W. F. HARTZELL.

THROTTLE VALVE FOR STEAM ENGINES.

APPLICATION FILED JAN. 5, 1911.

994,587. Patented June 6, 1911.

2 SHEETS—SHEET 1.

Fig. 1.

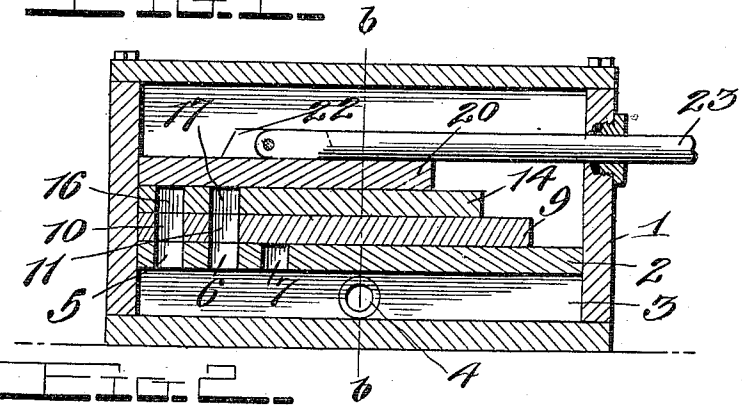


Fig. 2.

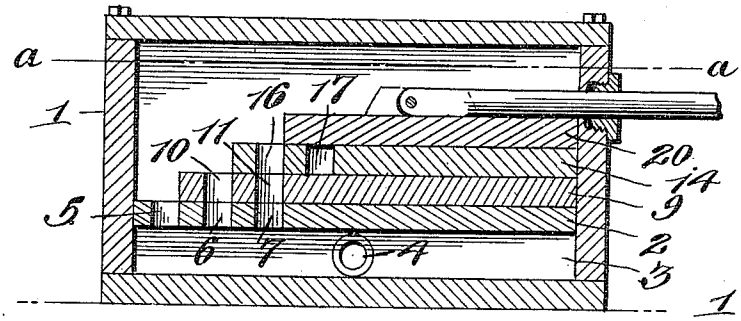


Fig. 3.

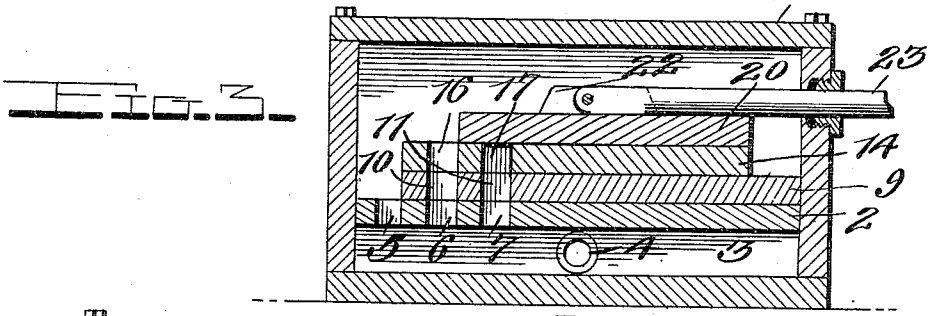
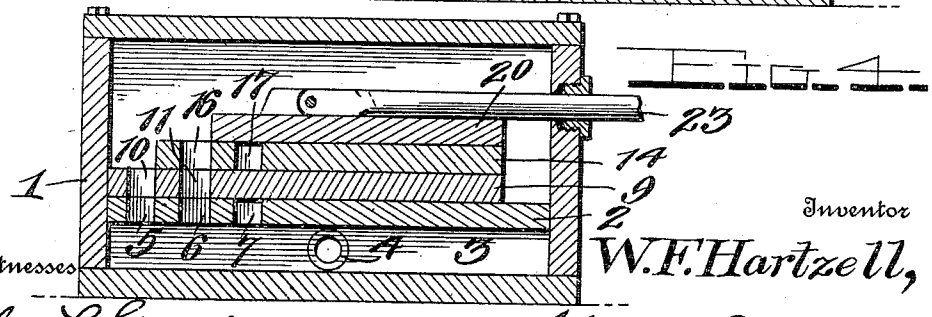


Fig. 4.



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2 SHEETS—SHEET 2.

Fig. 5.

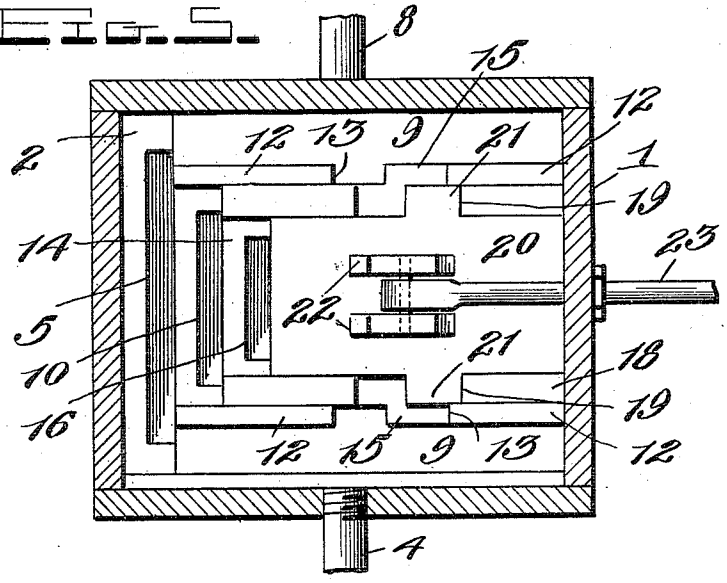


Fig. 6.

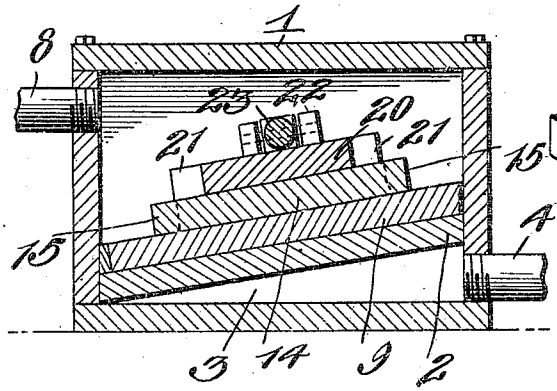


Fig. 7.

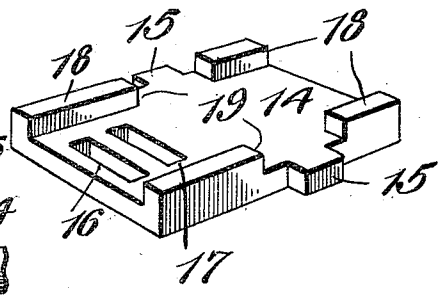
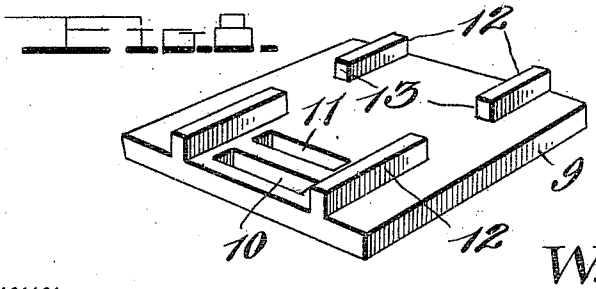


Fig. 8.



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UNITED STATES PATENT OFFICE.

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THROTTLE-VALVE FOR STEAM-ENGINES.

994,587. Specification of Letters Patent. Patented June 6, 1911.

Application filed January 5, 1911. Serial No. 600,956.

To all whom it may concern:

Be it known that I, WILLIAM FINDLEY HARTZELL, a citizen of the United States, residing at Marion, in the county of Marion and State of Ohio, have invented certain new and useful Improvements in Throttle-Valves for Steam-Engines, of which the following is a specification, reference being had to the accompanying drawings.

This invention relates to improvements in throttle valves for steam engines and other purposes, especially large engines in which the valve is subjected to great steam pressure, the object of the invention being to effect improvements in the construction of the valve, and to provide the same with a series of successively movable valve elements, each of which as it is moved to open position, serves to admit steam to opposite sides of the other movable valve elements, so as to equalize the steam pressure thereon, and enable the valve to be opened or closed by the exertion of only a moderate degree of power, and thus facilitate the operation of the valve and relieve the labor of the engineer.

In the accompanying drawings—Figure 1 is a vertical longitudinal sectional view of a throttle valve constructed in accordance with my invention showing the valve elements in closed position. Fig. 2 is a similar view showing the valve elements in open position. Fig. 3 is a similar view showing the valve elements in an intermediate position. Fig. 4 is a similar view showing the valve elements in another intermediate position. Fig. 5 is a horizontal sectional view through the casing, on the plane indicated by the line *a*—*a* of Fig. 2 and showing the valve elements in plan and in open position. Fig. 6 is a vertical transverse sectional view on the plane indicated by the line *b*—*b* of Fig. 1. Fig. 7 is a detail perspective view of one of the valve elements. Fig. 8 is a similar view of another one of the valve elements.

The casing 1 of my improved throttle valve is here shown as rectangular in form but may be of any other suitable shape. This casing is provided with a partition plate 2, which forms a wall that extends from end to end and from side to side thereof, and is spaced from the bottom of the casing so that a steam space or duct 3 is formed between the said partition plate and the bottom of the casing. The outlet pipe 4 which in practice leads to the steam chest of the engine, communicates with the said duct or steam space 3. The said partition plate is provided near one end with a series of steam ports, there being three of such ports here shown, and respectively indicated at 5, 6 and 7. The steam inlet to the casing 1 is indicated at 8, and is above and spaced from the partition plate 2.

A valve element 9 which is here shown as a rectangular valve plate is seated on the upper surface of the partition plate 2, and is movable longitudinally thereon, and in the casing 1, the said valve element 9 being somewhat shorter than the space between the end walls of the said casing, and being provided at one end with steam ports 10, 11 which respectively register with the ports 6, 7 of the partition plate 2 when the said element 9 is in open position, the said plate or element 9, when in open position also opening or uncovering the port 5. The said valve element 9 is provided on its upper side at a suitable distance from its side edges with a pair of longitudinal flanges 12, which flanges have openings 13 of suitable length and at a suitable distance from one end of the said valve element 9. A movable valve element 14 which is also here shown as a rectangular valve plate is mounted on the valve element 9, and has its seat on the upper face thereof, the said valve element 14 operating between and being guided by the flanges 12. The said valve element 14 has stop lugs 15 which project outwardly from its sides, and which operate in the openings 13 and coact with the ends of the said openings formed by the flanges 12 to limit the longitudinal movement of the valve element 14 on and independently of the valve element 9. The said valve element 14 is also provided near one end with openings or ports 16, 17 which register respectively with the ports 10, 11, of the valve element 9 when the said valve elements are in closed position, the port 16 registering with the port 11 of the valve element 9, when the valve elements are in open position, the said valve element 14 by reason of its being somewhat shorter than the valve element 9, also uncovering the port 10 of the valve element 9, when the valve elements are in open position. The valve element 14 is also provided on its upper side with longitudinal side flanges 18 which flanges are provided at a suitable distance

from one end of said valve element with openings 19. A valve element 20, which is not provided with ports and which is somewhat shorter than the valve element 14, is seated on the upper face of said valve element 14, is guided between the flanges 18 thereof, and has oppositely extending side lugs 21 which operate in the openings 19 and coact therewith to limit the longitudinal movement of the said valve element 20, on and independently of the valve element 14. The length of the said valve element 20 is such that when the same is in open position, it covers and closes the port 17, but one end thereof clears and uncovers or opens the port 16. On the upper side of the valve element 20 are a pair of lugs 22 between which is connected an operating rod 23, said rod extending through an opening in one end wall of the casing 1, and in practice being provided with a lever or other suitable device for operating the same and hence for operating the movable valve elements. The ports of the various elements of the valve are enlarged in descending order that is to say the ports of the element 9 are larger than those of the element 14, and smaller than those of the partition plate 2.

When the rod 22 is moved inwardly, assuming the elements of the valve to be in open position, it first communicates motion to the valve element 20, causing the said valve element to close the port 16, and at this instant the lugs 21 engage the inner ends of the openings 19. Further inward movement of the valve element 20 with the rod 22 then causes the element 14 to move with the element 20, and close the port 10, the port 11 having been already closed by the initial inward movement of the element 20, at the same time that the latter closed the port 16. Further inward movement of the element 20 with the operating rod 22 causes the valve element 9 as well as the valve element 14 to move with the valve element 20, by reason of the engagements of the lugs 15 of said valve element 9, with the inner ends of the openings 13 of the flanges 12 of the element 9, and hence the final inward movement of the valve elements causes the valve element 9 to dispose its port 10 in register with the port 5 and its port 11 in register with the port 6, so that the said element 9 closes the port 7 and the ports 5, 6 of the partition plate 2 together with the ports 10, 11 of the element 9, and the ports 16, 17 of the element 14 are in registration and are closed or covered by the element 20. In opening the valve, the initial outward movement of the element 20 uncovers the port 16 of the element 14. Said port 16 by reason of its coincidence with the ports 10 and 5, causes steam to pass therethrough and through the duct 3.

The element 20 by reason of the comparatively small superficial area thereof is under very much less steam pressure than would be the case if it were larger, and hence said valve element 20 can be moved without requiring the engineer to greatly exert himself. This initial movement of the valve element 20, independently of the other movable valve elements, also by reason of the initial coincidence of the ports 6, 11, and 17, establishes counter-pressure on a portion of the under surface of said valve element 20 through the steam duct or space 3, and the said ports 6, 11 and 17, as will be understood and owing to the varying sizes of the ports of the valve elements, counter-pressure is also exerted on portions of the under surfaces of the valve elements 9 and 14. Further movement of the valve element 20 causes the valve element 14 by the coaction of the lugs 21 and the flanges 18, to move with the valve element 20, so as to fully uncover the port 10 of the valve element 9, leave said port 10 in coincidence with the port 5, so as to also supply steam through said ports 16, 11 and 6, as well as through ports 10 and 5. This leaves the port 7 closed and covered by the valve element 9, but said port 7 causes the steam by counter-pressure from the duct or steam space 3 to act upon a portion of the under surface of the said valve element 9, and hence enables the latter to be moved together with the elements 20, and 14 at the final outward movement of said element 20 such final outward movement of said element 20 causing the member 9 to uncover the port 5 and bring its port 10 in registration with the port 6 and its port 11 in registration with the port 7 so that steam then passes through the port 5, the registering ports 10, 6 and the registering ports 16, 11 and 7.

I claim:—

1. A valve casing having a series of ports, and a series of valve elements, to open and close said ports, said valve elements being connected together for successive step by step movement, certain of said valve elements having ports disposed by the movement of said valve elements into and out of coincidence with one another, and those of the valve casing, said valve elements varying in length, each being shorter than the one next below, and the uppermost of said valve elements being unprovided with ports.

2. A valve casing having a series of ports and a series of valve elements arranged in superposed relation, said valve elements being provided with coacting devices adapting them each for limited independent movement on the next in succession, certain of said valve elements having ports for disposition by the movement of said valve elements into and out of coincidence with one another, and those of the valve casing, said valve elements varying in length, each being shorter

than the one next below and the uppermost of said valve elements being unprovided with ports.

3. A valve casing having a series of ports and a series of valve elements arranged in superposed relation, said valve elements being provided with coacting devices adapting them each for limited independent movement on the next in succession, certain of said valve elements having ports for disposition by the movement of said valve elements into and out of coincidence with one another, and those of the valve casing, said valve elements varying in length and width, each being shorter and narrower than the one next below, and the uppermost of said valve elements being unprovided with ports.

4. A valve casing having a wall provided with a series of ports, and a series of valve elements arranged in superposed relation in said casing and with the lowermost of said valve elements on said ported wall of the casing, said valve elements being connected together for successive step by step movement, certain of said valve elements having ports for disposition by the movement of said valve elements into and out of coincidence with one another and those of the said valve elements, the said ports of the valve casing wall being larger than those of the lowest valve element, and the ports of the ported valve elements being progressively smaller in ascending series, the uppermost of said valve elements being unprovided with ports.

5. A valve casing having a wall provided with a series of ports, and a series of valve elements arranged in superposed relation in said casing and with the lowermost of said valve elements on the said ported wall of the casing, said valve elements being connected together for successive step by step movement, certain of said valve elements having ports for disposition by the movement of said valve elements into and out of coincidence with one another and those of the said valve elements, the said ports of said valve casing wall being larger than those of the lowest valve element, and the ports of the ported valve elements being progressively smaller in ascending series, the uppermost of said valve elements being unprovided with ports, and operating means for the said uppermost valve element.

6. A valve casing having a series of ports, and a series of valve elements, to open and close said ports, said valve elements being connected together for successive step by step movement, certain of said valve elements having ports disposed by the movement of said valve elements into and out of coincidence with one another, and those of the valve casing, said valve elements varying in length, each being shorter than the one next below, and the uppermost of said valve elements being unprovided with ports, and operating means for the said uppermost valve element.

In testimony whereof I hereunto affix my signature in the presence of two witnesses.

WILLIAM FINDLEY HARTZELL.

Witnesses:

LOUIS M. BOLANDER,

DENNIS COOK.