Nov. 1, 1932. H. G. MUELLER 1,886,212

EXHAUST VALVE MECHANISM

Filed July 9, 1928 3 Sheets-Sheet 1

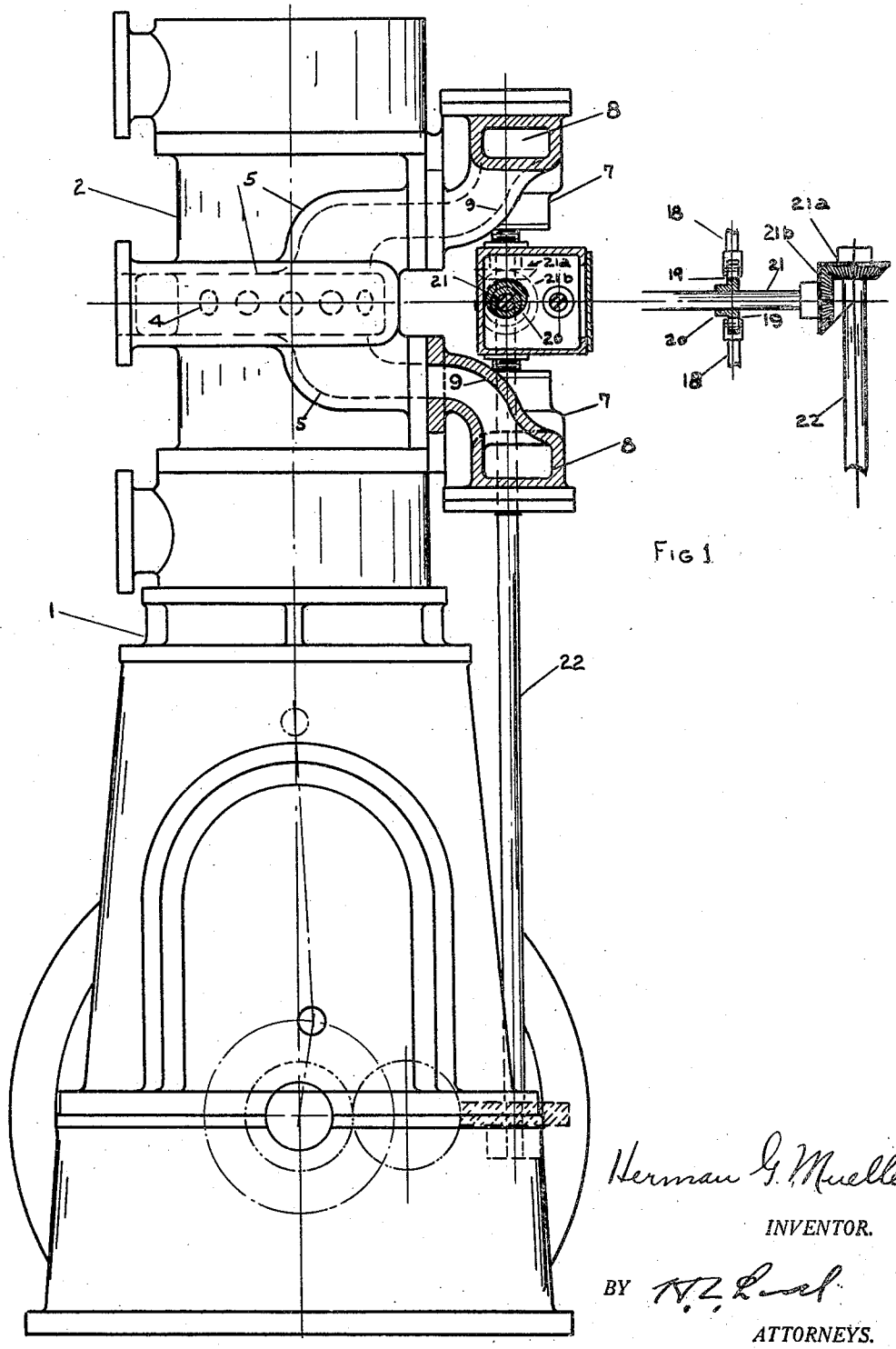


FIG 1

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EXHAUST VALVE MECHANISM

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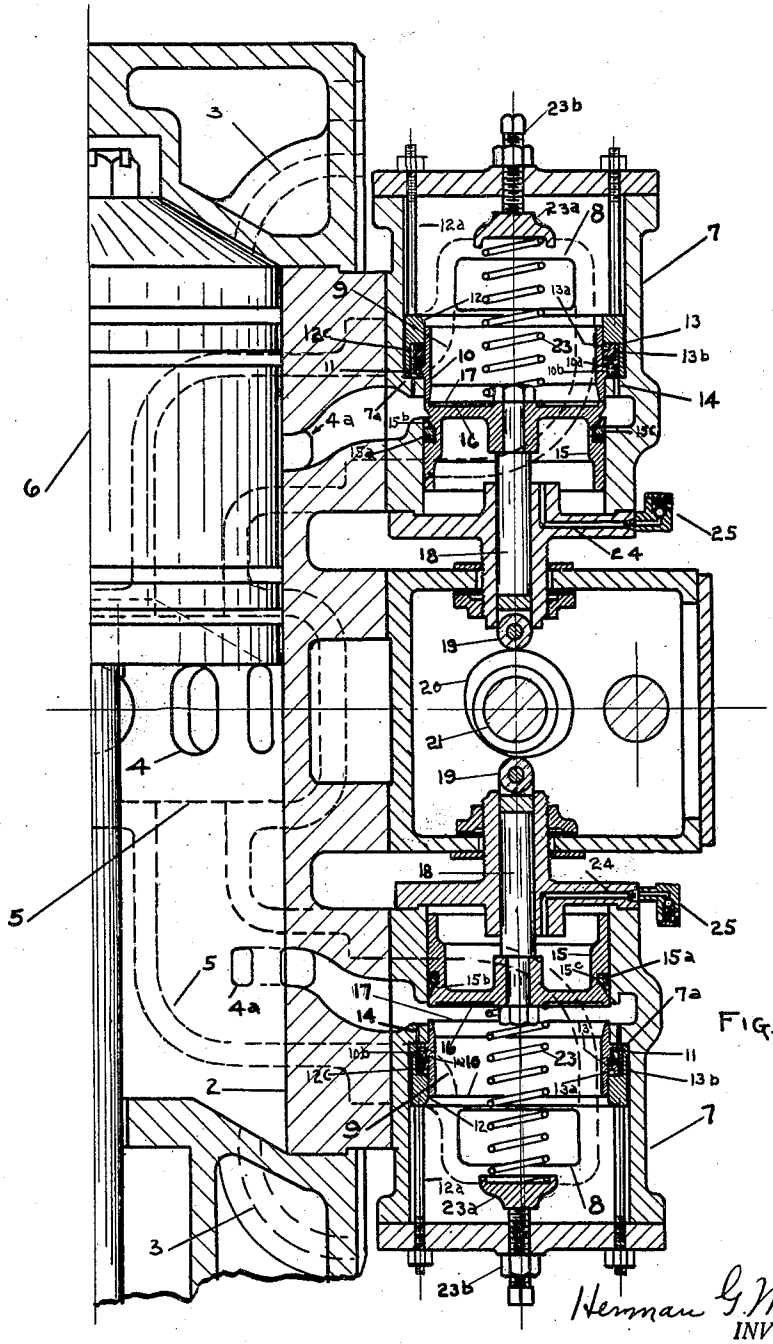


FIG. 2.

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EXHAUST VALVE MECHANISM

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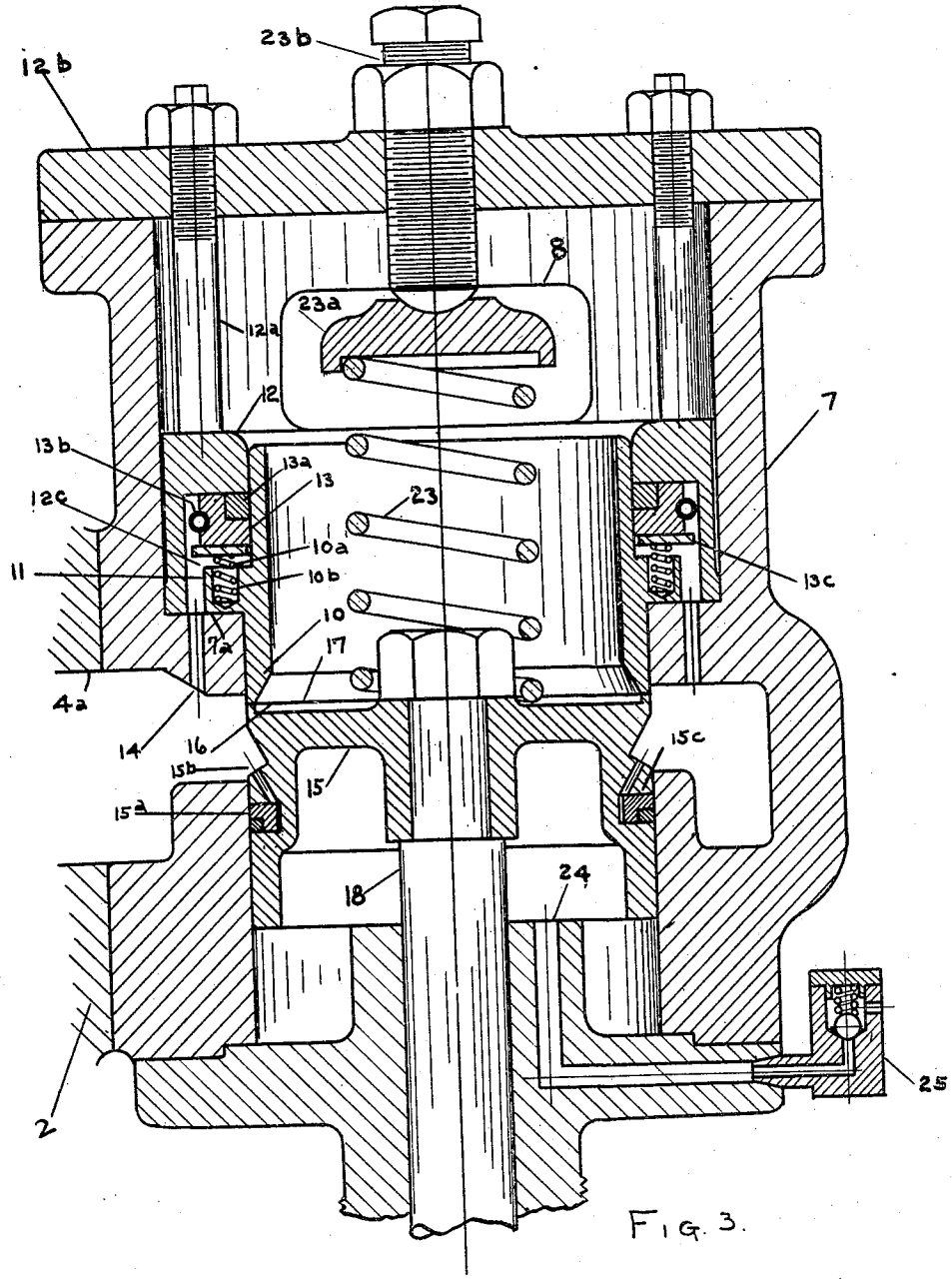


FIG. 3.

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Patented Nov. 1, 1932

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UNITED STATES PATENT OFFICE

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EXHAUST VALVE MECHANISM

Application filed July 9, 1928. Serial No. 291,358.

This invention is designed to improve and simplify exhaust valve mechanisms. In some of its aspects it is of general application but in a more limited sense it is peculiarly designed for an auxiliary exhaust in connection with central exhaust uniflow engines. The invention is in some respects an improvement of my application, Serial Number 238,437, filed Dec. 7th, 1927 and provides a yielding seat which is cushioned by the steam pressure. Features and details of the invention will appear more fully from the specification and claims.

A preferred embodiment of the invention is illustrated in the accompanying drawings as follows:—

Fig. 1 shows an elevation, partly in section of an engine having the exhaust valves of my invention.

Fig. 2 a detail view of the actuating shaft mechanism.

Fig. 3 an enlarged sectional view of the cylinder and exhaust mechanism.

1 marks an engine frame, 2 an engine cylinder, 3 inlet ports to the engine which are controlled by inlet valves (not shown), 4 central exhaust ports, 5 an exhaust passage to which the central exhaust ports lead, 6 an elongated piston of uniflow type operating over the central exhaust ports, 4*a* auxiliary exhaust ports, 7 an exhaust valve chest, 8 a discharge port from the exhaust valve chest and 9 a passage leading from the port 8 to the general exhaust passage 5.

A yielding valve seat 10 is arranged in the exhaust chest 7. The yielding seat is ring-shaped and provided with a shoulder 11 resting on a shoulder 7*a* in the chest 7, these shoulders limiting the movement of the yielding seat in a seating direction. A seat case 12 is arranged around the yielding seat 10 and is seated on the shoulder 7*a* in the chest 7 and held upon its seat by screws 12*a* extending through a valve chest cover 12*b*. The case has an annular pocket 12*c* in which is arranged a split sealing ring 13. The sealing ring is provided with a groove in which is arranged an auxiliary split sealing ring 13*a*, these sealing rings being of common construction. A spring 13*b* surrounds the ring 13 and tends to hold it in engagement with the yielding seat.

Passages 14 connect the pocket 12*c* with the exhaust port 4*a*. The upper face of the shoulder 11 has a greater area than the lower face of said shoulder and being subjected to the steam pressure of the exhaust port tends to hold the yielding seat in its downward position. Springs 10*a* extend into sockets 10*b* in the shoulder 11. These springs are seated against a plate 13*c* resting under the ring 13.

A valve 15 has a seating surface 16 which operates upon a seating surface 17 on the edge of the movable seat 10. The valve and seat are of the same diameter so that when closed there is no appreciable separating pressure exerted on the movable seat and valve. The valve is provided with a stem 18, which stem is provided at its end with a cam roller 19. The cam roller operates on a cam 20, the cam being fixed on a shaft 21. The shaft 21 is driven through gears 21*a* and 21*b* from a vertical shaft 22 and the vertical shaft is in turn driven from the crank shaft through suitable gearing in the usual manner, as indicated in dotted lines in Fig. 1.

The valve is provided with the usual sealing ring 15*a* and a passage 15*b* connects a groove 15*c* containing the sealing ring with the exhaust port so that the sealing ring is subjected to exhaust port pressure.

A spring 23 operates on the valve 15 and opens the same when the valve is released by the cam 20. The spring is seated on a plate 23*a* and is adjusted by means of a screw 23*b*, the screw extending through the cover plate 12*b*.

The lower end of the valve chest is closed and thus a chamber is formed under the valve. This chamber communicates with the atmosphere through a passage 24 which passage is provided with a non-return check valve 25 which permits of an exhaust from the passage 24 but prevents a return movement. It will be understood that the mechanism which I have described is duplicated at the opposite ends of the cylinder, the other exhaust valve being actuated by the same cam.

The timing of the valve 15 follows the

ordinary timing of valves of this type. The valve remains seated during the expansion stroke of the cylinder and opens approximately at the time of opening of the central ports by the piston. It remains open during the return stroke of the piston until the piston has passed the port 4*a*. The valve is closed at any time after the closing of the port by the piston and prior to the return of the piston to this port. Ordinarily the valve 15 is closed immediately after the piston covers the auxiliary port. It will be seen, therefore, that it is only necessary to provide a spring 23 of sufficient strength to open the valve with the aid of the slight differential between the partial vacuum below the valve and the preponderant exhaust port pressure above the valve when the engine is operating without condensing the exhaust. On the other hand, in closing the valve it is only necessary for the cam to overcome the spring 23 and the preponderant exhaust port pressure on the upper surface of the valve and the very slight resistance to movement on the valve seat. The closing pressure on the valve seat, as before stated, is supplied as the steam pressure builds up in the port 4*a*.

In operation, the valve is positively closed by the cam operating on the stem, the valve raising the seat slightly to assure a closure at each operation. This closure of the valve in the present instance requires a seating pressure corresponding only to the steam pressure at the moment of closing, the steam backing of the movable seat controlling this seating pressure, the springs 10*a* being so slight as to add very little to the steam pressure. In my prior application the movable seat was subjected to a spring pressure for holding it in yielding seating position. It was necessary with that construction to supply a spring of sufficient strength to force the movable seat forward under the maximum pressure to which it was subjected. This placed a very substantial load on the cam and roller which involved wear and took some power. With the present invention the movable seat is loaded with a steam pressure corresponding to the pressure in the port and therefore, the load on the cam is in each instance as slight as is practical. Further the steam pressure back of the ring 13 is slight at the time of movement of the movable valve but increases as the steam pressure increases, thus assuring a sealed joint corresponding to the pressure which it is necessary to hold and in as much as the central exhaust releases the main pressure prior to the movement of the auxiliary exhaust the ring pressure at the time of the movement of the movable seat is very slight.

As in my prior application the exhaust of air from the valve chest under the valve 15 adds to the effectiveness of the spring 23 in opening the valve in that it creates a sub-atmospheric condition under the valve against which the ordinary exhaust operates.

Also when the engine exhausts to a condenser the sub-atmospheric condition created by the condenser communicated from the exhaust passage by the passage 9 and port 8 reduces the pressure above the valve 15 so that the closing pressure on the valve is greater than the spring pressure and, therefore, the auxiliary valve under these conditions does not open so that the engine operates perfectly condensing and non-condensing with no attention whatever on the part of the operator. It will be understood that the condenser pressure is much below the small pressure difference below atmosphere which it is possible to create under the valve 15 by reason of pumping action through the passage 24 past the check 25.

What I claim as new is:—

1. In an exhaust valve mechanism, the combination of a cylinder having an exhaust port and an exhaust valve chest communicating with the port; a seat case in the chest forming a closure with the walls of the chest; a yielding seat carried by the case with a steam space between the seat and the case, the seat presenting a preponderant pressure face yieldingly holding the seat in position; a steam connection leading to said space from a pressure source having a pressure approximating the pressure of the steam on the valve; and a valve operating on the seat.

2. In an exhaust valve mechanism, the combination of a cylinder having an exhaust port and an exhaust valve chest communicating with the port; a seat case in the chest forming a closure with the walls of the chest; a yielding seat carried by the case with a steam space between the seat and the case, the seat presenting a preponderant pressure face yieldingly holding the seat in position; a steam connection leading to said space, said connection leading from a steam source having pressure approximating the pressure of the steam at the valve; a valve operating on the seat; and a sealing ring between the case and seat, said ring being subjected to steam pressure corresponding to the pressure in said space.

3. In an exhaust valve mechanism, the combination of a cylinder having a central exhaust port; an auxiliary exhaust port; an exhaust valve chest communicating with the auxiliary exhaust port; a seat case in the chest forming a closure with the walls of the chest; a yielding seat carried by said case with a steam space between the seat and the case, the seat presenting a preponderant pressure face yieldingly holding the seat in position; a steam connection leading to said space; from a pressure source having a pressure approximating the pressure of the steam at the valve; a valve operating on the

seat; a cam closing the valve; and a spring opening the valve.

4. In an exhaust valve mechanism, the combination of a cylinder having a central exhaust port; an auxiliary exhaust port; an exhaust valve chest communicating with the auxiliary exhaust port; a seat case in the chest forming a closure with the walls of the chest; a yielding seat carried by said case with a steam space between the seat and the case, the seat presenting a preponderant pressure face yieldingly holding the seat in position; a steam connection leading to said space, said connection leading from a steam source having a pressure approximating the pressure of the steam at the valve; a valve operating on the seat; a sealing ring between the seat and case, said ring being subjected to steam pressure corresponding to the pressure in said space; a cam closing the valve; and a spring opening the valve.

5. In an exhaust valve mechanism, the combination of a cylinder having an exhaust port; an exhaust valve chest communicating with the port; a valve controlling said port; a yielding seat in the chest on which the valve operates, said seat being steam-loaded from a pressure source approximating the pressure of the steam at the valve; and means closing the valve while the valve is subjected to a reduced pressure.

6. In an exhaust valve mechanism, the combination of a cylinder having an exhaust port; an exhaust valve chest communicating with the port; a valve controlling said port; a yielding seat in the chest on which the valve operates, said seat being steam-loaded from a pressure source approximating the pressure of the steam at the valve; and means opening and closing the valve while the valve is subjected to a reduced pressure.

7. In an exhaust valve mechanism, the combination of a cylinder having an exhaust port; an exhaust valve chest communicating with the port; an exhaust valve controlling said port; a yielding seat in the chest on which said valve operates, said seat being steam-loaded from a pressure source approximating the pressure of the steam at the valve; a cam closing the valve while the valve is subjected to a reduced pressure; and a spring opening the valve.

8. In an exhaust valve mechanism, the combination of a cylinder having an exhaust port; an exhaust valve chest communicating with the port; an exhaust valve controlling said port; a yielding seat in the chest on which said valve operates, said seat being steam-loaded from a pressure source approximating the pressure of the steam at the valve; a cam closing the valve while the valve is subjected to a reduced pressure; and a spring opening the valve while the valve is subjected to a reduced pressure.

9. In an exhaust valve mechanism, the combination of a cylinder having a central exhaust and an auxiliary exhaust port; an exhaust valve chest communicating with the auxiliary exhaust port; a valve controlling the exhaust port; a yielding seat forming a space between the seat and chest, the seat presenting a preponderant pressure face yieldingly holding the seat in position; a steam connection leading to the space from a source of pressure coresponding to the pressure to which the valve is subjected; and means closing the valve while the valve is subjected to a reduced pressure.

In testimony whereof I have hereunto set my hand.

HERMAN G. MUELLER.