G. W. BAKER.

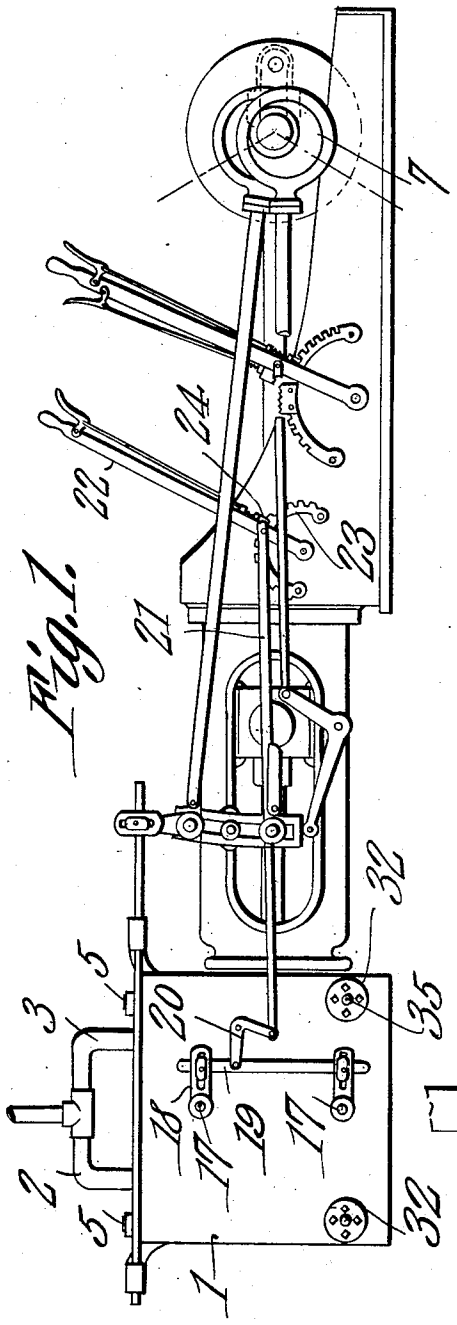
STEAM ENGINE.

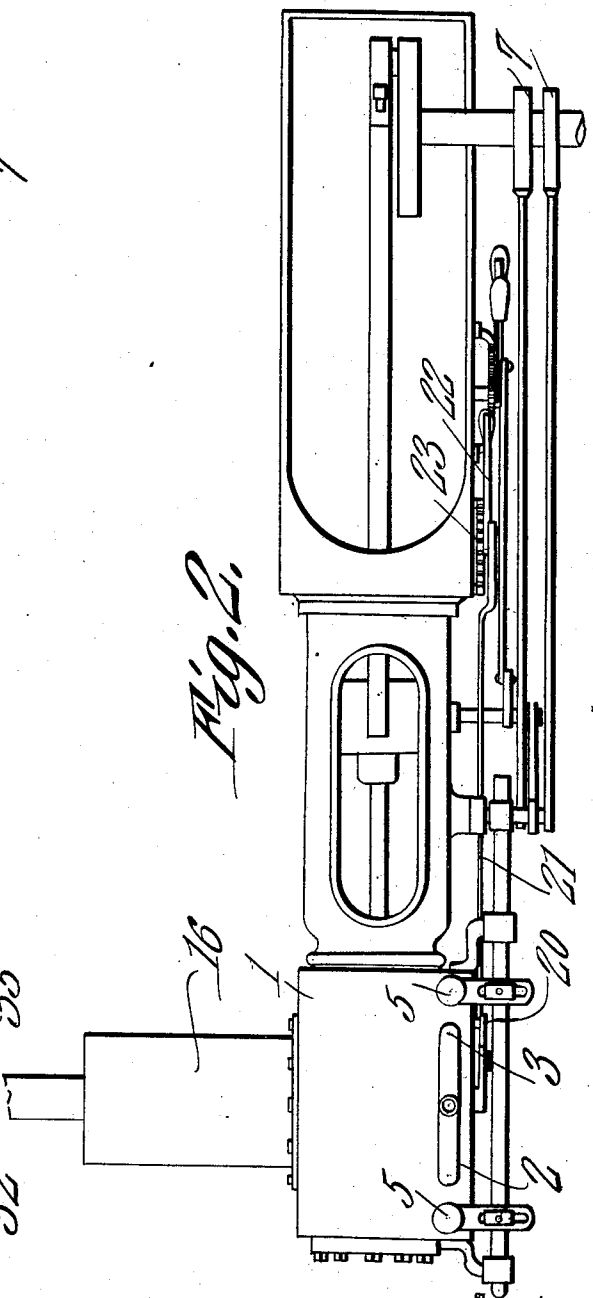
APPLICATION FILED SEPT. 23, 1909.

1,012,050.

Patented Dec. 19, 1911.

3 SHEETS—SHEET 1.





Witnesses

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3 SHEETS—SHEET 2.

Fig. 3.

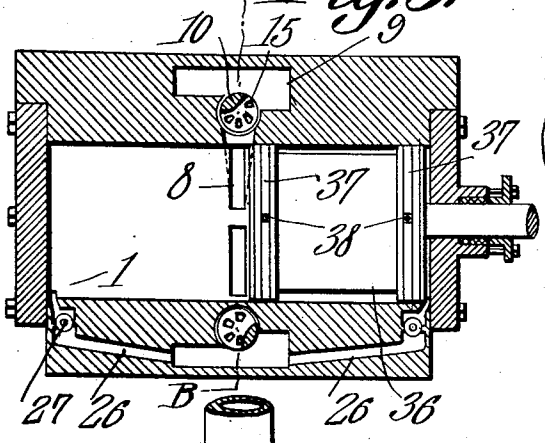


Fig. 4.

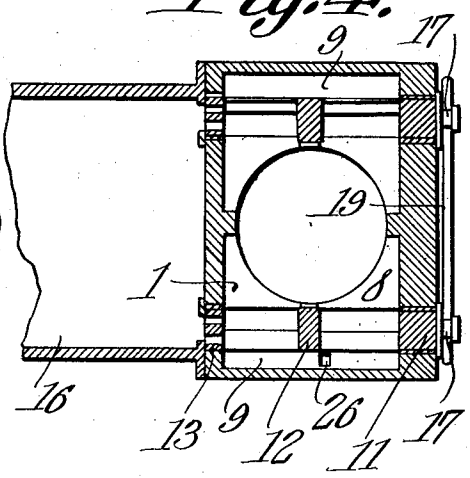


Fig. 5.

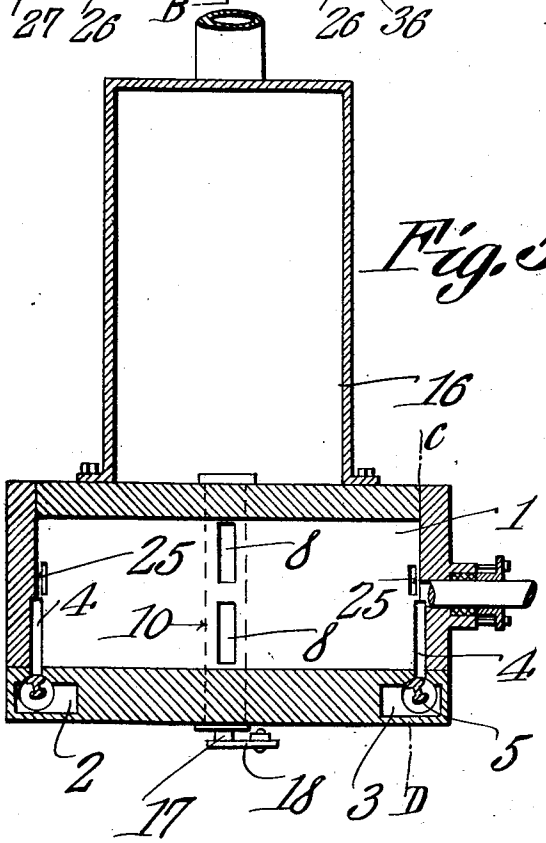
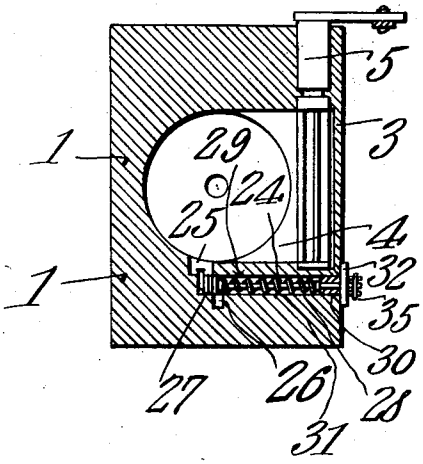


Fig. 6.



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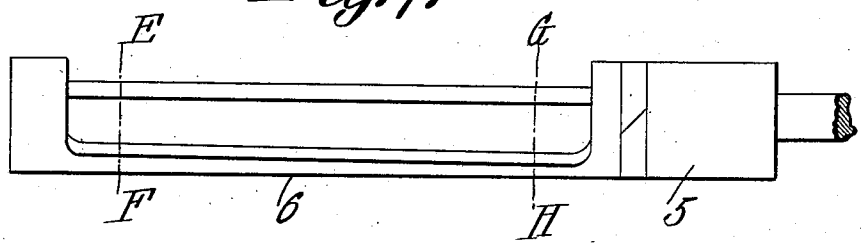
3 SHEETS—SHEET 3.

Fig. 7.



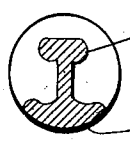
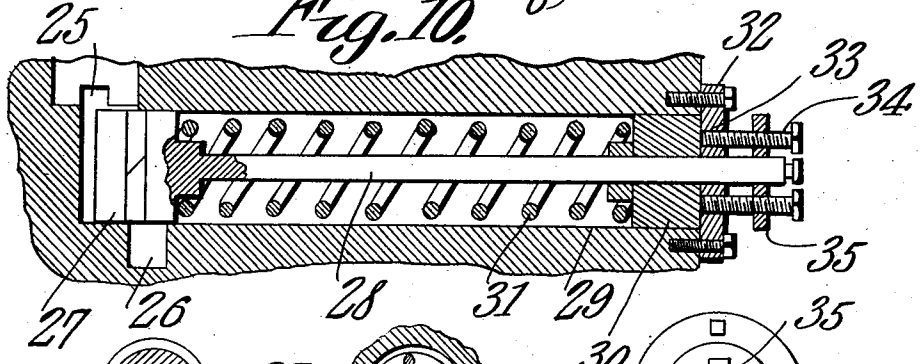


Fig. 8.

Fig. 9.

Fig. 10.



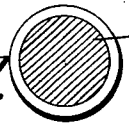


Fig. 11.

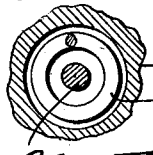


Fig. 12.

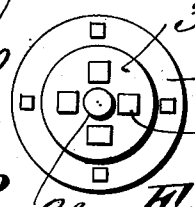


Fig. 13.

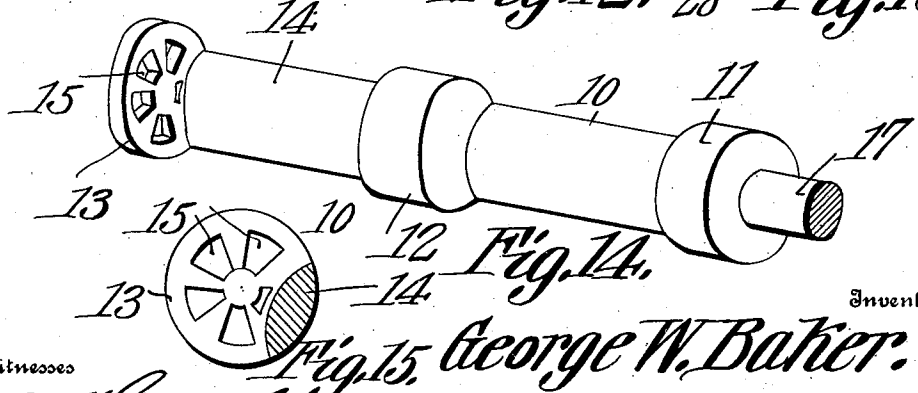


Fig. 14.

Fig. 15.

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GEORGE W. BAKER, OF RHEEMS, PENNSYLVANIA.

STEAM-ENGINE.

1,012,050. Specification of Letters Patent. Patented Dec. 19, 1911.

Application filed September 23, 1909. Serial No. 519,158.

To all whom it may concern:

Be it known that I, GEORGE W. BAKER, a citizen of the United States, residing at Rheems, in the county of Lancaster and State of Pennsylvania, have invented a new and useful Steam-Engine, of which the following is a specification.

The object of the present invention is to provide in combination with a steam engine of that pattern generally known as the "Corliss type"; valves and valve operating mechanisms which may be manipulated when the engine is running at a high rate of speed to trap in the engine cylinder, as the piston covers the exhaust port upon its return movement toward the induction port, an amount of the steam under pressure, which trapped steam is part of that which has previously been used while expanding to force the piston toward the exhaust port. The steam thus trapped is compressed within the cylinder between the piston and the cylinder head as the piston moves toward the induction port, but by reason of the fact that the engine is running at a fast or high rate of speed, this compression is accomplished by the momentum of the engine and the load that it carries, and does not materially or even perceptibly retard the action or speed of the engine.

A further object of the invention is to provide an induction port valve so shaped that the initial steam passage through the induction port when the valve begins to open is at a single point only (whereby the steam passes through in a very fine stream the greatest transverse dimension of which is not equal in length to the shortest tranverse dimension of the port) but this passage is increased in area in a regular and gradual manner until the entire area of the induction port is finally uncovered, thereby wire drawing the steam and preventing too sudden admixture of the live steam with the compressed steam in the cylinder. This wire drawing manner of admitting the steam into the cylinder causes the steam to move at a great velocity when the induction port valve is first cracked open or the induction port is opened at a point only (instead of at a line as is usual) and steam thus admitted into the compressed volume of steam trapped in the cylinder more effectually and promptly penetrates into the volume of steam and mixes with the same.

In the accompanying drawings the preferred form of the invention has been shown.

In said drawings, Figure 1 is a side elevation of an engine embodying the present improvements, the same being of a "Corliss" type. Fig. 2 is a plan view of the engine shown in Fig. 1. Fig. 3 is a central vertical longitudinal section through the cylinder of the engine, the piston being shown at one end of its stroke. Fig. 4 is a section on line A—B of Fig. 3. Fig. 5 is a central horizontal section through the cylinder, the piston being removed therefrom. Fig. 6 is a section on line C—D of Fig. 5. Fig. 7 is a side elevation of the valve controlling one of the intakes. Fig. 8 is a section on line E—F of Fig. 7. Fig. 9 is a section on line G—H of Fig. 7. Fig. 10 is a longitudinal section through the adjustable exhaust controlling device. Fig. 11 is a transverse section through the head of said controlling device. Fig. 12 is a transverse section through the stem thereof and the spring surrounding the same, the adjoining portion of the cylinder being shown in section. Fig. 13 is an elevation of the outer end of said controlling device. Fig. 14 is a perspective view of the main exhaust controlling valve. Fig. 15 is a transverse section therethrough.

Referring to the figures by characters of reference 1 designates the cylinder of an engine of the "Corliss" type, the steam intakes 2 and 3 of which communicate with the interior of the cylinder up to the ends thereof, the ports 4 connecting the intakes with the interior of the cylinder being of the same length as the internal diameter of the cylinder as clearly indicated in Fig. 6. The passage of fluid through each of the ports 4 is controlled by a valve 5 of the ordinary "Corliss" type and which has been illustrated in detail in Figs. 7, 8 and 9. This valve is in the form of an elongated cylinder cut away for a distance equal to the length of the port so as to form a segmental cut-off element 6. The side edges of this element 6 gradually converge toward one end of the valve so that when said valve is turned about its longitudinal axis the port 4

controlled thereby will be gradually opened, beginning at one end thereof. The two valves 5 are controlled by the ordinary eccentric mechanism 7, the eccentrics having the radii of their deep portions slightly beyond an angle of 45° to the radius of the shaft that passes through the center of the crank pin.

As shown particularly in Fig. 4 angular recesses 8 are formed in the inner surfaces of the cylinder 1 at the center thereof, these recesses constituting annular exhaust ports which usually increase in width toward their outer ends, said outer ends opening into steam compartments 9 formed within the upper and lower portions of the cylinder 1 as shown in Fig. 3. Two of the recesses 8 open into each compartment 9 and communication between said recesses or ports and the compartments 9 is controlled by means of exhaust valves 10. As shown in Figs. 14 and 15 each exhaust valve consists of preferably three disk like members 11, 12 and 13 respectively, the same being connected by eccentrically disposed segmental cut-off strips 14 which may be integral with the disks and the outer surface of which is in the same arch as the peripheries of the disks. Disks 11 and 12 are imperforate but the end disk 13 has a series of outlet openings 15 therein. This last mentioned disk 13 constitutes the closure for one end of the bore in which the valve 10 is located, and a muffler 16 is arranged at one side of the cylinder 1 and is designed to receive the steam exhausted through the openings 15. A neck or trunnion 17 extends from the center of the disk 11 and has an arm 18 extending therefrom, said arm being movably connected to the end of a link 19. A bell crank lever 20 is pivotally connected to this link and also to a rod 21 which is designed to be actuated by means of a lever 22, there being a toothed segment 23 and a spring controlled pawl 24 of the ordinary type for holding the lever and the parts connected thereto in any position in which they may be adjusted. Obviously by shifting the lever 22 the link 19 can be raised or lowered so as to cause simultaneous movement of the arms 18 and exhaust valves 10, this movement resulting in the partial or entire opening or closing of the ports 8 by the cut-off element 14.

An exhaust port 25 is formed at each end of the piston chamber within the cylinder 1, the two ports opening into passages 26 which in turn open into the steam compartment 9. Each of these passages 26 is normally intersected by the head 27 of an exhaust controlling device, said head being provided with a stem 28 located concentrically within a cylindrical bore 29 formed within the wall of the cylinder 1. The outer end of the bore is closed by means of a plug 30 and a spring 31 bears at its ends against the plug and the head 27 respectively and extends around the stem. A plate 32 is bolted or otherwise secured to the cylinder 1 and extends over the plug 30 and around the projecting end of the stem 28, this plate being provided with a series of screw threaded apertures 33 within which are mounted adjusting screws 34. These screws bear against the plug 30 and are also threaded through a ring 35 extending loosely around the projecting end of the stem 28. The head 27 of this automatic controlling device normally closes communication between the port 25 and the passage 26 but there is always sufficient space in front of the head 27 to permit the steam to be directed against the end of said head. Obviously by adjusting the screws 34 the plug 30 can be shifted a desired distance into the bore 29 and the stress of spring 31 thus increased so as to necessitate increased pressure in order to shift the head 27 and thus establish communication between the port 25 and the passage 26.

The operation of the engine is as follows: By means of levers 22 the exhaust valves 10 are turned so as to entirely open the port 8. Steam is then admitted into the interior of the cylinder through one of the ports 4 and directly back of the piston 36. Said piston will therefore be shifted the length of the piston chamber. During the completion of this stroke the piston passes the exhaust ports 8 and the active fluid passes out of the cylinder through the said ports. After the piston has passed the end of its stroke motive fluid may be admitted to the cylinder through the other intake port 4 so as to drive the piston in the reverse direction and, until a sufficiently high speed has been attained, the exhaust valve 10 can remain entirely open. When a high speed has been reached the exhaust valve 10 is partially closed. Then as the piston is driven in one direction and uncovers the ports 8 a portion of the steam passes out of said ports which are now partially closed by the valve 10. The piston then begins its stroke toward the steam induction port 4 and passes over the exhaust ports 8 closing them and trapping a portion of the steam pressure in the end of the cylinder 1. As the piston continues to move toward the end of the cylinder the steam thus trapped is compressed until its pressure overcomes the stress of force of the spring 31. When this occurs the piston 27 is moved against the force of the spring 31 and passes beyond the passage 26. This will check further compression of the trapped steam and will permit some of it to escape through the passages 25 and 26 into the compartment 9 until the degree of compression of the trapped steam and the force of the spring are equal. For example, should the

piston be driven by a boiler pressure of 200 pounds to the square inch, the steam trapped in the path of the piston can be compressed to, say, 1,500 pounds per square inch. If the compression exhaust be adjusted to retain 1,000 pounds pressure, the compressed steam will exhaust through the port 25 until the pressure in the cylinder has been reduced to 1,000 pounds. This steam pressure will return the piston when mixed with the minute quantity of live steam admitted to the cylinder prior to the next stroke of the piston.

By arranging the eccentrics 7 in the manner hereinbefore described, the valves 5 are shifted so as to open and close before the piston reaches the ends of its stroke and is what is generally known as the "lead."

By utilizing a cut off valve 6 of the shape hereinbefore described, the supply of motive fluid to each port 4 can be gradually controlled to a more minute extent than should said cut off be of uniform width throughout the length. This form of valve also has the effect of wire drawing the steam in the first instance through the induction port into the cylinder. As before stated this causes the fine stream of steam to move at great velocity and therefore it readily penetrates and mixes with the compressed trapped fluid pressure in the cylinder.

What is claimed is:

In combination with an engine having its cylinder provided with induction and exhaust ports, a piston mounted for reciprocation in its cylinder, a manually operable valve for controlling the exhaust ports, said cylinder being further provided with a channel at right angles to its main bore and in communication with the exhaust ports, said channel being provided with an off-set channel, of a slidingly mounted head fitting in said channel and opposed to the exhaust port, a stem mounted in the channel and carrying said head, a spring mounted in the channel and surrounding the stem and normally exerting a tension to hold the head closed, and an adjustable plug in the outer end of said channel for regulating the tension of the spring upon the stem.

In testimony that I claim the foregoing as my own, I have hereto affixed my signature in the presence of two witnesses.

GEORGE W. BAKER.

Witnesses:

JOALL B. SWEIGART,

E. HUME TALBERT.