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DECOMPRESSION DEVICE FOR COMBUSTION ENGINES

Filed May 1, 1963

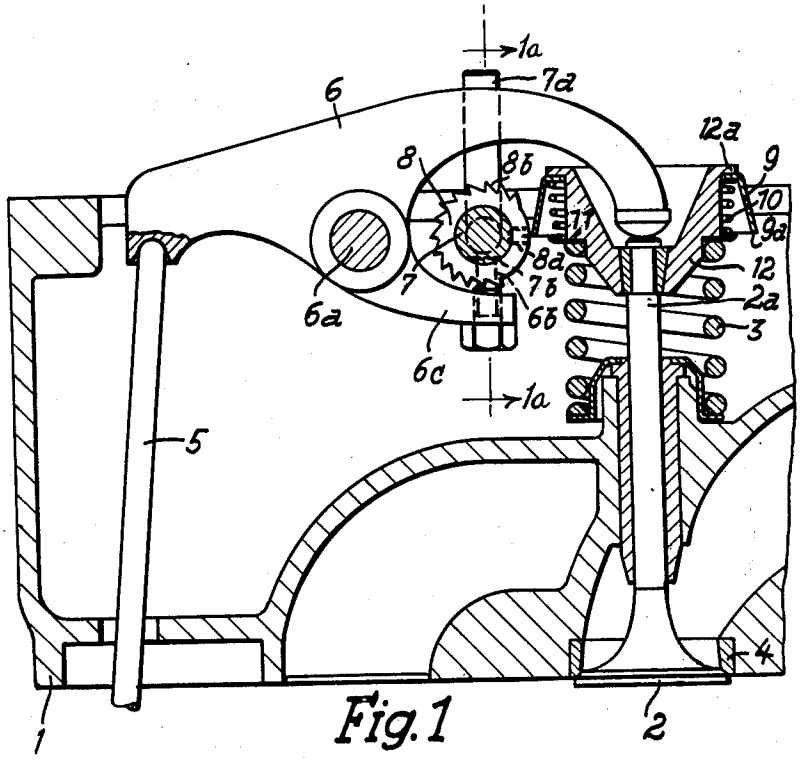


Fig. 1

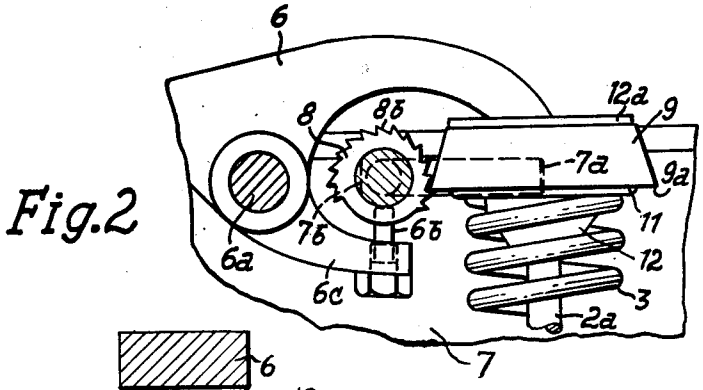


Fig. 2

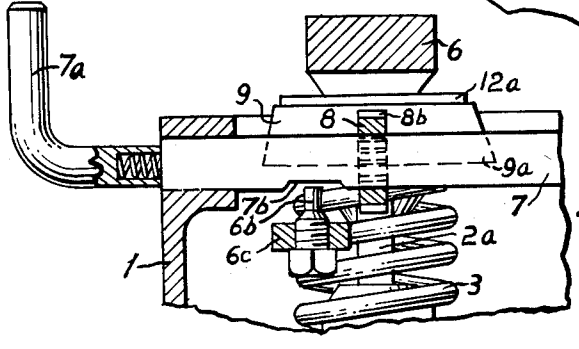


Fig. 1a

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DECOMPRESSION DEVICE FOR COMBUSTION ENGINES

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4 Claims. (Cl. 123—182)

This invention relates to decompression devices in valve-controlled internal combustion engines, particularly compression ignition engines, for facilitating starting thereof.

The invention is concerned, moreover, with such devices including a decompression cam which is arranged to act on a tappet-operated valve rocker and is rotatable in a sense to terminate decompression either by hand or by automatic means comprising a driving disc coupled to the decompression cam and an operating element co-operable with the said disc.

It is already known in connection with a decompression device of this kind to move the driving disc by an actuating lever which is mounted on the tappet or push rod for operating the valve rocker and is capable of being deflected away in resilient fashion upon downward movement of the said tappet. With this arrangement, however, the actuating lever must always assume a constant position relatively to the driving disc and this in turn requires the use of an additional safety device designed to prevent the operating tappet from rotating about its longitudinal axis.

The constructional difficulties involved in the provision of this additional safety device are very troublesome, however, and they also appreciably increase the costs of manufacture and assembly.

The object of the present invention is to obviate these drawbacks of the known mechanisms by the provision of a generally improved decompression device which is simple, compact and efficient in operation.

The decompression device according to this invention is of the kind herein referred to and is characterized in that the operating element is independently rotatable and has a circular working edge co-operating at one point with the driving disc, said element being so coupled with the valve stem as not only to be movable together therewith axially but also to enable at least that portion of the element which co-operates with the driving disc to be moved resiliently away from the latter at each return stroke of the element.

In the preferred embodiment of the invention the operating element which is of cup form, surrounds the valve stem and is pressed against a bearing on this stem by a retaining spring. The said bearing may be constituted by a flange provided on a valve spring abutment secured upon the valve stem. The end of the retaining spring remote from that portion of the operating element pressed against the bearing is arranged to bear against a plate or washer interposed between the valve spring abutment and the relevant end of the valve spring.

A specific example of the improved decompression device according to the invention will now be described with reference to the accompanying drawing, wherein:

FIGURE 1 is a vertical sectional view through the decompression device,

FIGURE 1*a* is a cross-sectional view taken along the lines 1*a*—1*a* of FIGURE 1, and

FIGURE 2 illustrates this device in its effective position.

In FIGURE 1 of the drawing is depicted the valve casing 1 of an internal combustion engine of known compression ignition type. In this casing is provided an outlet valve 2 which is urged upwards against a valve seat

4 by a valve spring 3 serving to close the valve. A tappet 5, movable up and down by an operating means (not shown) is in engagement with one arm of a valve rocker 6 which is mounted to turn about a pivot pin 6*a* in the valve casing 1 and operates to open the valve 2 by forcing it downwardly against the action of the valve spring 3. Thus, the valve 2 is opened in response to each upward movement of the tappet 5 and is closed under the action of the spring 3 during each downward movement of the said tappet.

To simplify the hand turning of the engine during starting, complete closure of the valve 2 is prevented in a generally known manner with the assistance of a decompression device, thereby preventing the development of a compression in the working chamber of the engine which makes the turning laborious. The decompression device illustrated in the drawing comprises a decompression shaft 7 which is mounted beneath the rocker arm 6 and has a reduced end portion projecting from the valve casing 1 and provided with a setting lever 7*a*. The shaft 7 is formed with a milled flat 7*b*. A screw 6*b* mounted in a limb 6*c* of the valve rocker 6 is located directly beneath this flat 7*b* and constitutes a decompression abutment. As will be appreciated the portion of the shaft 7 formed with the flat 7*b* is in the nature of a decompression cam. If the decompression shaft 7 is so set by means of the lever 7*a* that the flat 7*b* is disposed above the screw 6*b* (FIGURE 1), the rocker 6 can move unhampered in the counter-clockwise direction, thereby allowing the valve 2 to be fully closed by its spring 3 at each downward movement of the tappet 5. If, on the other hand, the decompression shaft 7 is turned so that a cylindrical peripheral part of the decompression cam is presented to the screw 6*b* (FIGURE 2), then this screw will knock against the cam during counter-clockwise movements of the valve rocker to prevent complete closure of the valve 2.

When, before starting the engine, the operator has brought in the decompression device (FIGURE 2), he must move it away again by hand to render it inoperative as soon as the fly wheel has attained the speed required for starting. For this purpose the operator must manually restore the setting lever 7 from the position shown in FIGURE 2 to the position of FIGURE 1. This manual procedure is, however, extremely troublesome in the case of large engines because the high degree of internal friction, particularly in cold weather, necessitates the crankshaft being turned with both hands, and consequently the manipulation of the setting lever can only be accomplished with considerable difficulty.

To avoid this manual cut-out after turning, which is very troublesome and frequently a cause of injury, use is made of an automatic cut-out device which, in accordance with the present invention, is of the following construction:

A driving disc 8 is mounted upon the decompression shaft 7 laterally alongside the flat 7*b* on the decompression cam and is secured in positon by means of a screw 8*a*. The driving disc 8 is formed partially around its periphery with ratchet teeth 8*b*, the remainder of the periphery of the disc being plain, e.g. untoothed. A cup-shaped component 12, secured upon the upper end of the valve stem 2*a*, is adapted to serve as an abutment for the upper end of the valve spring 3. The component 12 is formed at its upper end with a peripheral radially extending flange 12*a* against which is held, by a retaining compression spring 10, an annular, inwardly directed and flange-like upper portion of a truncated conical operating element 9 of inverted cup form. The cup-shaped element 9 thus tapers in the upward direction. The lower end of the cup-retaining spring 10 bears against the top side of an annular plate or washer 11 which is interposed between

the valve spring **3** and the abutment shoulder of the component **12**. The upper end of the valve spring **3**, in fact, bears directly against the underside of this washer **11**.

With the engine stopped, the decompression device is in the inactive position shown in FIGURE 1. In this position the flat *7b* on the decompression cam opposes the screw *6b*, and the plain, untoothed peripheral portion of the driving disc **8** is located opposite the circular rim *9a* of the operating element **9**.

Consequently, and since the screw *6b* has been permitted to rise, without contacting the decompression cam, on a counter-clockwise movement of the valve rocker **6**, the valve **2** is fully closed, and the operating element **9** of inverted cup form is in its highest position.

If now the engine is to be started up with the assistance of the decompression device, and the latter is to be automatically cut out after starting, the setting lever *7a* is first shifted in the clockwise direction from its inoperative vertical position indicated in FIGURE 1 to its operative horizontal position indicated in FIGURE 2. This movement of the lever *7a*, will, of course, turn the shaft **7** to the extent that one of the endmost series of the teeth *8b* on the driving disc **8** will be brought into engagement with the circular rim *9a* of the element **9**.

When the engine is turned, during starting, then each time the valve stem *2a* moves downwardly, the driving disc **8** is turned to the extent of one tooth in the clockwise direction by co-operating with the pawl-like rim *9a* of the element **9**, whereas during each upward movement of the valve stem *2a*, the disc **8** remains stationary and the element **9** is first forced away radially as it slides past the upper part of the relevant tooth *8b* and then rocks against the abutment flange *12a*, all against the action of the retaining spring **10**, whereupon the said element is orientated into an axially-parallel position under the action of the spring **10** as its rim *9a* drops in behind the next tooth *8b*. This sequence is repeated until the rim *9a* has reached a position behind the last tooth *8b* of the series and the flat *7b* on the decompression cam is again disposed immediately above the screw *6b* to terminate decompression.

It is left completely to the discretion of the operator to choose the decompression period, that is to say the time at which the decompression device is cut out; if, before the engine starting operation, he sets the driving disc **8** so that the rim *9a* of the disc-operating element **9**—as shown in FIGURE 2—engages behind the first or second operating tooth *8b*, the decompression extends over a fairly long period; that is to say, the decompression will be cut out only after a whole series of valve strokes. The further the driving disc **8** is set in advance of the rim *9a*, the shorter will be the decompression period.

It is also pointed out that at least the principal positions of the setting lever *7a* of the decompression device, for example the rest position depicted in FIGURE 1 and the fully operative position indicated in FIGURE 2, may, if desired, be specifically determined by a well defined detent, e.g. a spring-urged ball catch associated with the decompression shaft **7**. Moreover, if called for by particular operating conditions, a safety means, for example a pawl and ratchet mechanism, may additionally be provided to permit a rotary movement of the shaft **7** and the driving disc **8** in the clockwise direction only. This prevents the setting lever *7a* and the disc **8** from being inadvertently turned in the counter clockwise direction during setting, thereby preventing the rim *9a* of the cup-form operating element **9** being damaged by the teeth *8b* of disc **8** during this movement.

It is also to be noted that the restoring power of the retaining spring **10**, the width of the bearing surface of the flange *12a* and the taper of the operating element **9** must be so related that the said element cannot in any event rock during downward movements of the valve stem *2a*, but will surely engage teeth of the driving disc **8**.

The construction of the automatic decompression device provided according to the present invention, is very simple as the device consists of only a few additional components which can be very easily mass produced in the form of turned or pressed parts. The operating tappet or push rod **5** and also the valve **2** can freely rotate about their longitudinal axes without in anywise impairing the proper functioning of the device. Finally, the space required by the device is extremely small so that the automatic decompression cut-out device can be readily mounted in existing types of compression ignition internal combustion engines.

What I claim is:

1. In an internal combustion engine, the combination comprising a valve port, a valve movable in said valve port to regulate the passage of a fluid therethrough, valve actuating means to move said valve in said port, valve casing means defining a support for said valve actuating means, decompression means comprising a rotatable decompression cam and a driving disc coupled thereto, and an engaging element coupled to said valve and operable to engage said driving disc thereby rotating said decompression cam.

2. In an internal combustion engine, the combination according to claim 1 wherein said driving disc has a toothed portion at the circumference thereof.

3. In an internal combustion engine, the combination according to claim 2 wherein said valve comprises a valve stem and said engaging element comprises a cup-shaped member secured to said valve stem by spring means, a rim of said cup shaped member being engageable with the toothed portion of said driving disc to rotate said driving disc and decompression cam in one direction only.

4. In an internal combustion engine the combination comprising a valve port, a valve having a stem and movable in said port to regulate the passage of a fluid therethrough, first engaging means comprising a cup-shaped engaging member surrounding said valve stem and secured thereto by spring means, a cylindrical and rotatable decompression cam shaft having a flat portion and a partially toothed driving disc laterally displaced from said flat portion and rigidly secured to said shaft, valve actuating means comprising a rocker arm operable to move said valve in said port, said rocker arm comprising second engaging means for contacting said decompression cam shaft at the cylindrical and the flat portions thereof to regulate the movement of said rocker arm thereby limiting valve movement, valve casing means defining a support for said decompression cam shaft and rocker arm, said cup-shaped member of said first engaging means defining a rim engageable with the toothed portion of said driving disc to rotate said disc in one direction only upon movement of said valve stem in a first direction whereby said decompression cam shaft is actuated in one direction only, whereby, upon motion of said valve stem and cup-shaped member in said first direction, the rim of said cup-shaped member engages with the toothed portion of said driving disc to rotate said driving disc and decompression cam shaft in a first rotary direction, and whereby, upon motion of said valve stem and cup-shaped member in a second opposite direction, said cup-shaped member is axially displaced from said driving disc to prevent rotating engagement with said disc thereby providing for rotation of said disc and decompression cam shaft in one direction only.

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CERTIFICATE OF CORRECTION

Patent No. 3,146,772 September 1, 1964

Ernst Hatz, Jr.

It is hereby certified that error appears in the above numbered patent requiring correction and that the said Letters Patent should read as corrected below.

In the grant, lines 1 to 3, for "Ernst Hatz, Jr., of near Passau, Germany, assignor to Motorenfabrik Hatz, G.m.b.H., Co., of Passau, Germany, a corporation of germany," read -- Ernst Hatz, Jr., of Ruhstorf, near Passau, Germany, assignor to Motorenfabrik Hatz, G.m.b.H., Co., of Ruhstorf, near Passau, Germany, a corporation of Germany --; in the heading to the printed specification, lines 4 to 6, for "Ernst Hatz, Jr., near Passau, Germany, assignor to Motorenfabrik Hatz, G.m.b.H., Co., Passau, Germany, a corporation of Germany" read -- Ernst Hatz, Jr., Ruhstorf, near Passau, Germany, assignor to Motorenfabrik Hatz, G.m.b.H., Co., Ruhstorf, near Passau, Germany, a corporation of Germany --.

Signed and sealed this 2nd day of March 1965.

(SEAL)
Attest:

ERNEST W. SWIDER
Attesting Officer

EDWARD J. BRENNER
Commissioner of Patents