June 4, 1946. C. R. BRIGGS 2,401,545

THROTTLE VALVE CONTROL

Filed Feb. 17, 1944 2 Sheets-Sheet 1

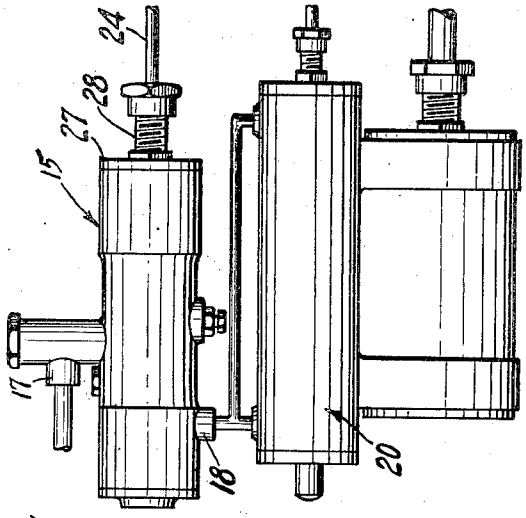


Fig.-1

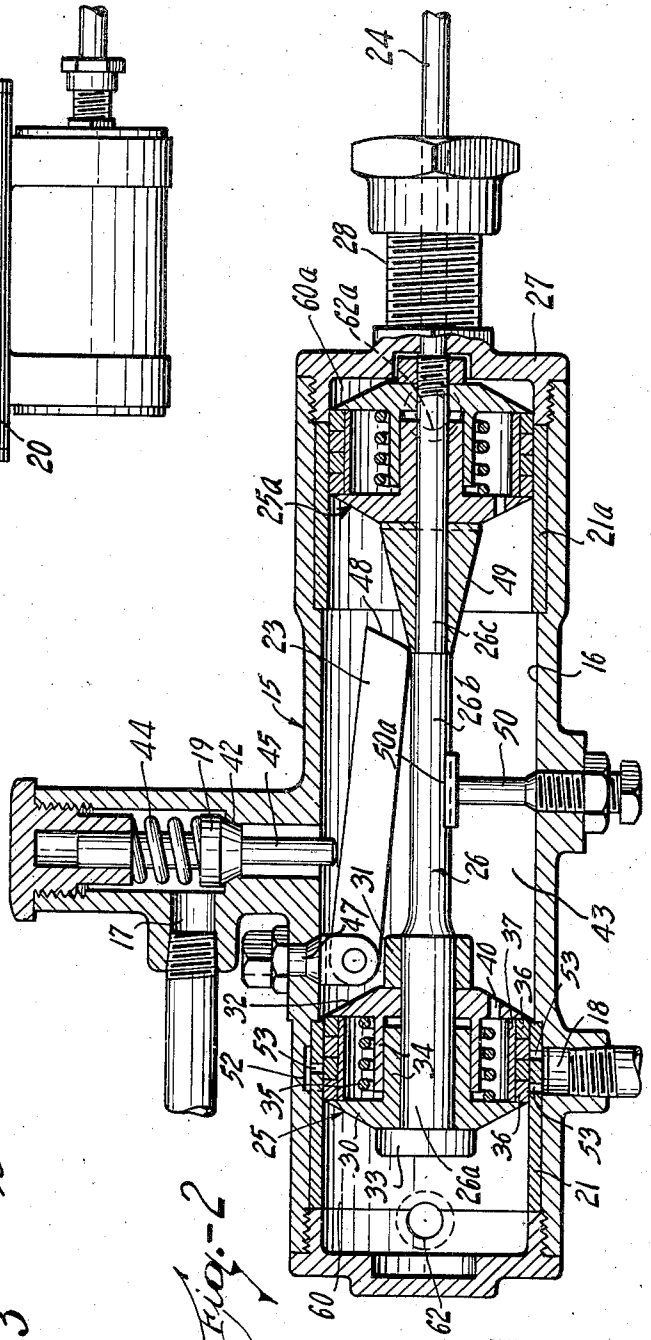


Fig.-2

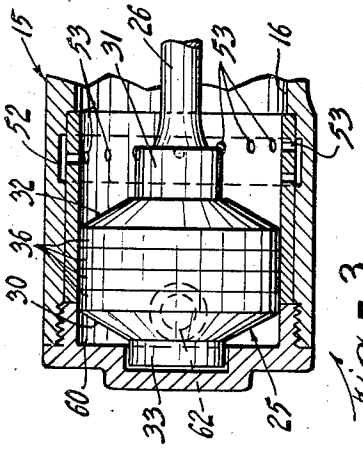


Fig.-3

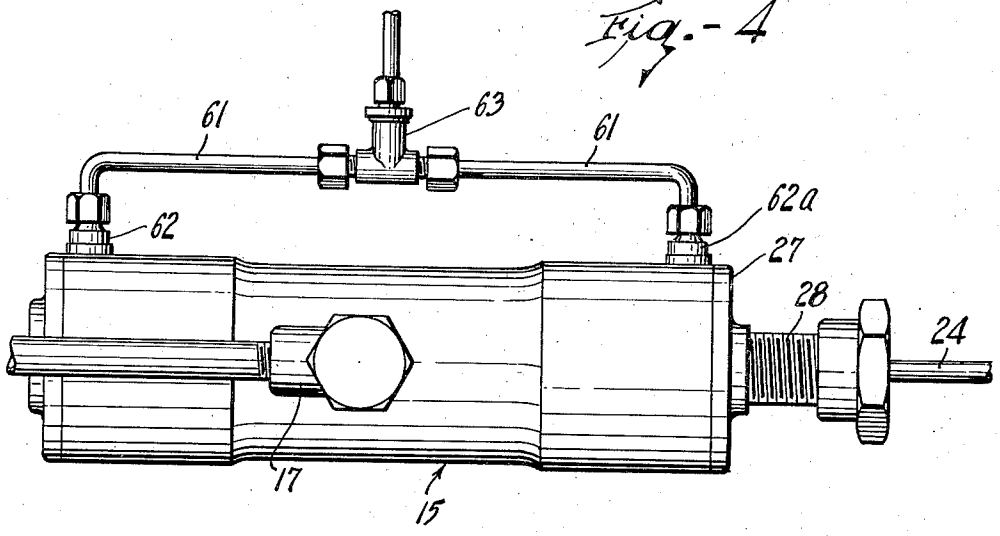
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Fig.-4



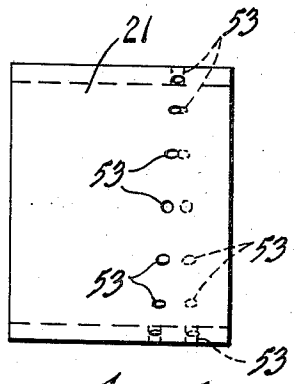


Fig.-5

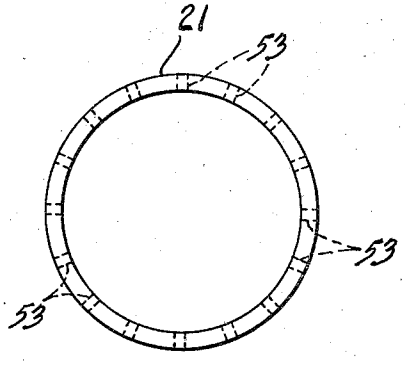


Fig.-6

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Patented June 4, 1946

2,401,545

UNITED STATES PATENT OFFICE

2,401,545

THROTTLE VALVE CONTROL

Carl R. Briggs, Mantua, Ohio

Application February 17, 1944, Serial No. 522,705

7 Claims. (Cl. 277—26)

1

The invention relates to steam engine valve mechanism and more particularly to throttle valve mechanism.

One object of the invention is to provide novel and improved throttle valve means for admitting steam, or other fluid power medium, to the engine valve chest and constructed and arranged to be smoothly, positively, and readily "cracked" in the presence of maximum boiler pressure. Another object is to provide a throttle valve, preferably of piston form, which is statically and dynamically balanced in all positions in such manner that it is readily operated manually so as to seat or unseat or for graduating adjustment despite the opposed head of pressure in the boiler. Another object of the invention is to provide novel mechanism of the nature indicated, readily adapted to an improved lubricating means and method.

Further objects of the invention in part are obvious, and in part will appear more in detail hereinafter.

In the drawings, which represent one suitable embodiment of the invention

Fig. 1 is a sketch, in outline, of the housed assembly of a throttle control, a valve chest and power cylinder.

Fig. 2 is a central longitudinal section of my improved throttle valve assembly in its housing.

Fig. 3 is a fragmentary section showing a portion of the left end of Fig. 2, some parts being in a different operating position.

Fig. 4 is a top plan view of the apparatus shown in Fig. 2.

Fig. 5 is a side elevation of the perforated bearing sleeve.

Fig. 6 is an end view of the sleeve shown in Fig. 5.

With reference to the following description of a preferred embodiment of my invention, the power cylinder and main valve chest of the steam engine are not shown in detail since they may be of conventional design, although I prefer to use a main valve system of the character illustrated and described in my copending application, Serial No. 517,215, filed January 6, 1944, which application may be referred to, if desirable or necessary, for a more particularized description of said main valve chest and cylinder. The present invention is devoted solely to a control for the throttle valve, one manner of disposition of said valve and control with respect to the steam chest and cylinder being shown in outline in Fig. 1.

Those skilled in the art are familiar with the effort which must be exerted to crack the throttle

2

valve of a steam engine manually, since in many throttle valve arrangements previously regarded as efficient and practical, opening movement of the valve is opposed by the pressure from the steam head. The effort thus required makes it difficult to open the valve with those preliminary gradual increments so necessary for smooth starting, especially since with the usual valve type, such as a poppet valve, the first increment of unseating motion is against practically full fluid pressure. The invention now to be described permits cracking of the valve by normal manual effort, either rapidly or slowly as needed, and affords positive control of minute increments of pressure change, in a manner substantially improved over throttle valves heretofore available.

With particular reference to Fig. 2, the preferred embodiment of my invention comprises a housing 15 having a cylindrical bore or chamber 16 for the reception of a reciprocable throttle valve. The housing is provided with a steam inlet port 17 and an outlet port 18. The inlet port, which is in communication with a steam supply (not shown) may be provided with an inlet valve or check valve 19, seating toward the engine, and the outlet port 18 is in communication with the main steam chest 20. In the embodiment shown I have provided inlet valve operating means comprising a lever 23, operated, as will be described, by the reciprocable throttle valve, and disposed to open the aforesaid inlet valve 19. I have also provided operator operatable means 24 for moving the throttle valve.

The reciprocable or slidable throttle valve member is in certain structural respects similar to the piston valve shown in my aforesaid copending application, Serial No. 517,215. It consists of a pair of matched and balanced pistons 25 and 25*a* affixed at spaced points to the piston rod 26 which conveniently may be an extension of the operating rod 24, or is operatively connected thereto. Pistons 25 and 25*a* are simultaneously slidable to the left or right (Fig. 2) in bearing sleeves or linings 21 and 21*a* respectively, the sleeves being fixed with respect to the cylindrical wall of chamber 16. The operating rod 24 passes through a centrally disposed aperture in the end wall 27 of the housing 15, being packed by a conventional stuffing box assembly 28.

The piston rod 26 has been diametrically reduced in successive steps 26*a*, 26*b*, 26*c*, from left end to right end (Fig. 2) to facilitate assembly thereon of the parts now to be described. Pistons 25 and 25*a* are similar, and only one will be described, reference being had to Fig. 2. Each

piston comprises a stationary head 30 seated against a rigid collar 33 on the left end of the rod, and an adjustable head 32 slidable on the rod and adjustable by a nut 31 capable of being locked. The several elements of the piston just described, as well as of piston 25*a*, and of cam 49 (later to be described) are assembled from the right end of the rod over operating stem 24 as will be understood from an examination of Fig. 2. Heads 30 and 32 are provided with telescoping sleeves 34 and are normally urged apart by a spring 35. In the cavity or space between the heads are mounted suitable resilient split sealing piston rings 36 outwardly expansible against the bearing sleeve 21 which provides the necessary sealing or bearing face. To support the sealing rings 36 and provide additional resiliency I have provided suitable spring backing means, which, in the embodiment illustrated, comprises a wide split ring 37, although two or more may be arranged concentrically one within the other. The nut 31 is adjusted to advance head 32 towards head 30 until the assembled parts are in operative relationship, due regard being had to the rise in temperature occasioned by contact with the steam. In such operative relationship the rings have a close mutual fit, but contracting surfaces are readily slidable on each other. On each piston, that head which is presented to the live steam (head 32 in the form shown) is provided with a small port or opening 40 to permit access of full steam pressure to the cavity within the piston so as to equalize the pressures internally and externally of the rings.

The inlet port 17 may be provided with valve means responsive to movement of the piston-like throttle valve. Such valve means is shown in Fig. 2. The inlet valve 19, here shown as a poppet valve, is seated at 42, in the steam line between intake port 17 and the chamber 16 of housing 15, and is biased to normally closed position both by a spring 44 and by the head of steam pressure transmitted through port 17. The stem 45 of the valve 19 extends downwardly into chamber 16 between pistons 25 and 25*a*, where it abuts an operating lever 23, pivoted at one end 46 in the bifurcated head of a stud 47, secured in the housing 15. The free end of the lever has a curved or beveled end face 48 adapted to be operatively engaged by a suitable cam portion 49 of rod 26. Movement of the piston assembly to the left interengages the respectively cooperating cam portions 48 and 49 of lever 23 and rod 26 and initiates an upward swing of lever 23, producing immediate abutment of an intermediate portion of the lever against the free end of valve stem 45 so as to unseat the inlet valve and admit steam to chamber 16. The relative lengths of the components of the leverage system are such that the motive force is applied to the long component of the lever at the cam face 48, while the short component of the lever cracks the inlet valve.

When the valve 19 begins to be unseated, there is a downward pressure exerted against piston rod 26 due to the pressure of the head of steam and of spring 44, transmitted through the valve stem 45 and lever 23. I have provided counteracting means to prevent deflection of rod 26, the means in the embodiment shown consisting of a stud 50 adjustably seated in a boss, in the bottom of housing 15, in such manner that its free upper end contacts the under side of rod 26. If desired the contacting surface portions of stud and rod may be suitably shaped to provide a bearing area of sufficient extent or the stud may carry any suitable bearing device, for example a semi-cylindrical bearing member 50*a* of conventional type.

The outlet port 18 is in communication with an annular groove 52 underlying the lining or bearing sleeve 21. The portion of the sleeve in registry with said groove is provided with a peripheral series of spaced apertures 53, helically arranged so as to be uncovered in regular succession by movement of piston 25 to its extreme left position. It will be immediately obvious that when the piston is moved to the left, the steam outlet area is increased by increments as each successive aperture 53 is uncovered by piston 25. From the foregoing description it is apparent that the steam pressure transmitted to the main valve chest may be increased or decreased by definite and minute increments by simple sliding motion of the throttle valve operating rod.

Operation of the device is apparent from the preceding description but may be briefly outlined as follows. Assuming the parts to be in the position shown in Fig. 2, the inlet valve 19 is seated, and the engine is at rest. Port 17 is in communication with a head of steam. The operator moves operating rod 24 to the left so that cam follower 48 begins to ride up on cam track 49 as the piston valve assembly begins to move, thereby initiating opening movement of the inlet valve to admit steam to chamber 16. At the same time, or as soon thereafter as desired depending on the spacing of the annular groove 52 with respect to the lapping peripheral face of piston 25, the apertures 53 are successively uncovered, permitting steam in chamber 16 to leave by port 18 and thence enter the main valve chamber. At full open throttle (Fig. 3) all apertures 53 are uncovered.

I have also provided a novel and improved lubricating system especially adapted for use with apparatus of the character described. A clearance space 60 at the left end of housing 15 is in communication with the like space 60*a* at the right end, through a conduit 61 running from port 62 to a port 62*a*. A T connector 63 leads to a source of lubricant (not shown). Movement of the piston assembly to the left transfers excess lubricant through conduit 61 to space 60*a*, the excess being returned to space 60 over the same path when the piston movement is reversed. The rings 36 serve as leak proof barriers between the steam space 43 and the clearance spaces 60 and 60*a*.

The whole apparatus herein described and illustrated is simple and sturdy, and the balanced character of the moving parts, permits easy and smooth operation of the main throttle valve, supplementing the same with an auxiliary gate valving effect if desired. The construction is durable and efficient in operation. Other advantages will be apparent to those skilled in the art.

What I claim is:

1. Throttle mechanism for controlling the flow of steam to the valve chest of a steam engine, comprising a housing having a cylindrical chamber provided near one end with an outlet port in communication with a valve chest, and, intermediate its ends, with an inlet port in communication with a steam supply, a piston-like valve device slidable in said chamber and including an operating rod extending to the outside of the chamber for operation thereof, said device comprising two pistons spaced upon said rod, one on either side of said inlet port, an internal surface

portion of said housing near one end being provided with an inwardly opening peripheral channel, a cylindrical sleeve overlying said channel and having its inner surface engageable with the sliding cylindrical bearing face of one of said pistons, said sleeve being provided with a plurality of peripherally spaced apertures in communication with said channel, and helically disposed with respect to the longitudinal axis of said sleeve, said channel being in communication with said outlet port whereby movement of the last said piston in one direction within said sleeve successively uncovers each of said apertures, so as to permit passage of steam from said chamber through said outlet port and into said valve chest in progressive increments, and whereby return movement of said piston successively seals said apertures, and progressively cuts off steam from said outlet port, an inlet valve in said inlet port, a lever pivotally carried within and by said housing and having a portion thereof operatively engaging said inlet valve, and having another portion thereof operatively engaging said piston-like valve means, whereby movement of said piston like valve means in one direction causes opening movement of said inlet valve.

2. Throttle mechanism for controlling the flow of steam to the valve chest of a steam engine, comprising a housing having a cylindrical chamber provided near one end with an outlet port in communication with a valve chest, and, intermediate its ends, with an inlet port in communication with a steam supply, a piston-like valve device slidable in said chamber and including an operating rod extending to the outside of the chamber for operation thereof, said device comprising two pistons spaced upon said rod, one on either side of said inlet port, an internal surface portion of said housing near one end being provided with an inwardly opening peripheral channel, a cylindrical sleeve overlying said channel and having its inner surface engageable with the sliding cylindrical bearing face of one of said pistons, said sleeve being provided with a plurality of peripherally spaced apertures in communication with said channel, and helically disposed with respect to the longitudinal axis of said sleeve, said channel being in communication with said outlet port whereby movement of the last said piston in one direction within said sleeve successively uncovers each of said apertures, so as to permit passage of steam from said chamber through said outlet port and into said valve chest in progressive increments, and whereby return movement of said piston successively seals said apertures, and progressively cuts off steam from said outlet port, a poppet valve in said inlet port having a depending stem, a lever pivotally carried within and by said housing, and having a portion thereof adjacent the pivot point in engagement with said valve stem, the free end of said lever operatively engaging said piston-like valve means whereby opening movement of said piston-like valve means produces opening movement of said poppet valve.

3. Throttle mechanism for controlling the flow of steam to the valve chest of a steam engine, comprising a housing having a cylindrical chamber provided near one end with an outlet port in communication with a valve chest, and, intermediate its ends, with an inlet port in communication with a steam supply, a piston-like valve device slidable in said chamber and including an operating rod extending to the outside of the chamber for operation thereof, said device comprising two pistons spaced upon said rod, one on either side of said inlet port, an internal surface portion of said housing near one end being provided with an inwardly opening peripheral channel, a cylindrical sleeve overlying said channel and having its inner surface engageable with the sliding cylindrical bearing face of one of said pistons, said sleeve being provided with a plurality of peripherally spaced apertures in communication with said channel, and helically disposed with respect to the longitudinal axis of said sleeve, said channel being in communication with said outlet means whereby movement of the last said piston in one direction within said sleeve successively uncovers each of said apertures, so as to permit passage of steam from said chamber through said outlet port and into said valve chest in progressive increments, and whereby return movement of said piston successively seals said apertures, and progressively cuts off steam from said outlet port, an inlet valve in said inlet port, a lever pivotally carried within and by said housing, and having a portion thereof operatively engaging said inlet valve means, and said piston-like valve means and said lever having mutually engageable cam-like elements whereby movement of said piston-like valve means in one direction produces engagement of said cam-like elements, and causes opening movement of said inlet valve.

4. Throttle mechanism for controlling the flow of steam to the valve chest of a steam engine, comprising a housing having a cylindrical chamber provided near one end with an outlet port in communication with a valve chest, and, intermediate its ends, with an inlet port in communication with a steam supply, a piston-like valve device slidable in said chamber and including an operating rod extending to the outside of the chamber for operation thereof, said device comprising two pistons spaced upon said rod, one on either side of said inlet port, an internal surface portion of said housing near one end being provided with an inwardly opening peripheral channel, a cylindrical sleeve overlying said channel and having its inner surface engageable with the sliding cylindrical bearing face of one of said pistons, said bearing face comprising a plurality of resilient, expansible piston rings, spring biased outwardly to contact with said sleeve, and said piston having a cavity therein communicating with the steam supply whereby sealing contact between said bearing face and said sleeve is augmented, said sleeve being provided with a plurality of peripherally spaced apertures in communication with said channel, and helically disposed with respect to the longitudinal axis of said sleeve, said channel being in communication with said outlet means whereby movement of the last said piston in one direction within said sleeve successively uncovers each of said apertures, so as to permit passage of steam from said chamber through said outlet port and into said valve chest in progressive increments, and whereby return movement of said piston successively seals said apertures, and progressively cuts off steam from said outlet port, an inlet valve in said inlet port, a lever pivotally carried within and by said housing, and having a portion thereof operatively engaging said inlet valve means, and said piston-like valve means and said lever having mutually engageable cam-like elements whereby movement of said piston-like valve means in one direction produces engagement of said cam-like elements, and causes opening movement of said inlet valve.

5. Engine throttle valve mechanism compris-

ing a casing provided with a cylindrical chamber, an operating rod extending along the axis of said chamber and through an opening in one end of said casing, two pistons spaced apart on said rod and slidable in said chamber by rod motion, one thereof serving as a valve, said casing being provided with a fluid supply opening between said pistons and with a fluid discharge opening near one end, inlet valve means controlling the flow of fluid through said supply opening, a lever pivotally carried within and by said chamber, and having a portion thereof operatively engaging said rod between said pistons, whereby movement of said operating rod causes opening movement of said inlet valve.

6. Engine throttle valve mechanism comprising a casing provided with a cylindrical chamber, an operating rod extending along the axis of said chamber and through an opening in one end of said casing, two pistons spaced apart on said rod and slidable in said chamber by rod motion, one thereof serving as a valve, said casing being provided with a fluid supply opening between said pistons and with a fluid discharge opening near one end, inlet valve means controlling the flow of fluid through said supply opening, a lever pivotally carried within and by said chamber, an inclined cam like surface rigid with said rod between said pistons, said lever being operatively engageable with said cam like surface whereby movement of said operating rod causes opening movement of said inlet valve.

7. Engine throttle valve mechanism comprising a casing provided with a cylindrical chamber, an operating rod extending along the axis of said chamber and through an opening in one end of said casing, two pistons spaced apart on said rod and slidable in said chamber by rod motion, one thereof serving as a valve, said casing being provided with a fluid supply opening between said pistons and with a fluid discharge opening near one end, inlet valve means controlling the flow of fluid through said supply opening, a lever pivotally carried within and by said chamber, an inclined cam like surface rigid with said rod between said pistons, said lever being operatively engageable with said cam like surface whereby movement of said operating rod causes opening movement of said inlet valve, means carried by the interior wall of said chamber, and abutting the surface of said rod between said pistons, and slidably engageable with the rod surface in diametric opposition to said cam like surface to prevent deflection thereof during operation.

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