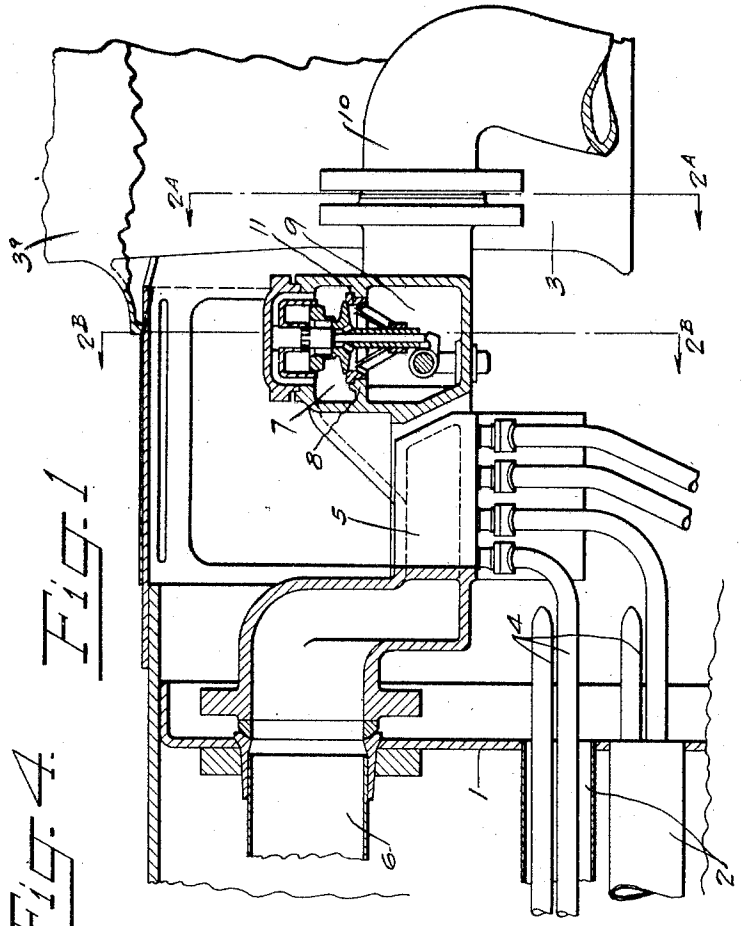

Fig. 1

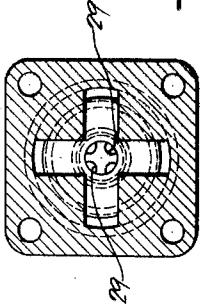

Fig. 5

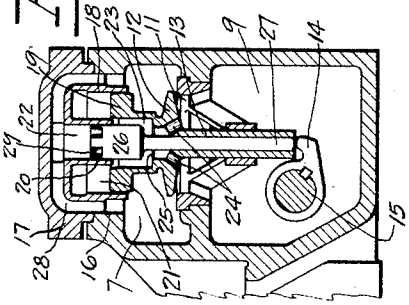

Fig. 4

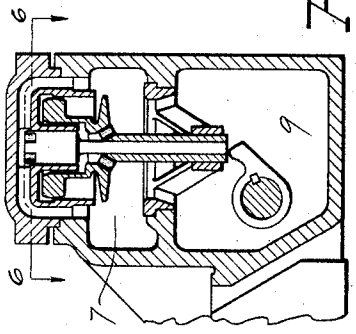

Fig. 6

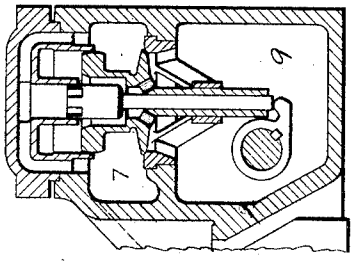

Fig. 3

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THROTTLE

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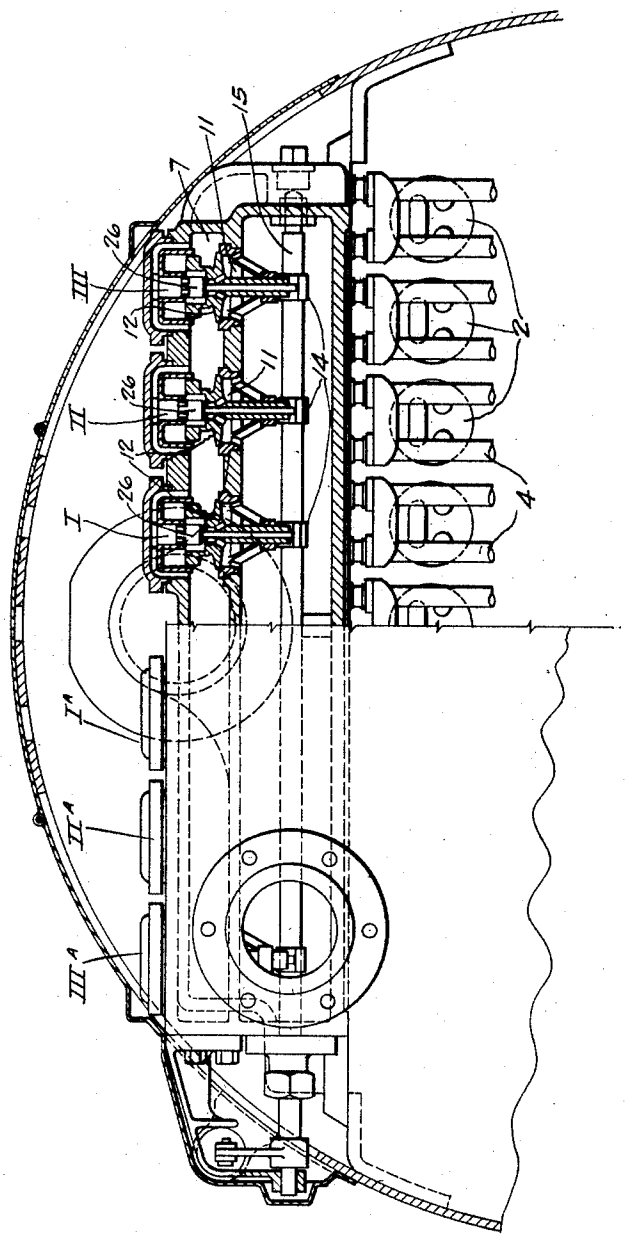

Fig. 2

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Patented Apr. 5, 1932 1,852,326

UNITED STATES PATENT OFFICE

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THROTTLE

Application filed December 2, 1927. Serial No. 237,290.

This invention relates to locomotives and particularly to superheater headers and multiple throttles such as disclosed in United States patent to R. M. Brown, Reissue #16,285 of March 9, 1926. A balanced form for such multiple throttles is shown and claimed in my United States Patent #1,712,982, dated May 14, 1929. The present invention constitutes an improvement on the disclosure in my application and has for its purpose the provision of an arrangement using such balanced throttles which gives sufficient steam for maneuvering the locomotive in tight places as well as for "drifting", and for insuring the closing of the throttles when the engineer manipulates his lever to this end.

The invention is illustrated in the two sheets of drawings filed herewith, in which Fig. 1 is a central, vertical, longitudinal section of the front upper part of a locomotive illustrating a superheater header with my invention applied, only enough of the locomotive being shown to make clear the relative position of my improvement; Fig. 2 is a composite figure, the left half being a section on line 2A—2A, while the right half is a section on 2B—2B of Fig. 1; Figs. 3, 4 and 5 are enlarged views of the throttle and its housing as they appear in Fig. 1, these figures illustrating three different positions of the valve, and Fig. 6 is a section on line 6—6 of Fig. 5.

The locomotive in connection with which I have shown my invention is of any ordinary or desired type equipped with a flue or other superheater. The front flue sheet 1 has, extending backward from it toward the fire-box, the flues 2. These flues deliver the products of combustion from the fire-box to the smoke-box of the locomotive whence they escape through the stack extension 3 and the stack 3*a*. Into the flues 2 extend the tubular superheater units or elements 4 whose ends are secured to the header 5. This superheater header 5 comprises two sets of intermeshed fingers or branches according to the ordinary well known construction, which needs no detailed description here. Steam is delivered to the superheater header by the dry-pipe 6, flows through the superheater units or elements 4 and is delivered by them back into the header 5 from which it flows into the transverse chamber 7. The partition 8 divides chamber 7 from the transverse chamber 9, the latter communicating with the two steam pipes 10 (only one showing) which convey the steam to the two steam chests. Chamber 7 communicates with chamber 9 through a series of ports 11 which are controlled by valves or throttles 12. These valves have downwardly extending stems 13 which are engaged by cams 14 on shaft 15 and are raised by a counter-clockwise movement of the shaft as viewed in the drawings. In alinement with each valve 12 is an opening 16 in the upper wall of the chamber 7 which is closed by the cap 17. This cap has a cylindrical bore 18 in it in which reciprocates the piston 19 unitary with the valve 12.

As far as described, this arrangement is like that described in my former application. My improvement in the present case resides in the peculiar construction of the pilot valves and associated parts which I shall next describe.

The hollow cylindrical interior of the cap 17 has an annular downwardly extending portion 20 separating the annular space 21 from the cylindrical interior space 22. The piston is provided with a cylindrical cavity 23 so that the body portion of this piston is annular in shape, sliding into the annular space 21. The fit between these two is made very loose both on the outer and inner sides of the annular piston body for the purpose stated more fully hereinafter. The valve-stem 13 has a cylindrical bore extending lengthwise through it coaxially with the hollow interior of the piston 19. From the lower portion of the space 23 a plurality of

passages 24 extend through the valve putting the space 23 into communication with the chamber 9. Above these passages 24 is a seat 25 controlled by the pilot valve 26. This pilot valve has a stem 27 extending downward through the bore of the steam 13. From chamber 7 a plurality of passages 28 extend to the upper portion of the cylindrical space 22. The pilot valve 26 has a plurality of notches 29 at its upper end extending downward a short distance as will be clear from Figs. 3 to 5. These notches appear in plan in Fig. 6.

The action of each throttle with its associated pilot valve may be described as follows: In its closed position with both the main throttle 12 and the pilot valve 26 on their seats, steam from chamber 7 under boiler pressure has filled the space 22 above valve 26, has passed through the notches 29 as well as through the clearance around the piston 19 into the annular space 21. The main throttle and the valve are therefore held on their seats by full boiler pressure against whatever pressure exists in chamber 9. When the shaft 15 is rotated to open one of the throttles, the cam 14 engages the stem 27 ahead of the stem 13 and raises the pilot valve 26 from its seat. The pilot valve is comparatively small and no great effort is required to open it. This permits the steam from chamber 21 to escape through the passages 24. Additional steam will flow through passages 28, through space 22, through the notches 29 and out through the passages 24 as long as valve 26 is not raised beyond the point where the annular wall 20 closes off the notches 29. When the valve is raised to the point where the notches are closed off, the steam flow described ceases. Further movement of the shaft 15 begins to raise the main throttle 12. This is not difficult as the main throttle is then substantially balanced by the steam which has passed into the steam pipes and connected spaces. The clearance between the annular wall 20 and the annular piston 19 is made larger than that between the cylindrical bore of the cap and the body 19 so that the steam from the annular space 21 will escape more rapidly toward the chamber 9 and the steam chests than new steam is supplied from the chamber 7.

The cam 14 has now begun to engage the lower end of main piston stem 13 and further movement of the shaft 15 raises the pilot valve 26 together with the main throttle 12 until they reach the uppermost position as shown in Fig. 5.

An essential feature of my invention is that the pilot valves are raised one after another, all of them being opened before the first main valve is raised. This will appear from an inspection of Fig. 2 where the right hand cam 14 is just about to raise the pilot valve 26; the second cam 14 from the right has raised its pilot valve a little distance, and the third cam 14 has raised its pilot valve 26 still more. This progressive arrangement may extend from one end of the shaft to the other or the successive raising can occur in any desired other sequence. If desired, two valves may be raised at a time. Thus in the form illustrated, the pilots of I and IA open first, followed by the opening II and IIA, and then by that of III and IIIA. It is only after all of the pilot valves have been raised off their seats that the first main valve is engaged by its cam 14. The sequence of events may be summarized as follows: The first pilot valve is engaged by its cam and opens. The second one is similarly raised and so on until they are all opened. The notches of the first valve are closed off by the annular portion 20. Main valve No. 1 is opened. The notches of the second valve are closed off. The main valve No. 2 then opens. The notches of No. 3 are cut off, and valve No. 3 next opens, and so on.

Where the pilots open in pairs, the sequence will be obvious.

The purpose of this arrangement is as follows: Sufficient steam flows through the notches and past the pilot valves to supply the necessary steam for "drifting", and when the engine is "drifting" the throttle lever in the cab will be set by the engineer in the position where all the pilot valves are opened but none of the main valves. Likewise, when the engineer wishes to maneuver the locomotive slowly as, for instance, in "spotting" cars, he will use only the pilot valves. The arrangement further serves to insure the closing of the valves when the throttle lever is put into closed position. When shaft 15 is rotated in clockwise direction, pilot valve 26 and main valve 12 will follow cam 14 together. Full steam pressure is exerted on top of the small valve and it will follow the cam in any event. Should the main valve stick from any cause, the pilot valve will become seated on its seat and thereafter the full boiler pressure on the top of the pilot valve will force the main valve down. If for some reason one of the valves should continue to stick until after all the other valves are closed, there will be a very material pressure difference in chamber 9 and in chamber 21, because of the free flow away from the former to the cylinders. This pressure will thereupon be added to that on top of the small valve 26, and the two combined will be certain to close the valve.

What I claim is:

1. In a locomotive the combination of a header, a horizontal partition therein having a plurality of ports, a corresponding number of throttles each controlling one of said partition ports and each provided with a balancing piston at its upper end, a cap above

each throttle having a piston chamber therein in which the piston fits loosely and reciprocates, each throttle having a port placing the piston chamber into communication with the space below the throttle, a like number of pilot valves each controlling one of the ports through the throttles, actuating mechanism to open said throttles and pilot valves in such order that all of the latter are opened before the first of the throttles is opened, and means controlled by the pilot valves to admit steam to the space below the throttles in addition to the steam released by them from the caps.

2. In a locomotive the combination of a header, a horizontal partition therein having a plurality of ports, a corresponding number of throttles each controlling one of said partition ports and each provided with a balancing piston at its upper end, a cap above each throttle having a piston chamber therein in which the piston fits loosely and reciprocates, each throttle having a port placing the piston chamber into communication with the space below the throttle, a like number of pilot valves each controlling one of the ports through the throttles, actuating mechanism to open said throttles and pilot valves in such order that all of the latter are opened before the first of the throttles is opened, and means to admit steam to the space below the throttles in addition to the steam released by the pilot valves from the caps, the additional steam supply being cut off by the pilot valves when they are seated and also when they are raised from their seats beyond a certain point.

3. In a locomotive the combination of a header, a horizontal partition therein having a plurality of ports, a corresponding number of throttles each controlling one of said partition ports and each provided with a balancing piston at its upper end, a cap above each throttle having a piston chamber therein in which the piston fits loosely and reciprocates, each throttle having a port placing the piston chamber into communication with the space below the throttle, a like number of pilot valves each controlling one of the ports through the throttles, actuating mechanism to open said throttles and pilot valves in such order that all of the latter are opened before the first of the throttles is opened, and means to admit steam to the space below the throttles in addition to the steam released by the pilot valves from the caps, the additional steam supply being cut off by the pilot valves when they are seated and also when they are raised from their seats beyond a certain point, the arrangement being such that each pilot valve shuts off its additional steam supply just before the corresponding throttle is raised.

4. In apparatus of the class described the combination of a header, a horizontal partition therein, the partition having a port, a throttle controlling the port, a balancing piston secured to the upper side of the throttle, a cap above the throttle having a piston chamber in which the piston reciprocates, a hollow stem extending downwardly from the throttle, there being a cylindrical cavity extending into the upper side of the piston and a port from the bottom of said cavity to the space below the throttle, an annular wall extending downward from the closed end of the cap, there being a port in the cap connecting the upper end of the space within said wall with the interior of the header above the partition, the lower end of the annular wall being a little above the top of the piston when the throttle is seated, and a cylindrical pilot valve adapted to close the port in the throttle and to reciprocate in the interior of the annular wall, portions being cut away at the upper end of the pilot valve to permit communication between the inside of the annular wall and the cylindrical space in the piston while the pilot valve is not above a certain selected position, a stem extending downwardly from the pilot valve through the interior of the throttle stem of such length that when the pilot valve is seated its stem extends beyond the throttle stem, and means to bear upwardly successively against the lower ends of the pilot valve stem and the throttle stem and so to raise them.

5. In a locomotive the combination of a header, a horizontal ported partition therein, a throttle controlling the port and having a balancing piston at its upper end, a piston chamber into which the piston fits loosely, there being a passage from the piston chamber to the space below the partition and a passage from the piston chamber to the space above the partition, and a pilot valve controlling both passages.

6. Apparatus in accordance with claim 5, the arrangement being such that the second passage is open when the first is closed, and that after opening the first passage the pilot valve must move some distance before it shuts off the second passage.

7. The combination of a throttle casing; a ported partition therein; and a throttle controlling the port and having balancing means comprising a piston, a piston chamber in which the piston reciprocates, and a pilot valve; there being a passage also controlled by said pilot valve to convey steam in addition to the balancing steam from one side of the partition to the other when the throttle is closed.

8. In a locomotive the combination of a header; a partition therein having a plurality of ports; a corresponding number of throttles each controlling one of the ports, and individual balancing means for each throttle comprising a piston, a piston chamber, and a pilot valve; each throttle having

associated with it a passage also controlled by its pilot valve to convey steam from one side of the partition to the other when the throttle is closed.

9. Apparatus in accordance with claim 8, comprising means for operating the throttles and pilot valves so arranged that all of the pilot valves are opened before the first throttle opens, and that each of said passages is closed off before the associated throttle opens.

NEAL T. McKEE.