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DECOMPRESSION DEVICES FOR INTERNAL COMBUSTION ENGINES

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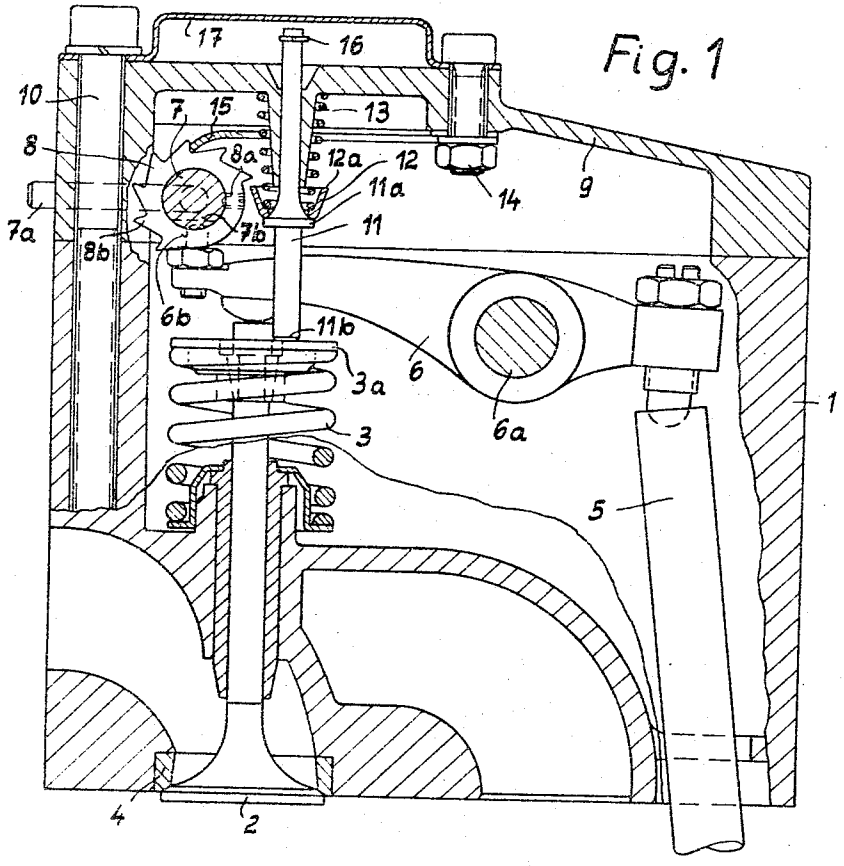


Fig. 1

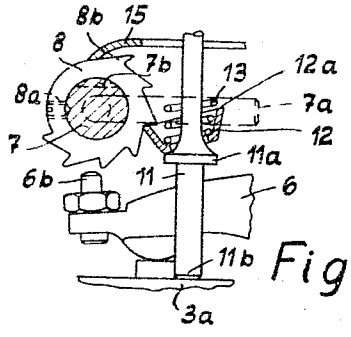


Fig. 2

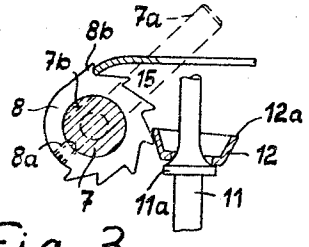


Fig. 3

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DECOMPRESSION DEVICES FOR INTERNAL COMBUSTION ENGINES

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6 Claims. (Cl. 123—182)

This invention relates to decompression devices for valve controlled internal combustion engines, and has reference particularly to such devices of the kind comprising a rotatable decompression element which is capable of being disposed for engagement by a member of or associated with the exhaust valve gear suchwise as to produce a condition of decompression, and is arranged to be turned in the direction necessary to terminate decompression by means coupled to the decompression element and adapted to be automatically operated by a driver in turn actuated from a movable member of the aforesaid valve gear.

Although there is no limitation in this respect, the aforementioned member of the exhaust valve gear may be the conventional rocker by means of which the exhaust valve is pushed off its seat and opened against the action of the valve spring. Thus, either an actual portion of this rocker itself or a pin secured therein may engage the appropriate disposed decompression element to prevent full closure of the exhaust valve and so produce the condition of decompression. In such a case, turning of the decompression element in a direction to terminate decompression will prevent the said element from being engaged by the rocker or the pin secured therein as a consequence of which the exhaust valve will be permitted to close.

Moreover, although the aforesaid means coupled to the decompression element may consist of a peripherally toothed driving disc, whilst the driver is in the nature of a pawl carried by a plunger engaged by a rhythmically rising and falling part of or associated with the exhaust valve gear, there is again no limitation in this respect.

It is an object of the present invention to provide an improved decompression device which not only can be incorporated with advantage in a new internal combustion engine, but if desired can also be applied to any appropriate existing form of internal combustion engine which originally had no automatic decompression device.

The important aim is to enable the application of the invention to an existing engine to be readily carried out without any substantial conversion work and without requiring any additional space for installation between the control parts.

According to this invention, a decompression device of the kind herein referred to for a valve controlled internal combustion engine is characterised in that all the constructional parts of the said device are mounted within a common carrier which is adapted to be secured on a part of the engine surrounding the exhaust valve gear, in such a way that when the carrier is mounted on the engine the driver of the means whereby the decompression element is turned comes automatically into cooperative relationship with the relevant movable member of the exhaust valve gear by which it is activated.

In the preferred embodiment of the invention, the driver is supported by a spring-biassed plunger which is axially displaceable in the common carrier and is so disposed that, when the carrier is mounted on the engine, an end of the plunger will as a matter of course be applied against the relevant movable member of the exhaust valve gear.

In accordance with a further feature of the invention, the common carrier is in the form of an exterior housing cover which closes a part of the engine casing, e.g. cylinder head, serving to house the exhaust valve gear.

In order that the invention may be more clearly understood and readily carried into practical effect, one specific constructional form of the improved decompression device will now be described, by way of example, with reference to the accompanying drawing, wherein:

FIGURE 1 is a cross sectional view of so much of an internal combustion engine as is necessary to illustrate the application thereto of the said decompression device, and

FIGURES 2 and 3 show individual parts of this device in two different working positions.

In the drawing, the cylinder head of an internal combustion engine of known type is designated by the numeral **1**. The exhaust valve indicated at **2** is urged upwardly against a valve seat **4** under the action of a closure spring **3**. A rod **5**, movable up and down by a driving means (not shown), engages a double-armed rocker **6** which is mounted to turn about a spindle **6***a* secured in the cylinder head **1** and is effective to move the exhaust valve **2** downwardly, i.e. in the opening direction. Whenever the rocker-operating rod **5** is moved upwards, the valve **2** is opened against the action of its spring **3**, whereas the said valve closes under the spring action whenever the said rod moves downwards.

To ease the turning of the engine by hand during starting, the exhaust valve **2** is prevented from fully closing at such time by a decompression device so that there is no compression in the working chamber of the engine such as would make starting difficult.

This decompression device includes a decompression element in the form of a spindle **7** which is located above the rocker **6** and is provided on a tapered end portion thereof projecting from the head **1**, with a setting lever **7***a*. A portion **7***b* of the spindle **7** is flattened, at a location above the rocker **6** by virtue of being milled. An adjustable screw threaded pin **6***b* is mounted in the rocker immediately beneath the milled portion **7***b*. If the decompression spindle **7** is set by means of the lever **7***a* so that its milled portion **7***b* is above the pin **6***b* (FIGURE 1), then the rocker **6** is enabled to move without obstruction in the clockwise direction thereby permitting full closure of the valve **2**. If, however, the decompression spindle **7** is turned until its cylindrical surface opposes the pin **6***b* (FIGURE 2), this pin will abut against the rocker **6** during movement of the latter in the clockwise direction, thereby preventing the valve **2** from being fully closed.

Mounted on the decompression spindle **7** laterally alongside the milled portion **7***b* is a driving disc **8** which is held on the said spindle by a screw **8***a*. The spindle **7** is mounted in a cover **9** which is secured by a plurality of screws **10** upon the top of the cylinder head **1** so as to house and enclose from the exterior the parts operating and controlling the exhaust valve **2**. Also mounted in the cover **9** is an axially displaceable plunger **11** which is furnished with a flange **11***a* serving as a bearing for a cup-like driver **12**. A cone-shaped helical compression spring **13** bears at one end against the underside of the cover **9** and at the other end urges the driver **12** against the flange **11***a*.

Secured within the cover **9** by a screw **14** is a leaf spring **15**, the free end of which cooperates with the teeth **8***b* of the driving disc **8** and serves as a catch or detent, so that, for a purpose hereinafter to be described, the disc **8** is only permitted to turn in the counterclockwise direction.

Mounted on the upper end of the plunger **11** is a spring clip **16** which prevents the plunger from falling out of the cover **9** under the influence of the spring **13**. In addition,

a protective end closure plate **17** is secured upon the top of the housing **9** by means of the screws **10** and **14**.

When the cover **9** is mounted on the cylinder head **1**, the lower end **11***b* of the plunger **11** is applied, under the influence of the spring **13**, against the upper face of the valve spring plate **3***a*, whereby, during the running of the engine, the plunger **11** moves up and down in rhythm with the valve **2**. The cup-like driver **12** accompanies the plunger **11** in its up and down movement so that the said driver functions after the manner of a pawl to impel the disc **8** in the counterclockwise direction whenever the decompression device is brought into action.

When the engine is either running or has been stopped, the decompression device is in the ineffective position illustrated in FIGURE 1. In either of these two conditions the screwthreaded pin **6***b* can move up, with a certain amount of play, on to the milled portion **7***b* of the spindle **7**, and a nontoothed zone of the driving disc **8** is located opposite to the circular rim **12***a* of the driver **12**. The valve **2** thus fully closes and the cup-like driver **11** moves idly up and down relatively to the stationary disc **8**. If, on the other hand, the engine is to be started up with the help of the decompression device, in such conditions that decompressin will be automatically cut out after starting has been accomplished, it is necessary to move the setting lever **7***a*, in the counterclockwise direction, from the raised position indicated in FIGURE 1 until a portion of the rim **12***a*, of the driver **12** (in the nature of a circular operative edge) comes into engagement with one of the driving teeth **8***b* on the disc **8**. At the first upward stroke of the plunger **11** in company with the valve spring plate **3***a*, during starting, the disc **8** will consequently be turned to the extent of one tooth in the counterclockwise direciton, whilst during the subsequent downward stroke of the plate **3***a* the disc **8** remains stationary as the driver **12**, in the manner shown in FIGURE 3, slides down past the relevant tooth **8***b*. At this phase of the decompression cycle, the spring **15**, acting as a catch or detent, prevents the driving disc **8** being involuntarily turned in the clockwise direction by any slight pressure exerted laterally thereupon by the driver **12** as it slides past it.

At the conclusion of the downward stroke of the valve spring plate **3***a*, and thus also of the plunger **11** and the driver **12**, the rim **12***a* of the latter drops behind the next driving tooth **8***b*. The described sequence is repeated several times until the rim **12***a* is positioned behind the last one of the series of teeth **8***b*, and the milled portion **7***b* again reaches a position above the pin **6***b*, thereby terminating the decompression. The facility is made freely available to the operator to determine the period of decompression, that is to say the time at which it shall cease. Thus, if, before the starting procedure commences, the driving disc **8** is set by means of the lever **7***a* in such a way that the rim **12***a* of the driver engages behind the first or second tooth **8***b* on the said disc, the decompression period will be a relatively long one for the reason that the driving disc will now cease to turn and thus terminate the decompression until several strokes of the valve **2** have been effected. On the other hand, the further the driving disc **8** is turned relatively to the rim **12***a* of the driver **12** prior to starting, the shorter will be the decompression period.

In the decompression device according to this invention all the constructional parts thereof are housed within a single, i.e. common, carrier or holder, namely the cover **9** adapted to be secured upon the cylinder head **1**.

In certain circumstances the screwthreaded pin **6***b* in the rocker **6** can be omitted. The improved construction therefore has the advantage that the decompression device can be readily assembled as a closed constructional unit and accurately adjusted. Another advantage of the improved construction of the invention lies in the fact that the decompression device does not necessitate the provision of any additional room for installation between the operating parts in the cylinder head; the device can accordingly be applied even to an engine of very compact design. Furthermore, the decompression device of this invention can be applied to an existing engine which had previously been operated without any antomatic decompression device. Such a conversion can be made without difficulty inasmuch as the original cylinder head cover can be removed and readily replaced by a new one carrying a unitary group of decompression elements so arranged that the axially displaceable plunger **11** engages the valve spring plate **3***a*.

Finally, it should be borne in mind that the plunger **11** may alternatively be arranged for engagement by another operating member which rises and falls rhythmically, for example in company with the rocker **6** or its operating rod **5**. Moreover, the principal feature of the invention, namely the assembly of all the constructional elements of the decompression device in a single part of a housing adapted to be readily mounted in position, is not necessarily limited to the particular form of the decompression device actually illustrated in the drawing.

I claim:

1. In a valve controlled internal combustion engine, in combination; an exhaust valve, exhaust valve gear comprising movable members operating and controlling said valve, an engine housing a part of which accommodates and surrounds said valve gear, a rotatable decompression element capable of being disposed for engagement by a relevant one of said valve operating and controlling members suchwise as to prevent full closure of the valve and so produce a condition of decompression, means coupled to the decompression element and operable for turning said element in a direction to terminate decompression, a driver for operating said means, said driver being automatically actuatable from another of the aforesaid members of the exhaust valve gear, and a common carrier in which are mounted the decompression element, the means coupled to the latter for turning it and the said driver being supported by a spring-biassed plunger which is axially displaceable in the common carrier and is so disposed that, when the said carrier is mounted on the engine housing, an end of the plunger will, as a matter of course, be applied against the relevant movable member of the exhaust valve gear.

2. In a valve controlled internal combustion engine, in combination; an engine housing, an exhaust valve slidable in said housing, exhaust valve gear comprising movable valve-operating and controlling members which are accommodated in and surrounded by a hollow part of said housing, an exterior cover secured upon the part of the housing to close the exhaust valve gear, a decompression element which is mounted and rotatable within said cover and is capable of being disposed for engagement by a relevant one of said valve operating and controlling members suchwise as to prevent full closure of the said valve, means within the cover and operable for turning said decompression element in a direction to terminate decompression, a driver for operating said means, and a plunger supporting said driver, said plunger being mounted and axially displaceable in the cover with one of its ends in engagement with another of the movable members of the exhaust valve gear, the cover thereby constituting a common carrier for all of the parts of the decompression mechanism, and the arrangement being such that the very act of mounting this carrier on the engine housing automatically causes the said end of the plunger to come into engagement with the relevant movable member.

3. In a valve controlled internal combustion engine in combination: a cylinder head, an exhaust valve having a stem slidable in said head; exhaust valve gear compris ing a valve spring for closing the valve, a plate secure to said stem and against which the spring bears, a pivote rocker having an arm for acting on the valve stem an depressing the exhaust valve to open same against th action of said spring, and a driven rod for actuating th rocker, said valve gear being accommodated within an surrounded by a hollow part of the cylinder head; an ex

terior cover screwed down upon the said hollow part of the cylinder head to close the exhaust valve gear; a decompression element which is mounted and rotatable within said cover and is capable of being disposed for engagement by the said rocker suchwise as to prevent full closure of said valve; means within the cover and operable for turning said decompression element in a direction to terminate decompression; a driver for operating said means; and a plunger supporting said driver, said plunger being mounted and axially displaceable in the cover with one of its ends in engagement with the valve spring plate, the cover thereby constituting a common carrier for all of the parts of the decompression mechanism, and the arrangement being such that the very act of mounting this carrier on the cylinder head automatically causes the said end of the plunger to come into engagement with the valve spring plate.

4. In a valve controlled internal combustion engine, in combination: a cylinder head; an exhaust valve having a stem slidable in said head; exhaust valve gear comprising a valve spring for closing the valve, a plate secured to said stem and against which the spring bears, a pivoted rocker having an arm for acting on the valve stem and thus depressing the exhaust valve to open same against the action of said spring, and a driven rod for actuating the rocker, said valve gear being accommodated within and surrounded by a hollow part of the cylinder head; an exterior cover screwed down upon the said hollow part of the cylinder head to close the exhaust valve gear; a decompression spindle which is journalled in the cover and has both a cylindrical surface and a flat milled surface for presentation selectively to the rocker arm, the arrangement being such that whenever the spindle is turned to present its cylindrical surface to the rocker arm the exhaust valve is prevented from fully closing whereas the valve is permitted to close when the flat milled surface is presented to the arm; a toothed driving disc which is coupled to the decompression spindle and is turnable to turn the latter in a direction to terminate decompression; a driver for engaging the teeth of said disc; and a plunger supporting said driver, said plunger being mounted and axially displaceable in the cover with one of its ends in engagement with the valve spring plate, the cover thereby constituting a common carrier for all of the parts of the decompression mechanism, and the arrangement being such that the very act of mounting this carrier on the cylinder head automaticallly causes the said end of the plunger to come into engagement with the valve spring plate.

5. A combination as claimed in claim 4, wherein the driver is cup-shaped and is urged by a spring on to a supporting flange provided on the axially displaceable driver, a portion of a circular rim of the latter engaging the teeth on the toothed driving disc.

6. A combination according to claim 4, wherein a leaf spring secured at one end within the cover is arranged with its free end in engagement with a tooth on the driving disc, this spring thus serving as a yieldable detent to permit rotation of the decompression spindle in one direction only.

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