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AIR HEATING MEANS FOR INTERNAL COMBUSTION ENGINES

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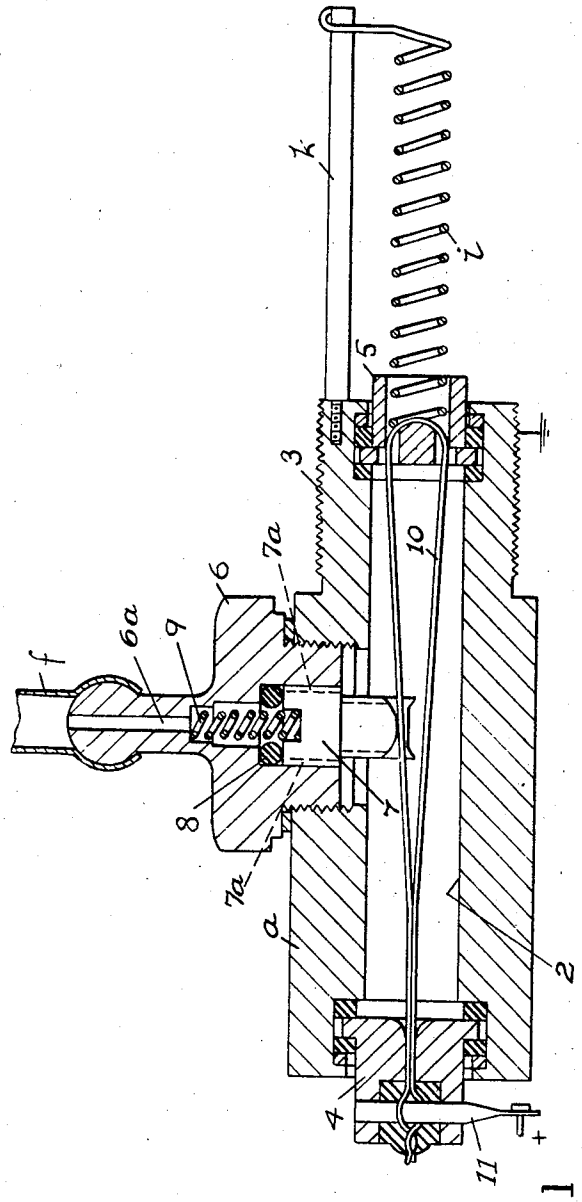



Fig.1

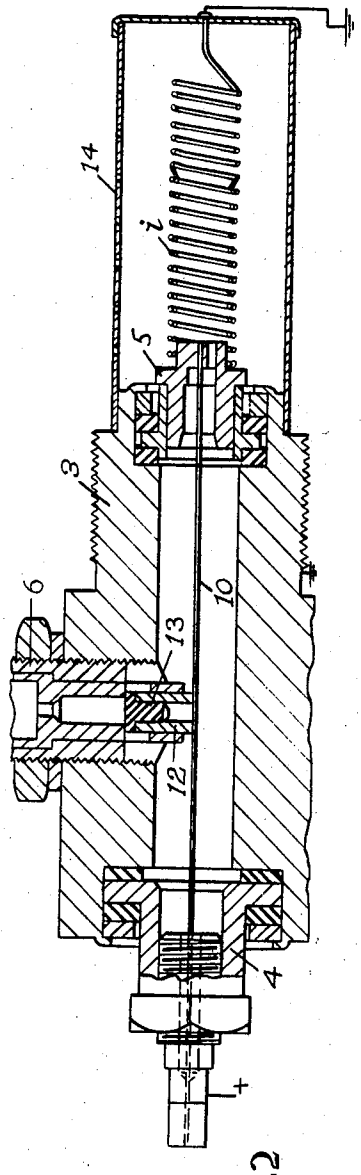



Fig.2

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# AIR HEATING MEANS FOR INTERNAL COMBUSTION ENGINES

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3 Claims. (Cl. 158—28)

This invention has for its object to provide in a simple and convenient form an air-heating means for facilitating the starting of an internal combustion engine of the kind to which the fuel is supplied by pump-injection, the subject of the invention being divided out from that of co-pending application Serial No. 568,095, filed February 27, 1956.

An air-heating means in accordance with the invention comprises in combination an elongated and longitudinally bored body part which forms a fuel supply passage, and which is adapted at one end to be attached to the air intake manifold of the engine so that liquid fuel can be supplied to the manifold through the said passage, a valve having a movable closure member and mounted on the body part to control the admission of liquid fuel thereto, an electrically heatable means extending from the said end of the body part and adapted to be located within the manifold for effecting varporisation and ignition of the fuel supplied thereto through the said passage, and a thermally deformable and electrically heatable element arranged in the body part for controlling movement of the valve closure member, the thermally deformable element being electrically connected to the fuel vaporising and igniting means so that electric current can be supplied to the last mentioned means through the thermally deformable element.

In the accompanying drawings,

Figure 1 is a sectional side elevation illustrating one embodiment of the invention.

Figure 2 is a similar view to Figure 1 illustrating another embodiment of the invention.

The embodiment shown in Figure 1, comprises an elongated body part *a* of substantially cylindrical form and having therein a relative large axial bore **2** extending throughout the length of the plug, the end **3** of the body part being externally screw threaded for engagement with a corresponding hole in one side of the air intake manifold (not shown) of the engine. The outer end of the bore is closed by a metal terminal piece **4** which is electrically insulated from the body part, and at the other end of the bore is secured a metal bushing **5** which is also electrically insulated from the body part.

In a hole formed in one side of the body part, is secured a valve housing **6** having therein a stepped axial bore **6***a*, the portion of the bore of smaller diameter being situated at the outer end of the valve housing which is adapted for the attachment thereto of a flexible or other tube *f* for conveying fuel to the housing. Within the inner portion of the bore **6***a* is arranged a freely slidable closure member **7** of substantially cylindrical form, which at one end abuts against a flexible sealing ring **8** in the adjacent part of the bore. The periphery of the closure member **7** is formed with longitudinal grooves **7***a* through which fluel can flow to the axial bore in the body part *a* when the closure member is moved away from the sealing ring **8** by a spring **9** in the bore **6***a* of the valve housing.



In the bore of the body part is contained an electrically heatable element **10** adapted (when cold) to hold the closure member in contact with the sealing ring. This element is made from a length of wire bent to a hair-pin form and having its free ends twisted together. The twisted ends of this element are inserted through and sealed by solder or other means to the terminal piece **4**, the other or bent end of the element being supported by the bushing **5**. One side of the element **10** bears against the inner end of the closure member **7** and the element is such that by the heating action of the current passed through it a deformation occurs which permits the closure member to be moved to its open position by the spring **9**.

On the inner end of the body part is attached a longitudinally extending stem *k* which at the end remote from the body part has attached to it one end of the vaporising and igniting coil *i*, the other end of this coil being supported by the bush **5** and being in contact with the bent end of the element **10**. The coil *i* may be of uniform diameter and have equi-spaced convolutions as shown. Alternatively, the coil may have differentially spaced convolutions, and may be of non-uniform diameter, so that a given current through the coil effects non-uniform heating thereof.

Electrical connection with the element **10** is effected by a peg **11** inserted through the part **4** and adapted for attachment thereto of a current supply conductor, the circuit being completed through the earthed body part *a* and being controlled by an convenient switch (not shown).

The arrangement is such that when no current passes the closure member is held in its closed position by the element **10**. To bring the device into action the switch is closed, and the current which then passes causes the vaporising and ignition coil *i* to be heated. Meanwhile the heating action of the current on the element **10** causes it to be deformed for release of the valve closure member **7**, the time occupied before the closure member is released being sufficient to allow the coil *i* to be sufficiently heated to perform its function before the valve closure member is released. The flame resulting from ignition of the vapour serves to warm the air flowing to the engine through the air intake manifold as already described.

An alternative construction of the device shown in Figure 1 is shown in Figure 2. This example differs in that the element **10** consists of a flat strip or straight wire which at its ends is anchored to the parts **4**, **5**. At one side the element **10** support a hollow plug **12** which carries a closure member **13** made from rubber or rubber-like material and adapted to bear against an annular seating in the body part **6** of the valve. One end of the coil *i* tightly embraces a portion of the part **5** and the other end is attached to a hollow protective shield **14** of cylindrical form, the shield being supported at one end on the body part *a*, and being perforated at (at least) its downstream side. Preferably the coil *i* consists for a part of its length of inner and outer mutually contacting helical coils as shown, the outer coil being extended at one end in the form of a single coil which is attached to the shield **14**. The action of the device shown in Figure 2 is essentially similar to that shown in Figure 1, heating of the element **10** enabling it to release the closure member **13** and so allow fuel to pass through the valve and through the body part to the coil *i*. On cooling, the element **10** returns the closure member to its closed position.

Having thus described our invention what we claim as new and desire to secure by Letters Patent is:

1. An air-heating means for facilitating the starting of an internal combustion engine to which fuel is sup-

plied by pump-injection, and which is provided with an air intake manifold, comprising in combination an elongated and longitudinally bored body part which forms a fuel supply passage, and which is adapted at one end to be attached to the air intake manifold so that liquid fuel can be supplied to the manifold through the said passage, a valve having a movable closure member and mounted on one side of the body part to control the admission of liquid fuel thereto, an electrically heatable means extending from the said end of the body part and adapted to be located within the manifold for effecting vaporisation and ignition of fuel supplied thereto through the said passage, a thermally deformable and electrically heatable elongated element mounted longitudinally in the body to serve as a support for retaining the valve closure member in its closed position until the thermally deformable element is heated whereupon deformation thereof permits the valve closure member to open, the thermally deformable element being electrically connected to the fuel vaporising and igniting means so that electric current can be supplied to the last mentioned means through the thermally deformable element.

2. An air-heating means according to claim 1, in which the thermally deformable element consists of a length



of wire bent to a hair-pin form and having its free ends twisted together, the said element having in combination therewith a terminal piece which is situated at one end of the body part, and to which the twisted free ends of the thermally deformable element are attached, and a bush which is situated at the other end of the body part, and to which the other end of the thermally deformable element is attached, an intermediate portion of the deformable element serving to support the closure member of the valve.

3. An air-heating means according to claim 1, in which the thermally deformable element is anchored at its ends to opposite ends of the body part, an intermediate portion of the said member serving to support the closure member of the valve.

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