

PATENT SPECIFICATION

(11) 1309 256

DRAWINGS ATTACHED

- (21) Application No. 4303/70 (22) Filed 29 Jan. 1970
(23) Complete Specification filed 1 July 1970
(44) Complete Specification published 7 March 1973
(51) International Classification F04B 49/02
(52) Index at acceptance
F1N 2D1A
F1B 2B12 2B13E 2B13F 2B25 5R2 6X1
(72) Inventor FOONG WENG HING



(54) IMPROVEMENTS IN OR RELATING TO THE CONTROL OF ENGINE-DRIVEN COMPRESSORS

(71) I, FOONG WENG HING, of 83 Kuala Kangsar Road, Ipoh, West Malaysia, Federation of Malaysia, a Malaysian Citizen, do hereby declare the invention, for which I pray that a patent may be granted to me, and the method by which it is to be performed to be particularly described in and by the following statement:—

The invention relates to the control of engine-driven compressors, especially compressors in air conditioning systems of engine-driven vehicles.

The provision of an air conditioning system is very desirable in vehicles intended for use in a hot climate, and such systems are now frequently provided in vehicles driven by an internal-combustion engine, particularly automobiles, the system employing a compressor that is driven by the vehicle engine, for example via a magnetic clutch.

However, the additional load presented to the engine by such a compressor may have an adverse effect in adverse climatic conditions, as the engine may be caused to over-heat due to the additional load.

One object of the present invention is to provide a control system which substantially avoids any danger of engine overheating due to such over-loading during idling or acceleration, and preferably also when running at speeds above a given maximum.

The invention consists in an engine driven compressor in which the compressor is provided with an automatic control system, said system comprising a first monitoring arrangement operable to cause unloading of the compressor when the engine is idling, and a second monitoring arrangement operable to cause unloading of said compressor when said engine is called upon to deliver immediate extra power.

The invention will now be described with reference to the drawing, which schematically illustrates one exemplary embodiment.

The automatic control system illustrated in the drawing operates the energising circuit of a

magnetic clutch (not shown) that is provided to enable an engine 1 to drive the compressor (not shown) of an air conditioning system.

The energising circuit of the magnetic clutch is connected to a terminal 2, and a circuit is completed to a positive power supply terminal 3 to engage the clutch via contacts r1 of a first monitoring relay R1, contacts s of a vacuum-operated switch S, and contacts r2 of a further monitoring relay R2.

To provide a first monitoring stage, the relay R1 is connected in the collector circuit of a transistor T2 whose base is connected to the junction of a resistor 4 and a capacitor 5, which are connected in series between the supply terminal 3 and a negative supply terminal 6. The capacitor 5 serves as an integrator to count pulses applied via a transistor T1, the resistor 4 being connected in the collector circuit of the transistor T1, whose base is connected via an adjustable resistor 7 and a limiting resistor 8 to the circuit breaker of the engine distributor (not shown). This monitoring stage is adjusted so that the relay R1 is energised to release the magnetic clutch when the engine is only operating at its idling speed, but de-energises the relay R1 at higher engine speeds.

A second monitoring stage is provided by the vacuum-operated switch S in this embodiment, which acts to release the magnetic clutch when the vacuum in the inlet manifold 1A of the engine 1 has a value indicating that the engine controls have been adjusted to give maximum acceleration.

A further monitoring stage is provided in this embodiment containing the relay R2 and a further electronic pulse counter 9, which is similar to that comprising the transistors T1 and T2, but is set to energise the relay R2, and thus release the magnetic clutch, when the engine is running at speeds above a pre-determined maximum. In alternative embodiments, the relay R1 may be arranged to be operated when the engine is running above a maximum speed in addition to being

operated when the engine is at idling speed, or the vacuum-switch S can be utilised to operate the relay R1.

5 The control system enables the air conditioning system to be cut-off when the engine is idling, to prevent any danger of the additional load presented by the compressor leading to over-heating of the engine when the cooling is insufficient due to the vehicle being
10 stationary or slowly moving. The first monitoring stage can be adjusted so that the air-conditioning system becomes operational as soon as the engine speed reaches a given value, for example 900 r.p.m. The simple
15 transistorised pulse counter shown in the drawing can be readily constructed as a solid-state integrated circuit, and if required, a switching transistor stage can be used in place of the relay R1. To permit the vehicle
20 to attain its maximum speed when required, the further monitoring stage 9 enables the load of the compressor to be disengaged, so that the vehicle performance is unaffected at top engine speeds. Furthermore, to give maximum
25 acceleration at intermediate speeds, the vacuum switch S enables the full power of the engine to be utilised when over-taking or hill-climbing, and an adjusting screw 10 enables the cut-off condition to be set.
30 A breather tube 11 is provided, the tube extending from the upper part of a fuel tank 12 in the vehicle to the inlet manifold 1A of the engine 1. This gives a valuable improvement in fuel economy, since the significant
35 amount of petrol vapour normally wasted in a hot climate is conveyed via the breather tube 11 to be consumed by the engine 1.

WHAT I CLAIM IS:—

40 1. An engine driven compressor in which the compressor is provided with an automatic control system, said system comprising a first monitoring arrangement operable to cause unloading of said compressor when
45 said engine is idling, and a second monitoring arrangement operable to cause unloading of said compressor when said engine is called upon to deliver immediate extra power.

2. An engine driven compressor as claimed in Claim 1, in which said first monitoring arrangement or a further monitoring arrangement is operable to unload said compressor when said engine is operating above a predetermined maximum speed. 50

3. An engine driven compressor as claimed in Claim 1 or Claim 2, in which said first monitoring arrangement and/or said further monitoring arrangement employs a revolution counter to measure the speed of said engine. 55

4. An engine driven compressor as claimed in Claim 3, in which said revolution counter comprises an electronic pulse counter. 60

5. An engine driven compressor as claimed in any preceding Claim, in which said second monitoring arrangement employs a vacuum-operated switch coupled to the inlet manifold of said engine. 65

6. An engine driven compressor as claimed in any preceding Claim, in which said compressor is driven via a magnetic clutch controlled by said monitoring arrangements. 70

7. An engine driven compressor substantially as described with reference to the drawing.

8. An engine-driven vehicle having an engine driven compressor as claimed in any preceding Claim, said compressor forming part of an air conditioning system and said engine driving both said vehicle and said compressor. 75

9. An engine-driven vehicle as claimed in Claim 8, in which a breather tube is provided between the upper region of the vehicle fuel tank and the inlet manifold of said engine. 80

For the Applicants,
G. F. REDFERN & CO.,
St. Martin's House,
177 Preston Road,
Brighton.
and
Chansitor House,
38 Chancery Lane,
London, W.C.2.



operated when the engine is at idling speed, or the vacuum-switch S can be utilised to operate the relay R1.

5 The control system enables the air conditioning system to be cut-off when the engine is idling, to prevent any danger of the additional load presented by the compressor leading to over-heating of the engine when the cooling is insufficient due to the vehicle being
10 stationary or slowly moving. The first monitoring stage can be adjusted so that the air-conditioning system becomes operational as soon as the engine speed reaches a given value, for example 900 r.p.m. The simple
15 transistorised pulse counter shown in the drawing can be readily constructed as a solid-state integrated circuit, and if required, a switching transistor stage can be used in place of the relay R1. To permit the vehicle
20 to attain its maximum speed when required, the further monitoring stage 9 enables the load of the compressor to be disengaged, so that the vehicle performance is unaffected at top engine speeds. Furthermore, to give maximum
25 acceleration at intermediate speeds, the vacuum switch S enables the full power of the engine to be utilised when over-taking or hill-climbing, and an adjusting screw 10 enables the cut-off condition to be set.

30 A breather tube 11 is provided, the tube extending from the upper part of a fuel tank 12 in the vehicle to the inlet manifold 1A of the engine 1. This gives a valuable improvement in fuel economy, since the significant
35 amount of petrol vapour normally wasted in a hot climate is conveyed via the breather tube 11 to be consumed by the engine 1.

WHAT I CLAIM IS:—

40 1. An engine driven compressor in which the compressor is provided with an automatic control system, said system comprising a first monitoring arrangement operable to cause unloading of said compressor when
45 said engine is idling, and a second monitoring arrangement operable to cause unloading of said compressor when said engine is called upon to deliver immediate extra power.

2. An engine driven compressor as claimed in Claim 1, in which said first monitoring arrangement or a further monitoring arrangement is operable to unload said compressor when said engine is operating above a pre-determined maximum speed. 50

3. An engine driven compressor as claimed in Claim 1 or Claim 2, in which said first monitoring arrangement and/or said further monitoring arrangement employs a revolution counter to measure the speed of said engine. 55

4. An engine driven compressor as claimed in Claim 3, in which said revolution counter comprises an electronic pulse counter. 60

5. An engine driven compressor as claimed in any preceding Claim, in which said second monitoring arrangement employs a vacuum-operated switch coupled to the inlet manifold of said engine. 65

6. An engine driven compressor as claimed in any preceding Claim, in which said compressor is driven via a magnetic clutch controlled by said monitoring arrangements. 70

7. An engine driven compressor substantially as described with reference to the drawing.

8. An engine-driven vehicle having an engine driven compressor as claimed in any preceding Claim, said compressor forming part of an air conditioning system and said engine driving both said vehicle and said compressor. 75

9. An engine-driven vehicle as claimed in Claim 8, in which a breather tube is provided between the upper region of the vehicle fuel tank and the inlet manifold of said engine. 80

For the Applicants,
G. F. REDFERN & CO.,
St. Martin's House,
177 Preston Road,
Brighton.
and
Chansitor House,
38 Chancery Lane,
London, W.C.2.