COMMONWEALTH of AUSTRALIA  
Patents Act 1952  
APPLICATION FOR A STANDARD PATENT

I/We  
Austin Rover Group Limited  
of  
Fletchamstead Highway, Canley, Coventry, CV4 9DB, United Kingdom  
hereby apply for the grant of a Standard Patent for an invention entitled:  

An internal combustion engine inlet manifold  
which is described in the accompanying complete specification.

Details of basic application(s):-

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<th>Number</th>
<th>Convention Country</th>
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<tr>
<td>8819431.1</td>
<td>United Kingdom</td>
<td>16 August 1988</td>
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The address for service is care of DAVIES & COLLISON, Patent Attorneys, of 1 Little Collins Street, Melbourne, in the State of Victoria, Commonwealth of Australia.

DATED this TWENTY EIGHTH day of JUNE 1989

To: THE COMMISSIONER OF PATENTS

[Signature]

a member of the firm of DAVIES & COLLISON for and on behalf of the applicant(s)

Davies & Collison, Melbourne
1. An internal combustion engine inlet manifold comprising a housing defining a plenum and at least one inlet tract having first and second lengths one of which extends away from the plenum for connection to an engine and at least one rotary valve member supported by the housing, wherein the or each valve member is rotatable from a first position in which the first and second lengths are connected in series between the plenum and the engine via the or each valve member and a second position in which connection is made between the plenum and the engine solely by means of the first length of the or each inlet tract via the or each valve member.
NAME & ADDRESS
OF APPLICANT:

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COMPLETE SPECIFICATION FOR THE INVENTION ENTITLED:

An internal combustion engine inlet manifold

The following statement is a full description of this invention, including the best method of performing it known to me/us:-
This invention relates to internal combustion engines and in particular to an inlet manifold for an internal combustion engine in which the inlet tract length is switchable between at least two lengths.

In order to improve the performance of an internal combustion engine it is desirable to reduce the length of the inlet tract as the rotational speed of the engine is increased.

It is known to provide for example from GB2174454 a cast aluminium inlet manifold having a single plenum a first length of inlet passage extending from the plenum for connection to an engine to which the inlet manifold is to be connected, a second length of inlet passage extending from the plenum to a valve, the valve being operable to either connect the first and second lengths of inlet passage in series or to connect the first inlet passage directly to the plenum.

It is an object of this invention to provide an internal combustion engine having an improved inlet manifold.

According to the invention there is provided an internal combustion engine inlet manifold comprising a housing
defining a plenum and at least one inlet tract having first and second lengths one of which extends away from the plenum for connection to an engine and at least one rotary valve member supported by the housing, wherein the or each valve member is rotatable from a first position in which the first and second lengths are connected in series between the plenum and the engine via the or each valve member and a second position in which connection is made between the plenum and the engine solely by means of the first length of the or each inlet tract via the or each valve member.

Preferably, the housing is formed as two halves secured together there being a first half and a second half.

Preferably, the rotary valve member is located in a valve chamber formed as an integral part of a least one of said first and second halves.

Preferably, each first length extends from the valve chamber for connection to said engine and each second length extends from the valve chamber to the plenum.

Advantageously, the plenum is connected to the valve chamber and to the second length via bellmouth shaped entry portions.
This has the advantage that a smooth air flow between the plenum and the valve chamber or the second length is produced thereby increasing the efficiency of the inlet manifold.

Advantageously, at least part of the or each second length is formed by a fabricated tube.

This has the advantage that the length of the second length can be altered without the need for a new housing.

Preferably, the second half is made of a plastics material.

This has the advantage of low weight combined with good vibration absorption.

Advantageously, the rotary valve member is made of a plastics material. This has the advantage of low weight and if the same material is used as for the lower part the effects of differential thermal expansion are minimised.

Advantageously, each inlet tract has an independent valve member associated with.

This has the advantage that switching from the first position to the second position or vice-versa can be
effected at the most efficient point in time.

The invention will now be described by way of example with reference to the accompanying drawing of which:

Figure 1 is a plan view of an internal combustion engine inlet manifold according to the invention;

Figure 2 is a view in the direction of arrow 'E' on Figure 1 but showing only a lower half of the inlet manifold;

Figure 3 is a part section along the line A-A on Figure 2;

Figure 4 is a view in the direction of arrow 'T' on Figure 2;

Figure 5 is a view in the direction of arrow 'S' on Figure 1 but showing only the lower half of the inlet manifold;

Figure 6 is a cross section along the line B-B on Figure 5;

Figure 7 is a cross section along the line C-C on Figure 1 showing a rotary valve member of the inlet manifold in a first position;
Figure 8 is a cross section similar to Figure 7 but showing the rotary valve member in a second position.

With reference to the figures there is shown an internal combustion engine inlet manifold having a plenum 11 and a number of inlet tracts 12.

The plenum 11 is defined by a two part housing there being an first half 25 cast from aluminium alloy and a second half 26 moulded from plastics material the two halves being secured together to form the plenum 11.

Each of the inlet tracts 12 is in two lengths, there being a first length 13 extending from the plenum 11 for connection by means of a flange 19 to a respective inlet port of an engine 50 and a second length 14 connected at both ends to the plenum 11.

Each of the first lengths 13 is defined by a passageway 23 cast into the first half 25 and by a further passageway 33 moulded into the second half 26.

Each of the second lengths 14 is defined by a passageway 24 moulded into the second half 26, a fabricated bellmouth 16 and by a fabricated tube 34.
Each of the bellmouths 16 is push fitted into one end of a respective passageway 24 to connect that passageway with the plenum 11.

Each of the fabricated tubes 34 extends externally of the plenum 11 and is connected to the second half 26 at both ends by respective couplings 29.

A number of valve chambers 30 are moulded as an integral part of the second half 26. Each of the valve chambers 30 has a valve element of a valve member 15 located in it.

Each of the valve chambers 30 is connected to a respective passageway 23 and tube 34 and to the plenum 11.

Each of the valve chambers 30 is connected to the plenum 11 via a respective bellmouth shaped inlet 31.

The rotary valve member 15 is rotatably mounted at both end portions by means of bearings 35,36 located in end caps 37,38 and is rotatable from a first position in which it connects the first and second lengths 13 and 14 together to a second position in which it connects the first length 13 to the inlet 31 by an actuator in the form of a solenoid 17 and associated linkage 18.
The solenoid 17 is energised by a control unit 32 when the engine speed exceeds a pre-determined speed to move the rotary valve 15 into said second position or to move the rotary valve 15 into said first position if the engine speed drops below the pre-determined speed.

An engine speed signal is supplied to the control unit 32 from a speed sensor 39 for comparison with a pre-determined value to check whether the speed is above or below said pre-determined speed.

The rotary valve member 15 is moulded from the same plastics material as the lower half 26 and has a number of transverse ducts 40 formed in it at positions corresponding to the locations of the inlets 31 to provide the connection between said first and second lengths 13,14 and said inlets 31 in said first and second positions.

Operation of the inlet manifold is as follows; when the engine speed is below a predetermined average rotational speed as sensed by the speed sensor 39 the rotary valve member 15 is in said first position as shown in Figure 7.

In this first position the first and second lengths 13 and 14 are connected together to form one long inlet tract.
As air is drawn into the plenum 11 via an aperture 21 in the upper half 25 it enters the or each second length 14 via the respective bellmouth 16 and travels along the respective passageway 24 and tube 34 defining that second length 14 to the rotary valve member 15. The air is then transferred via the cooperating duct 40 into the corresponding passageways 23, 33 to the respective inlet port of the engine 50.

When the engine speed as measured by the speed sensor 39 exceeds said predetermined rotational speed the solenoid 17 is energised by the control unit 32 causing the rotary valve member 15 to be rotated to said second position as shown in Figure 8 thereby disconnecting the first and second lengths 13 and 14.

In this second position air enters the plenum 11 via the aperture 21 and passes through the inlets 31 directly into the ducts 40 of the rotary valve member 15. The air flows through the ducts 40 and into the passageways 23, 33 to the respective inlet port of the engine 50.

When the engine speed as measured by the speed sensor 39 falls below said predetermined rotational speed the solenoid 17 is energised by the control unit 32 causing the rotary valve member 15 to be rotated back to said first position thereby re-connecting the first and second lengths 13 and 14.
The length of the inlet tract 12 is therefore switchable between a long length utilising the first and second lengths 13 and 14 connected in series to produce good torque at low engine speeds and a short length utilising the first length 13 only to produce improved power at higher engine speeds.

In either case a smooth entry to the or each inlet tract is ensured by providing a bellmouth shaped entry portion in the form of the bellmouth 16 and inlet 31.

Although this invention has been described with respect to a specific embodiment in which the valve member is of unitary construction having a number of separate ducts moveable in unison it is not limited to such a construction. Each of the inlet tracts may have a separate valve member moveable independently of the others so that switching can occur at the most efficient point in time. For example the switching could occur at the first time a piston of the engine associated with that inlet tract enters a compression stroke after the pre-determined speed has been exceeded.

Similarly, other forms of actuator could be used to replace the solenoid described herein.
CLAIMS
THE CLAIMS DEFINING THE INVENTION ARE AS FOLLOWS.

1. An internal combustion engine inlet manifold comprising a housing defining a plenum and at least one inlet tract having first and second lengths one of which extends away from the plenum for connection to an engine and at least one rotary valve member supported by the housing, wherein the or each valve member is rotatable from a first position in which the first and second lengths are connected in series between the plenum and the engine via the or each valve member and a second position in which connection is made between the plenum and the engine solely by means of the first length of the or each inlet tract via the or each valve member.

2. An internal combustion engine inlet manifold as claimed in claim 1 in which the housing is formed by a first half and a second half secured together.

3. An internal combustion engine inlet manifold as claimed in claims 1 or 2 in which each rotary valve member is located in a valve chamber formed as an integral part of at least one of said first and second halves.
4. An internal combustion engine inlet manifold as claimed in claim 3 in which each first length extends from a respective valve chamber for connection to said engine and each second length extends from the valve chamber to the plenum.

5. An internal combustion engine inlet manifold as claimed in claims 3 or 4 in which each valve chamber is connected to the plenum via a bellmouth shaped inlet.

6. An internal combustion engine inlet manifold as claimed in any preceding claim in which the second length is connected to the plenum via a bellmouth entry portion.

7. An internal combustion engine inlet manifold as claimed in any of claims 2 to 6 in which at least part of the or each first length is formed by a passageway in the first half.

8. An internal combustion engine inlet manifold as claimed in any of claims 2 to 7 in which at least part of the or each second length is formed by a passageway in the second half.
9. An internal combustion engine inlet manifold as claimed in any of claims 2 to 8 in which at least part of the or each second length is formed by a fabricated tube.

10. An internal combustion engine inlet manifold as claimed in any of claims 2 to 9 in which the first half is cast from an aluminium alloy.

11. An internal combustion engine inlet manifold as claimed in any of claims 2 to 10 in which the second half is made of a plastics material.

12. An internal combustion engine inlet manifold as claimed in any of claims 1 to 11 in which the or each rotary valve member is made of plastics material.

13. An internal combustion engine inlet manifold as claimed in claim 11 in which the or each rotary valve member is made of the same plastics material as the second half.

14. An internal combustion engine inlet manifold as claimed in any of claims 1 to 13 in which the rotary valve member has the same number of transverse ducts formed in it as there are inlet tracts.
15. An internal combustion engine inlet manifold as claimed in any of claims 1 to 13 in which each inlet tract has an independent valve member associated with it.

16. An internal combustion engine inlet manifold as claimed in any of claims 1 to 15 in which the or each valve member is moveable from said first position to said second position by an actuator when a pre-determined engine speed has been reached.

17. An internal combustion engine inlet manifold as claimed in any preceding claim in which the or each valve member is moveable from said second position to said first position by an actuator when the engine speed falls below a pre-determined speed.

18. An internal combustion engine inlet manifold substantially as described herein with reference to the accompanying drawings.
19. The steps, features, compositions and compounds disclosed herein or referred to or indicated in the specification and/or claims of this application, individually or collectively, and any and all combinations of any two or more of said steps or features.

DATED this TWENTY EIGHTH day of JUNE 1989

Austin Rover Group Limited

by DAVIES & COLLISON
Patent Attorneys for the applicant(s)
position to the second position or vice-versa can be
thereby re-connecting the first and second lengths 13 and 14.