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RAMMING MACHINE DRIVEN BY INTERNAL COMBUSTION

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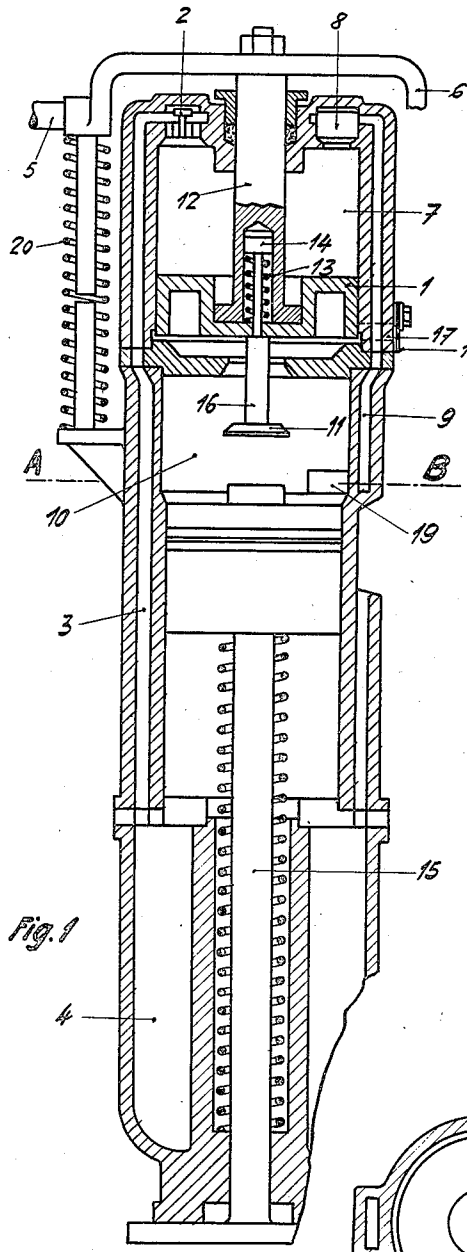

Fig. 1

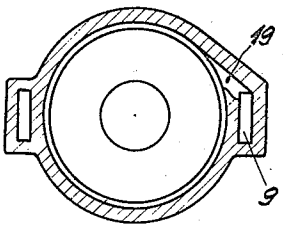

Fig. 2

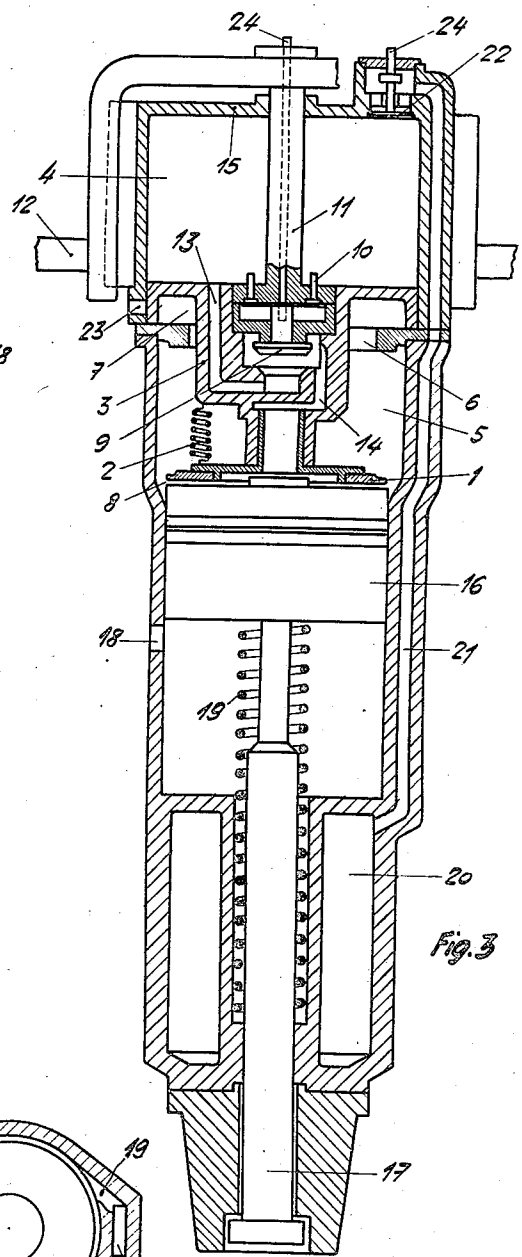

Fig. 3

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RAMMING MACHINE DRIVEN BY INTERNAL COMBUSTION

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5 Claims. (Cl. 123—7)

The present invention relates to a ramming machine operated by internal combustion. One of its objects is to feed the fuel mixture under high pressure into the combustion chamber and another object is to obtain a safe discharge of the burnt gases.

The drawing represents a working example of the invention.

Fig. 1 is a longitudinal section of the machine,

Fig. 2 a horizontal section on line A—B of Fig. 1,

Fig. 3 a modified form of the machine shown in Fig. 1.

The machine, shown in Fig. 1, comprises an upright cylinder 30, to the lower end of which is attached a ramming head 31 containing a surface carburetter, a piston 26 controlled by a spring 32 being slidably fitted to said cylinder having a rod 15 passing through said ramming head and carrying a foot plate 33. The upper part of the cylinder is widened to form a combustion chamber 10 and is closed by a plate 29 provided with the seat of a valve 11 at its center. A pump cylinder enclosing a chamber 7 which is made still wider than the combustion chamber is connected to said plate and has a piston 1 slidably fitted therein. The pump is manually operated. Its piston 12 is attached to a stirrup 6 which is provided with handles 5 and is supported by a spring 20 which helps in operating the upstroke of the piston.

The stem 16 of said valve 11 projects from the bottom face of the pump piston and is held against it by a spring 13 supporting a pistonlike extension 14 of the stem lodged within a hollow of the piston rod. In the end wall of the pump chamber are seated an admission valve 2 communicating by a conduit 30 with the surface carburetter and an exhaust valve 8 communicating by a conduit 9 with a port 19 in the combustion chamber 10. Besides there is also provided at the bottom of the pump chamber an escape port 17 controlled by a non-return valve 18.

The machine is operated as follows:—

The pump chamber has been filled with fuel mixture by the down stroke of piston 1. This piston during the first part of its upstroke, that is while valve 11 remains still open, evacuates the burnt gases from the combustion chamber 10 into the pump chamber where they will escape through port 17 to the outside. During this first part of the upstroke which occupies a volume in the pump cylinder equal to the volume of the combustion chamber the fuel mixture evacuated from the pump chamber through valve 8 will have completely filled the combustion chamber. After the closing of valve 11 pump piston 1, completing its upstroke, will evacuate with increasing pressure the remainder of the fuel mixture into the combustion chamber. At the end of its upstroke the compressed charge of the combustion chamber will be ignited by means, not shown, but well known. By the explosion of said charge the pump cylinder together with cylinder 30 and ramming head 31 will be thrown upwards while piston 26 compressing spring 32 will be pressed by means of foot plate 33 upon the surface to be rammed. Then the parts thrown upwards coming down again by their own inertia will do the ramming by striking the foot plate 33.

With the down coming of the upthrown parts also piston 1 of the pump cylinder will be thrown into in its lowest positon, will open again valve 11 and let part of the burnt gases (which have been compressed by the down coming parts so far as spring 32 admits) escape from the compression chamber through port 17 until piston 1 has reached its lowest position where it closes said port. The machine is then ready for a second operation initiated by raising piston 1 by hand.

It must be stated here that the admission port leading into the combustion chamber is arranged tangentially to the cylinder walls to the effect that the incoming charge will assume a rotating movement whereby the heavier parts of the mixture will remain by centrifugal force next to the walls, while the lighter parts only will occupy the center and escape through valve 11 while it remains open.

Furthermore the width of the pump chamber 7 which as has been stated, is made wider than the combustion chamber 10, could be increased to such an extent that the compression of the charge is further increased to obtain a better jumping.

The advantages of the invention are evident. The ram is operated not only with a compressed charge but can also be operated with varying fuel charges by adapting the stroke of the pump piston 1 to such charges.

In certain known ramming devices the fuel mixture is charged directly into the hot combustion chamber to the effect that the mixture is expended at once and the amount of the effective charge. This will sometimes reduce the jump to nearly 50 per cent. In the present machine the upper part of the pump chamber re-

ceiving the fresh mixture is so much separated from the combustion chamber that it will remain cool also when the latter chamber becomes heated. The charge once filled into the pump chamber will keep its effect and be forced to its whole extent into the combustion chamber. The sucking effect of the pump will therefore remain nearly constant.

The modified form according to Fig. 3 is in its main parts similar to the form shown in Fig. 1.

Here also a ramming head is attached to a cylinder **30'** and a working piston **26'** having a rod **15'** and a foot plate **33'** attached thereto is fitted into the lower part of said cylinder, but the foot plate is receivable in a recess of the ramming head. The working piston is supported by a compression spring **32'** and the upper piston **1'** is attached to a stirrup **6'** provided with handles **5'**.

The upper piston **1'** has a downward extension **1''** inside of which is centrally arranged a pressure valve **8'** adapted to control a passageway **9'** leading from the upper pump chamber **7'** to the combustion chamber **10'**, passages **14'** and **21** leading from said valve to the center of valve disk **11'** which has its seat in the partition wall **29'** which separates the pump chamber from the combustion chamber. The valve disk **11'** leaves a narrow annular space between it and the cylinder wall and nearly touches the working piston when the machine is at rest. The valve disk **11'** is fitted with a sleeve inserted in the outlet **21** of the fuel mixture passage and is held in position by a spring **13'**. The discharge port for the products of combustion is at **17'** and the admission of the fuel mixture into the pump cylinder is permitted by the non-return valve **2'** which is provided with a testing rod **27** projecting to the outside. Likewise valve **8'** has a push rod **25** secured to its stem. Fast to the stem of valve **8'** is also a plate **23** having two pins **24** which project so far from the upper face of piston **1'**, that, when they are pushed in nearly flush with said face, valve **8'** will be pressed down to its seat by compressing a spring, not shown, which maintains the open position of said valve.

The operation of the modified form is as follows:—

If the upper piston **1'** is moved upwards with the handles **5'** the fuel mixture in the chamber **7'** will be pressed through the passages **9'**, **14'** and **21** into the combustion chamber **10'**. During this upstroke piston **1'** sucks at the same time the products of combustion from chamber **10'** which will be evacuated through the port **17'**. This will continue until piston **1'** has travelled through about ⅔ of its whole stroke. Then, owing to the fact that the pump chamber **7'**, as in the first example, has a larger diameter than the combustion chamber **10'**, the bulk of burnt gases evacuated from chamber **10** will be about equal to the bulk displaced in the pump chamber **7'** and when the piston has travelled a little farther valve disk **11'** will have shut off the combustion chamber. The piston has now still about a quarter of its whole stroke to travel and during this quarter stroke will be compressing the charge of the combustion chamber. This compression is increased until, at the end of the stroke, pins **24** will be pushed in and close also valve **8'**. The charge is then ignited by means not shown but well known. While the cylinder **30'** is thrown upwards by the explosion, the foot plate **33'** will rest on the object to be rammed and when the working piston **26'** has passed the port **34** the largest portion of the products of combustion will escape through this outlet. When the ramming head **31'** has dropped upon the object to be rammed piston **1'** will retake its first position and suck fresh fuel mixture from the surface carburetter **4'** through conduit **3'** and non-return valve **2'** and expel the products of combustion from the combustion chamber **10'** through port **17'** to the atmosphere.

What I claim is:—

1. In a ramming machine operated by internal combustion and in combination, an upright cylinder, a ramming head containing a surface carburetter attached to said cylinder, a spring controlled working piston slidably fitted into the lower portion of said cylinder and having a piston rod guided in said ramming head and having a foot plate attached to the rod, a partition wall having a valve seat therein and dividing the upper cylinder portion into a combustion chamber which is limited by said working piston and into a pump chamber having a larger diameter than the combustion chamber, a piston fitted into the pump chamber, a discharge valve held resiliently on a downward extension of said piston and adapted to close the valve seat in the partition wall before the explosion takes place, and a stirrup with handles located outside of the cylinder head and attached to the piston rod of the pump, a non-return valve in the cylinder head for the fuel mixture and an exhaust port at the bottom of the pump chamber.

2. In a ramming machine according to claim 1, a downward extension of the pump piston having a passageway for the fuel charge of the combustion chamber, a cut-off valve to control this passageway, a plate with pins attached to the stem of said valve and adapted to come into contact with the cylinder head to close said valve before the explosion in the combustion chamber takes place.

3. In a ramming machine according to claim 1, a downward extension of the pump piston provided with passageways for the fuel charge and a discharge valve disk fitted with a sleeve slidingly into said outlet and extended downward to nearly touch the working piston and sideways to nearly touch the cylinder walls of the combustion chamber a spring holding said valve disk within said outlet of the extension.

4. In a ramming machine according to claim 1, the lower part of the cylinder formed as a cylinder for the working piston carrying the foot plate and an exhaust port in said cylinder for the first discharge of the products of combustion, when the jump of the cylinder takes place.

5. In a ramming machine according to claim 1, a cylinder having a combustion chamber separated from a pump chamber by a partition wall, said pump chamber having a somewhat larger volume than the combustion chamber to secure the compression of the fuel charged into said combustion chamber.

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