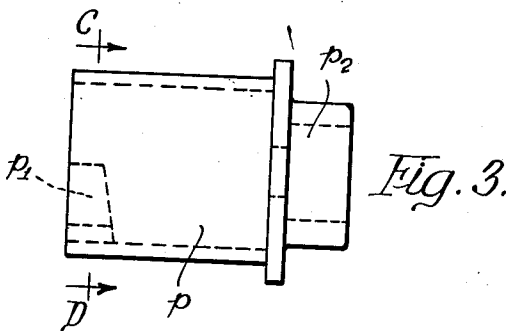
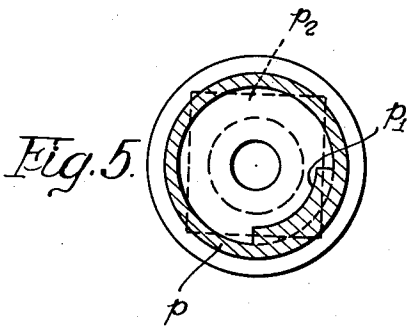
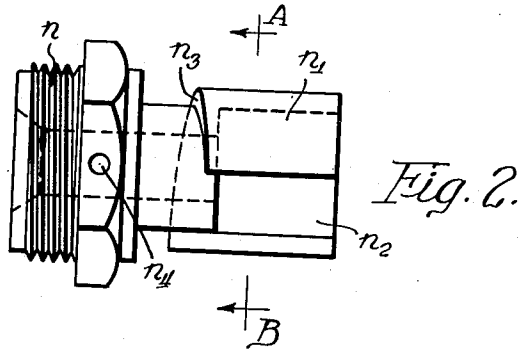
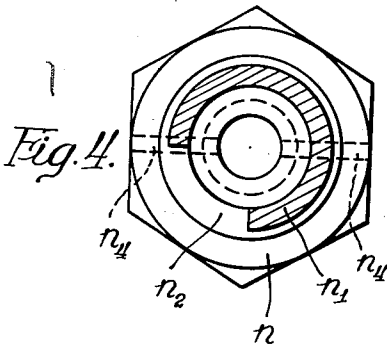
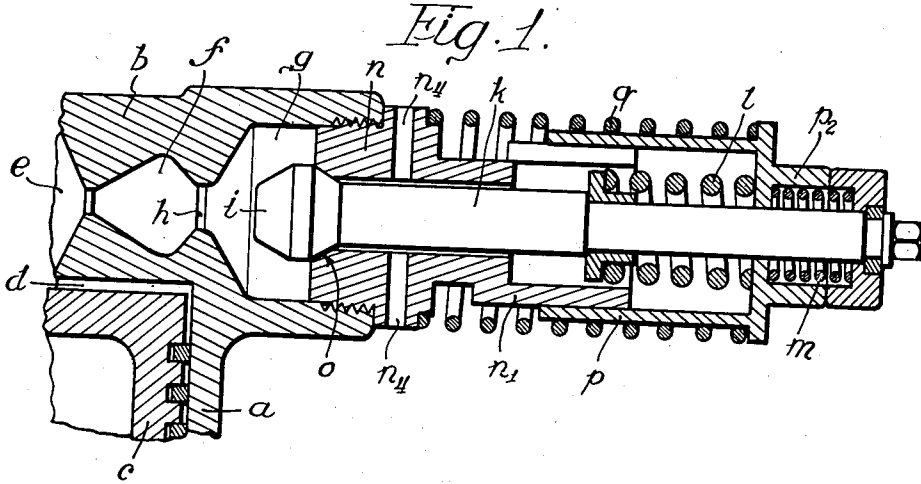


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AIR CHAMBER DIESEL ENGINE AND SHUT-OFF SAFETY  
AND VENTILATING VALVE THEREFOR  
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## AIR CHAMBER DIESEL ENGINE AND SHUT-OFF SAFETY AND VENTILATING VALVE THEREFOR

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6 Claims. (Cl. 123—32)

This invention relates to air chamber Diesel engines, and has to do with the air storage chamber and appurtenances thereto.

My invention is directed to the provision, in an engine of the character stated having an air storage chamber of variable capacity, of valve means for varying the effective capacity of the storage chamber for starting and normal operation, said valve means also providing means for ventilating the chambers and the cylinder preliminary to starting, and serving as a relief valve. It is also an object of my invention to provide valve means of the character stated of comparatively simple construction and operation, and capable of withstanding the abuses to which it is subjected in use. Further objects and advantages of my invention will appear from the detail description.

In the drawing:—

Figure 1 is a fragmentary axial sectional view of those portions of an air chamber Diesel engine and associated valve mechanism with which my invention is concerned;

Figure 2 is a detail elevational view of the plug closure member for the outer end of the air storage chamber;

Figure 3 is a detail elevational view of the cap member for adjusting the valve;

Figure 4 is a section taken substantially on line A—B of Figure 2; and

Figure 5 is a section taken substantially on line C—D of Figure 3.

In the drawing, *a* indicates the cylinder, *b* the cylinder head, *c* the piston operating in the cylinder, *d* the clearance between the cylinder head and the piston when the latter is in upper dead center position, *e* the main combustion chamber, *f* the starting or idling air storage chamber opening into chamber *e* through a restricted orifice, and *g* indicates the operating air storage chamber opening into chamber *f* through orifice *h*.

A closure plug *n*, threaded into the outer end of chamber *g*, slidably receives stem *k* of a double cone valve *i* the outer portion of which, in the outermost position of the valve, seats in the corresponding seat *o* formed in the inner face of the plug. Clearance is provided between the stem *k* of the valve and the base of the plug, as shown, and the latter is provided with radial ducts *n*<sup>4</sup> opening to atmosphere and into this clearance space.

Plug *n* is provided, at its outer end, with a sleeve *n*<sup>1</sup> slotted from its outer end at *n*<sup>2</sup>, the inner end of which forms a helical shoulder *n*<sup>3</sup>. A cylindrical cap *p* fits about the reduced outer portion of valve stem *k*, and extends about the sleeve *n*<sup>1</sup>. Cap *p* is provided, at its inner end and on its inner face, with a projection *p*<sup>1</sup> of a length to fit into slot *n*<sup>2</sup>, the outer edge of which projection is inclined similarly to shoulder *n*<sup>3</sup>.

A squared collar *p*<sup>2</sup> projects from the outer end of cap *p* and is provided with a cylindrical bore concentric with the valve stem, which bore accommodates a coil compression spring *m* disposed about the valve stem and confined between the outer end of cap *p* and a cup washer suitably secured on the outer end of the valve stem. A coil compression spring *l* is disposed within cap *p*, about the outer reduced portion of valve stem *k*, and is confined between the outer end of this cap and a flanged collar fitting about the reduced outer portion of the valve stem and abutting the shoulder between said reduced portion and the larger inner portion of the valve stem. Cap *p* is urged outward by a compression coil spring *q* disposed about the cap and confined between a flange at the outer end thereof and plug *n*, the latter having an outwardly projecting boss about which the inner end of spring *q* seats. Spring *l* urges the valve *i* inward relative to cap *p*, and spring *m* urges the valve outward in opposition to spring *l*.

The valve *i* is held in an intermediate position for ventilating the air storage and combustion chambers and the cylinder preliminary to starting. This is accomplished by moving cap *p* inward a proper distance and then turning it a short distance in a clockwise direction, so as to cause engagement of projection *p*<sup>1</sup> beneath shoulder *n*<sup>3</sup>. This holds valve *i* inward away from seat *o*, establishing communication between chamber *g* and atmosphere, through ducts *n*<sup>4</sup> and the clearance space about valve stem *k*. With valve *i* in this position, rotation of the engine crank shaft serves to ventilate the chambers and the cylinder and to charge them with air.

After the cylinder and the chambers communicating therewith have been ventilated, as above, cap *p* is turned into its extreme position in a clockwise direction, which forces the cap into its extreme inner position by camming action between projection *p*<sup>1</sup> and shoulder *n*<sup>3</sup>. This moves valve *i* inward so that the inner cone element of this valve seats against the wall of chamber *g*, at the outer end of orifice *h*, this wall being suitably shaped for this purpose, and places spring *l* under compression. This spring *l* is relatively strong and is effective for holding valve *i* seated so as to cut off communication between chambers *f* and *g* for starting. At the same time, if excessive pressure is developed during the starting and warming up period, valve *i* may open against the expansive force of spring *l*, thus acting as a safety relief valve.

When the engine has been sufficiently warmed up, cap *p* is turned in a counter-clockwise direction so as to disengage projection *p*<sup>1</sup> from shoulder *n*<sup>3</sup> and move it into register with slot *n*<sup>2</sup>. As soon as projection *p*<sup>1</sup> reaches this latter position, cap *p* is projected outward by spring *q*, quickly

returning valve *i* to its outermost or normal position shown in Figure 1. In this latter position, valve *i* forms a tight closure with seat *o*, effective to prevent leakage and resulting loss of compression.

While I have illustrated, by way of example, a preferred embodiment of my invention, changes in construction and arrangement of parts thereof may be resorted to, without departing from the field and scope of my invention, as will be understood by those skilled in the art, and I intend to include all such variations, as fall within the scope of the appended claims, in this application in which the preferred form only of my invention is disclosed.

What I claim is:—

1. In a Diesel engine, a cylinder and a piston operating therein, a combustion chamber, an inner air storage chamber opening into the combustion chamber, an outer air storage chamber opening into said inner chamber, a closure member secured in the outer end of said outer chamber, a valve having a stem slidable in said member with clearance therebetween, said closure member having a duct opening to atmosphere and into said clearance, a sleeve secured to and projecting outward from the closure member, said sleeve being slotted from its outer end and provided at its inner end with an inclined shoulder, a cap fitting loosely about the sleeve and having a projection engageable into said slot and beneath said shoulder, an abutment member secured on the outer end of the valve stem, a second abutment member on the valve stem intermediate the ends thereof and disposed inward of the outer end of said cap, a compression spring confined between the first abutment member and the outer end of the cap, a compression spring confined between said second abutment member and the outer end of the cap, and a compression spring confined between said closure member and said cap and urging the latter outward, the valve being aligned with the opening between the two air storage chambers and in its innermost position closing said opening, the closure member having a valve seat in its inner face forming a fluid tight closure with the valve in the outermost position of the latter.

2. In a Diesel engine, a cylinder and a piston operating therein, a combustion chamber, an inner air storage chamber opening into the combustion chamber, an outer air storage chamber opening into said inner chamber, a closure member secured in the outer end of said outer chamber, a valve aligned with the opening between the two air storage chambers and having a stem slidable in said member with clearance therebetween, the closure member having a duct opening to atmosphere and into said clearance, a sleeve secured to the closure member, an adjusting member, said sleeve and said adjusting member having cooperating means for moving the adjusting member inward of the sleeve, yielding means connecting the valve to the adjusting member for movement therewith, said closure member having a valve seat in its inner face forming a fluid tight closure with the valve in its innermost position seating about the opening between the two air storage chambers and cutting off communication therebetween, and yielding means urging the adjusting member outward of the sleeve.

3. In a Diesel engine, a cylinder and a piston

operating therein, a combustion chamber, an inner air storage chamber opening into the combustion chamber, an outer air storage chamber opening into said inner chamber, a closure member secured in the outer end of said outer chamber, a valve aligned with the opening between the two air storage chambers and having a stem slidable in said member with clearance therebetween and communicating with atmosphere, a sleeve secured to the closure member, an adjusting member, said sleeve and said adjusting member having cooperating means for moving the adjusting member lengthwise of the sleeve, and yielding means connecting the valve to the adjusting member for movement therewith, said closure member having a valve seat in its inner face forming a fluid tight closure with the valve in the outermost position of the latter, said valve in its innermost position seating about the opening between the two air storage chambers and cutting off communication therebetween.

4. In a Diesel engine, a cylinder and a piston operating therein, a combustion chamber, an inner air storage chamber opening into the combustion chamber, an outer air storage chamber opening into said inner chamber, a closure member secured in the outer end of said outer chamber, a valve aligned with the opening between the two air storage chambers and having a stem slidable in said member with clearance therebetween and communicating with atmosphere, an adjusting member adjustable lengthwise of the closure member, and yielding means connecting the valve to the adjusting member for movement therewith, said valve in its outermost position effecting a fluid tight closure with the closure member and in its innermost position seating about the opening between the two air storage chambers and cutting off communication therebetween.

5. In a Diesel engine, a cylinder and a piston operating therein, a combustion chamber, an inner air storage chamber opening into the combustion chamber, an outer air storage chamber opening into said inner chamber, a closure member secured in the outer end of said outer chamber, a valve aligned with the opening between the two air storage chambers and having a stem slidable in said member with clearance therebetween and communicating with atmosphere, and valve adjusting means for moving the valve into its innermost position and its outermost position and for holding the valve in an intermediate position, said adjusting means comprising means for yieldingly holding the valve in its innermost position, said valve when in its innermost position seating about the opening between the two air storage chambers and cutting off communication therebetween, the valve when in its outermost position forming a fluid tight closure with said closure member.

6. In a Diesel engine, a cylinder and a piston operating therein, a combustion chamber, two communicating air storage chambers one of which opens into the combustion chamber, and valve means adjustable for optionally connecting the other of said air storage chambers to atmosphere, cutting off communication between said air storage chambers, and reestablishing communication between the air storage chambers and closing said other air storage chamber to atmosphere.

FRANZ LANG.