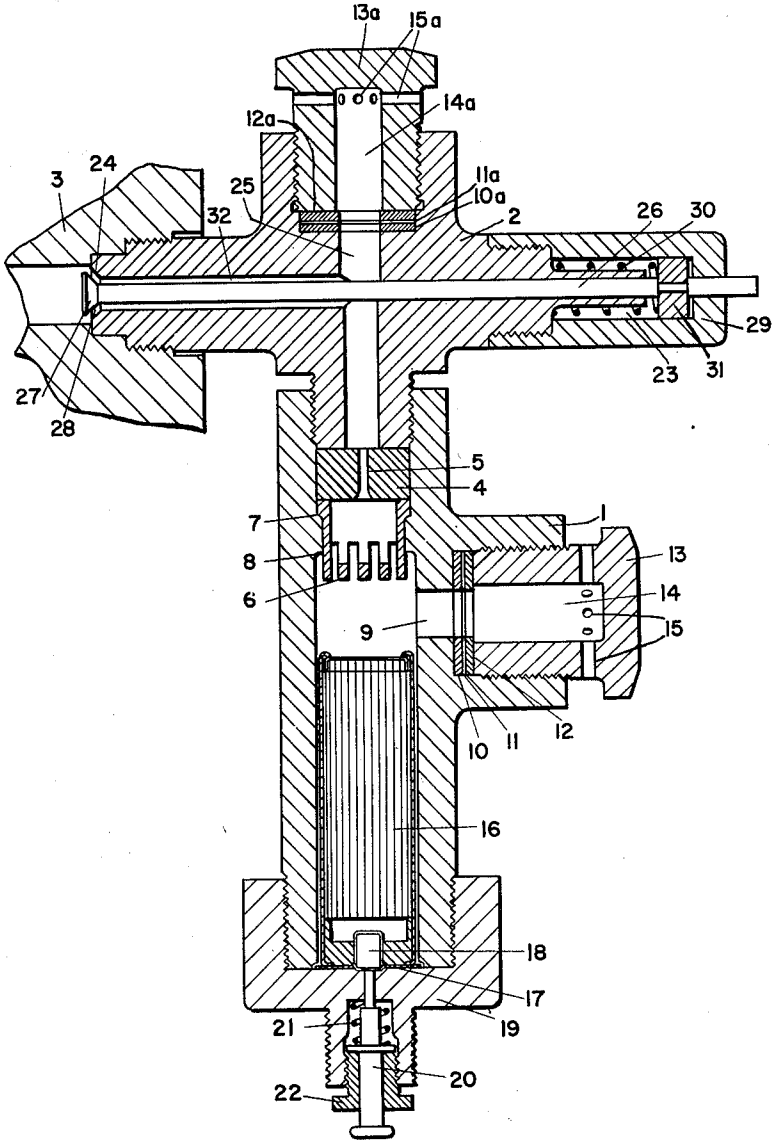
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SELF-COMBUSTIBLE SOLID CHARGE OPERATED ENGINE STARTER

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SELF-COMBUSTIBLE SOLID CHARGE OPERATED ENGINE STARTER

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The present invention is concerned with a new and improved device operated by a cartridge containing a self-combustible solid charge for engine starting and more particularly for the starting of internal combustion engines. The starting device in accordance with the present invention is especially suitable for use with cartridges containing self-combustible charges comprising colloided nitrocellulose, but self-combustible charges of other kinds may be used in the cartridges employed if desired.

A cartridge operated starting device according to the present invention comprises in combination a firing chamber to accommodate a cartridge, a spring controlled non-return valve positioned in a housing and adapted to release pressure within said housing, a pressure controlling orifice, a trap to prevent choking of said pressure controlling orifice, and a breech, the said pressure controlling orifice being positioned between said trap and said spring controlled non-return valve.

It is desirable that the said firing chamber should have a safety burning disc.

It is also desirable that the said housing should be provided with a safety burning disc.

To use the cartridge operated starting device of the invention the housing thereof is attached to the cylinder head of an engine, either by screwing it in or attaching it by a flange, so as to permit the gas from the cartridge to enter a conduit which is within the cylinder head and leads into the cylinder of the engine, preferably by way of the combustion chamber or other ancillary chamber of said cylinder. After the cartridge has been fired within said firing chamber of the device the pressure created therein opens the non-return valve and allows gas to enter the said combustion chamber or said other ancillary chamber of said cylinder so as to develop a predetermined maximum pressure in said cylinder. This causes the appropriate combustion of the engine to move and thus to bring about the rapid rotation of the engine shaft.

The device of the invention is designed particularly to permit a cartridge of the double base propellant type to burn within it at a pressure of for example 1500 to 2000 lbs. per sq. inch in order to eliminate the objectionable residues which are formed when such cartridges burn at lower pressures. As the pressure normally permitted in the cylinder is 1000 lbs. per sq. inch the pressure controlling orifice is of such size with respect to the nature of the charge and the engine

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to be started that the pressure within the cylinder is never above 1000 lbs. per sq. inch.

The device of the present invention permits the gas evolved by a burning cartridge to be used efficiently and economically as it acts directly on the piston of an engine.

The invention will be better understood by reference to the diagrammatic drawing accompanying the specification which illustrates in longitudinal axial section one form of starting device in accordance with the present invention with a self-combustible gas producing charge positioned within it.

In the drawing 1 is a tubular firing chamber member formed in the fashion of a T-piece, the wad of which is externally threaded at one end in order to cooperate with an internally threaded breech closure 19. The greater part of the cylinder bore of this firing chamber member 1 constitutes the firing chamber, which extends for some distance beyond the cartridge 16, containing the self-combustible gas producing charge to be employed. Thereafter the diameter of the bore is somewhat reduced for a short distance and again expanded as shown at 8 and 7 terminating in an internally threaded portion, in order to permit the insertion and retention of a powder trap 6 of grid-like construction and a steel ring member 4 having an axial throat 5 so that the powder trap extends for a short distance into the empty portion of the firing chamber. An emergency gas escape channel 9 of smaller diameter than the combustion chamber opens out in the stem of the T-piece to provide a shoulder and internal thread for the seating and retention of an emergency gas release device of which the members consist of a disc 11, adapted to burst at a predetermined pressure, interposed between annular gaskets 10 and 12, an externally threaded hollow stud bolt venting head 13 having a central channel 14 of greater diameter than the channel 9 and ports 15 radiating from the channel 14 to the atmosphere in a plane at right angles to the axial channels 9 and 14. The internal shoulder in the stem of the T-piece is accurately machined so that the disc 11 between the gaskets 10 and 12 forms a gas-tight seal between the channels 9 and 14 when the hollow stud bolt venting head 13 is screwed home.

2 is a valve housing member of cross-piece construction channelled through three of its arms to provide an internal bore substantially greater than that of valve stem 26 and through the fourth arm to a diameter sufficient to provide a sliding

fit for said valve stem. One of the aforesaid three arms terminates in an externally threaded portion serving to cooperate with the internally threaded end of the combustion chamber member 1, to retain the grid 6 and throated steel ring 4 in position in the latter member. The channel through the opposite arm of the cross piece terminates in a shouldered and expanded portion adapted to accommodate a relatively low pressure emergency pressure release device constituted similarly to that provided in the combustion chamber and constituted by a sealing disc 11*a* adapted to burst at a predetermined pressure interposed between two gaskets 10*a* and 12*a* and an externally threaded hollow stud bolt venting head 13*a* having an axial gas space 14*a* and ports 15*a* radially venting to the atmosphere in a plane at right angles to that of the ports 15. The third arm of the cross piece has a gas channel 32 of wider diameter than stem 26 of the valve 27 and at its end has a seating 24 for the valve. The channel 25 extending from the throated ring 4 to the sealing disc 11*a* and the communicating channel 32 provide an expansion space for the gases from the cartridge 16.

The end of the arm accommodating the valve seat is threaded and shaped so as to enable it to be screwed into the cylinder head 3 of the engine or an extension thereof, and permit the gases to enter through the channel 28 into the cylinder head. The opposite arm of the cross piece is externally threaded for a portion of its length and terminates in an annular cylindrical portion of reduced external thickness. A portion of the valve stem 26 emerging immediately beyond this extremity is of reduced diameter but the valve stem terminates in a portion of the same diameter as the main portion of the stem. 29 is an internally threaded cap having a channel through its closed end and enclosing a split ring 31 around the portion of the valve stem of reduced thickness, and a spring 30 in compression, so that when the cap 29 is screwed on to the threaded portion of the cross piece the valve face is held in contact with its seating. 17 is the brass base of the cartridge and 18 is the percussion cap thereof. 20 is a striker normally held out of contact with the percussion cap by means of the spring 21 and gland 22. On striking the striker with a hammer or the like the percussion cap ignites the charge in the cartridge 16, which conveniently comprises one or more massive pieces of colloided nitrocellulose, the gases from which build up a relatively high pressure, suitable for the self-combustion of the colloided nitrocellulose charge in the combustion chamber, and pass through the grid 6 which retains any dislodged large fragments of the burning powder charge and thence through the throat 5 from which they emerge under reduced but still substantial pressure into the channels 25 and 32, as a result of which they cause the valve 27 to leave its seating and flow past it into the cylinder head and forcibly depress the piston of the engine. By the time the piston reaches its lowest position the charge in the cartridge 16 has been wholly consumed. The energy transmitted through the piston to the fly-wheel of the engine

now causes the piston to commence to rise, and is sufficient to ensure that the motion of the piston will continue until the engine fires and the fall in pressure in the channels 25 and 32 consequent on the cessation of the self-combustion of the now wholly consumed self-combustible charge in the cartridge 16, enables the spring 26 to effect the closing of the valve 27 so that there will be no blow back on the compression stroke or after firing.

Should an excessive pressure develop in the channel 25 or the channel 32 as a result of the combustion of the self-combustible charge in the cartridge 16, the safety disc 11*a* will burst and the gases vent through the ports 15*a* to the atmosphere. An excessive pressure might develop if the valve should become sluggish in its action as the piston of the engine should seize.

For example, in a device fashioned of high tensile steel for starting a diesel engine rated at 50 H. P. a device in accordance with the invention attached to one of the cylinders could work at a maximum combustion chamber pressure of 2000 lbs. per sq. inch and a maximum pressure 1000 lbs. per sq. inch on the cylinder to be put in motion. The spring would be such that the valve 27 opened under a pressure of 70 lbs. per sq. inch and closed when the pressure in the channel 32 fell to 35 lbs. per sq. inch, and the discs 11 and 11*a* would be such as to burst respectively at pressures of 3500 and 1750 lbs. per sq. inch.

What we claim is:

1. A cartridge operated starting device comprising in combination a firing chamber to accommodate a cartridge, a spring controlled non-return valve positioned in the housing and adapted to release pressure within said housing, a pressure controlling orifice, a trap to prevent choking of said pressure controlling orifice, and a breech, the said pressure controlling orifice being positioned between said trap and said spring controlled non-return valve.

2. A cartridge operated starting device as claimed in claim 1 wherein the said firing chamber has a safety bursting disc.

3. A cartridge operated starting device as claimed in claim 1 wherein the said housing is provided with a safety bursting disc.

4. A cartridge operated starting device as claimed in claim 1 wherein the said firing chamber and the said housing are both provided with a safety bursting disc.

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