FORM 1

COMMONWEALTH OF AUSTRALIA

PATENTS ACT 1952

599395

APPLICATION FOR A STANDARD PATENT

I\We,

SANDEN CORPORATION

of 20 KOTOBUKI-CHO
ISESAKI-SHI
GUNMA-KEN
JAPAN

hereby apply for the grant of a standard patent for an invention entitled:

ELECTROMAGNETIC CLUTCH

which is described in the accompanying complete specification

Details of basic application(s):

Number of basic application	Name of Convention country in which basic application was filed	Date of basic application
P 160907/61	JP	10 JUL 86

My/our address for service is care of CLEMENT HACK & CO., Patent Attorneys, 601 St. Kilda Road, Melbourne 3004, Victoria, Australia.

DATED this 09th day of July 1987

SANDEN CORPORATION

APPLICATION ACCEPTED AND AMENDMENTS

ALLOWED 3-5-90

CLEMENT HACK & CO.

TO: The Commissioner of Patents.

LODGED AT SUB-OFFICE
- 9 JUL 1987
Melbourne

FEE STAMP TO VALUE OF $135 ATTACHED
OFFICER

PATENT OFFICE AUSTRALIA FIFTY DOLLARS
PATENT OFFICE AUSTRALIA FIFTY DOLLARS
PATENT OFFICE AUSTRALIA TWENTY DOLLARS
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PATENT OFFICE AUSTRALIA FIVE DOLLARS

Forms 7 and 8

AUSTRALIA

Patents Act 1952

DECLARATION IN SUPPORT OF A CONVENTION OR NON-CONVENTION APPLICATION FOR A PATENT OR PATENT OF ADDITION

Name(s) of Applicant(s)

In support of the application made by Sanden Corporation

for a patent for an invention entitled

Title

Electromagnetic Clutch

Name(s) and address(es) of person(s) making declaration

I/We, Masayoshi Ushikubo
c/o Sanden Corporation
20 Kotobuki-cho, Isesaki-shi, Gunma, 372 Japan

do solemnly and sincerely declare as follows:-

1. I am/we are the applicant(s) for the patent, or am/are authorised by the abovementioned applicant to make this declaration on its behalf.

2. The basic application(s) as defined by Section 141 of the Act was/were made in the following country or countries on the following date(s) by the following applicant(s) namely:-

Country, filing date and name of Applicant(s) for the or each basic application

in Japan on 10th July, 1986
by Sanden Corporation
in _____ on _____ 19____
by _____

3. The said basic application(s) was/were the first application(s) made in a Convention country in respect of the invention the subject of the application.

Name(s) and address(es) of the or each actual inventor

4. The actual inventor(s) of the said invention is/are

Takatoshi Koitabashi
90-5 Yanase Annaka-shi, Gunma, 379-01 Japan

See reverse side of this form for guidance in completing this part

5. The facts upon which the applicant(s) is/are entitled to make this application are as follows:-

The applicant is the assignee of the actual inventor.

DECLARED at Isesaki this 28th day of August, 1987

M. Ushikubo

Masayoshi Ushikubo, Vice-President

This form may be completed and filed after the filing of a patent application but the form must not be signed until after it has been completely filled in as indicated by the marginal notes. The place and date of signing must be filled in. Company stamps or

(12) PATENT ABRIDGMENT (11) Document No. AU-B-75509/87
(19) AUSTRALIAN PATENT OFFICE (10) Acceptance No. 599395

(54) Title
ELECTROMAGNETIC CLUTCH

International Patent Classification(s)
(51)[4] F16D 003/12 F16D 027/14

(21) Application No. : 75509/87 (22) Application Date : 09.07.87

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SANDEN CORPORATION

(72) Inventor(s)
TAKATOSHI KOITABASHI

(74) Attorney or Agent
GRIFFITH HACK & CO. MELBOURNE

(56) Prior Art Documents
US 4493407
US 3752279

(57) Claim

1. An electromagnetic clutch comprising, a first rotatable member arranged for rotation about a drive shaft, the first rotatable member having an axial end plate of magnetic material, a second rotatable member connected to the drive shaft, an annular armature plate of magnetic material disposed to face said axial end plate of said first rotatable member with an axial gap therebetween, said annular armature plate being capable of limited axial movement, and electromagnetic means associated with said axial end plate for attracting said armature plate to said axial end plate of said first rotatable member, a radial flange formed on said second rotatable member and provided with a plurality of pairs of first projecting potions on an axial end surface thereof, a damper plate disposed adjacent said armature plate and connected with said armature plate through a plurality of leaf springs, said damper plate having a plurality of pairs of second projecting portions each pair of which face and interfit a pair of said first projecting portions on said

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radial flange, and an elastic member positioned between each pair of interfitting pairs of said first and second projecting portions to absorb torsional and vibrational forces upon activation of said electromagnetic clutch.

AUSTRALIA

599395

PATENTS ACT 1952

Form 10

COMPLETE SPECIFICATION

(ORIGINAL)

FOR OFFICE USE

Short Title:

Int. Cl:

Application Number:
Lodged:

Complete Specification-Lodged:
Accepted:
Lapsed:
Published:

Priority:

Related Art:

TO BE COMPLETED BY APPLICANT

Name of Applicant:
SANDEN CORPORATION

Address of Applicant: 20 KOTOBUKI-CHO
ISESAKI-SHI
GUNMA-KEN
JAPAN

Actual Inventor:

Address for Service: CLEMENT HACK & CO.,
601 St. Kilda Road,
Melbourne, Victoria 3004,
Australia.

Complete Specification for the invention entitled:
ELECTROMAGNETIC CLUTCH

The following statement is a full description of this invention including the best method of performing it known to me:-

ELECTROMAGNETIC CLUTCH

Technical Field

This invention relates to an electromagnetic clutch, such as one used in controlling the transmission of power from an automotive engine to a refrigerant compressor for an automotive air conditioning system and more particularly, to an improved engaging structure between an armature and a hub for transferring the rotation of a pulley to the drive shaft of a driven device.

Background of the Invention

Various types of electromagnetic clutches are well known in the prior art and each type of electromagnetic clutch is selected in accordance with the type of driven device.

One type of electromagnetic clutch suitable for use with the compressor of an automobile air conditioner is disclosed in U.S. Patent No. 4,445,606. That patent discloses an electromagnetic clutch comprising a rotor rotatably mounted on the stationary housing of a driven device through a bearing, a hub fixed on the axial end surface of the drive shaft and an armature which is disposed to face one end surface of the rotor with an axial gap therebetween.

A bumper plate is disposed on the outer peripheral portion of the hub to couple it with the hub by means of a toothed structure. An elastic spider is placed between the hub and bumper plate to allow limited rotation of the hub. The bumper faces the armature plate with a gap therebetween, and engages the armature plate through a plurality of leaf springs. Therefore, torsional shock and vibration which is caused by the initial attachment of the armature plate to the pole of the rotor and which acts against the drive shaft, is absorbed.

In this type of electromagnetic clutch, the elastic spider is made of an elastic material, for example, rubber, and attached on the toothed structure of the hub and bumper plate by a vulcanizing process. However, the coupling structure between the bumper plate and the hub is very complicated. As a result, the assembly of the clutch, particularly, the vulcanizing process, is quite complicated. Thus, the cost of the clutch is increased.

Summary of the Invention

It is a primary object of this invention to provide an electromagnetic clutch which has a mechanism, of a simple construction, for easing the tortional resonance, shock, and vibration transmitted to a drive shaft.

It is another object of this invention to provide an electromagnetic clutch which has parts that are easily manufactured.

It is still another object of this invention to provide an electromagnetic clutch which may be easily assembled by a simple process.

It is still another object of this invention to provide an electromagnetic clutch which is manufactured at a low cost.

An electromagnetic clutch, according to the present invention, includes a first rotatable member having an axial end plate of magnetic material and a second rotatable member which is to be connected to a driven member. An annular armature plate made of a magnetic material is disposed to face the first rotatable member with a gap therebetween so as to be capable of limited axial movement. An electromagnetic means is associated with the axial end plate for attracting the armature plate thereto. A hub flange is located on the outer surface of the second rotatable member and is provided with a plurality of pairs of first projecting portions on the axial end surface. A damper plate is disposed forwardly of the armature plate so as to be connected with the armature plate through a plurality of leaf springs and is provided with a plurality of pairs of second projecting portions and longitudinal holes on the axial end surface thereof so that each pair of the first projecting portions can be put into each pair of the second projecting portions through one of a plurality of elastic members. A stopper plate is disposed on the axial end surface of the damper plate so as to be radially movable within the range of the longitudinal holes. Therefore, torsional resonance, shock and vibration are eased by the principally compressive deformation of the elastic member which is enclosed within the space between the first and second projecting portions.

Further objects, features and aspects of this invention will be understood from the following detailed description of the preferred embodiment of this invention and by referring to the annexed drawings.

Brief Description of the Drawings

Figure 1 is a cross-sectional view of an electromagnetic clutch in accordance with one embodiment of this invention.

Figure 2 is a partial perspective view of the electromagnetic clutch of Figure 1.

Figure 3 is a cross-sectional view of a part of the electromagnetic clutch of Figures 1 and 2.

Detailed Description of the Preferred Embodiments

Referring to Figure 1, there is shown an electromagnetic clutch which, according to one embodiment of this invention, is assembled to a refrigerant compressor for an automotive air conditioning system. Compressor housing 1 is provided with tubular extension 2 axially projecting therefrom for surrounding an extension of drive shaft 3 of the compressor. Drive shaft 3 is rotatably supported in compressor housing 1 by a bearing (not shown).

A rotor 4 is rotatably supported on tubular extension 2 through bearing 5 which is mounted on the outer peripheral surface of tubular extension 2. Rotor 4 is made of magnetic material, such as steel, and comprises outer cylindrical portion 41, inner cylindrical portion 42 and axial end plate portion 43 which connects outer and inner portions 41, 42 at an axial forward end. Outer cylindrical portion 41 has V-shaped portions formed therein for receiving a belt which is coupled to the output shaft of the automotive engine (not shown).

Axial end plate portion 43 has one or more concentric slits 431 which are disposed on one or more concentric circles. These slits 431 define a plurality of

annular or arcuate magnetic pieces with the surface of the poles being on the axial end surface of axial end plate portion 43.

Electromagnetic coil 6 is disposed in annular cavity 7 of rotor 4. Coil 6 is contained within annular magnetic housing 61 which has a U-shaped cross-section. Housing 61 is fixed to supporting plate 8, which is secured to the axial end surface of compressor housing 1 by a plurality of rivets 9. Coil housing 61 is maintained within cavity 7 of rotor 4 without contact therewith, with a small gap between for permitting rotation of rotor 4.

As best seen in Figures 2 and 3, a hub 10 is disposed on an outer terminal end of drive shaft 3 and is secured by nut 11. Hub 10 is provided with radial flange 12 which extends radially outwardly therefrom. Radial flange 12 is fixed to hub 10, for example, by welding it thereto. Also, a stopper plate 13 and a damper plate 14 are attached on flange 12 by a plurality of rivets 15. Damper plate 14 is joined to an armature plate 16 by a plurality of leaf springs 17, i.e., one end portion of leaf spring 17 is secured to armature plate 16 by rivets 18 and the other end is secured to damper plate 14 by rivets 19, so that armature plate 16 faces rotor 4 with a small axial gap therebetween.

Radial flange 12 is provided with a plurality of projecting portions 121. Projecting portions 121 are formed by cutting and bending a part of radial flange 12 and face each other in the circular direction.

Damper plate 14 is provided with a plurality of projecting portions 141 which are formed on the axial end surface thereof to project axially and face the plurality of projecting portions 121 with a gap therebetween. The gap between projecting portions of the radial flange and the damper plate accommodates elastic member 20. The number of projecting potions 141 is preferably the same as the number of projecting portions 121. Projecting portions 141 are disposed

such that they are positioned facing projecting portions 121 and are formed by cutting and bending a part of damper plate 14.

The distance between a pair of projecting portions 141 is greater than the distance between a pair of projecting portions 121 so that elastic members 20 including vibration absorber portions 20a, 20b may be placed therebetween. Elastic member 20 is made of an elastic material, such as rubber.

Damper plate 14 is provided with a plurality of substantially longitudinal holes 142 which may be penetrated by rivets 15. The size of tne longitudinal holes, with respect to the rivets, is such that the longitudinal holes are larger than the diameter of the rivets to allow the damper plate to move to a limited degree as dictated by the size of the holes and diameter of the rivets. Accordingly, damper plate 14 may be rotated within the angular range allowed by longitudinal holes 142 with respect to hub flange 12.

The operation of the above-mentioned electromagnetic clutch, when disposed on a refrigerant compressor, will now be described. When coil 6 is energized, armature plate 16 is attracted to rotor 4 by the magnetic force generated by coil 6. Accordingly, the rotational force of rotor 4 is transmitted to drive shaft 3 through armature plate 16 and hub 10, then drive shaft 3 rotates together with armature plate 16. Thus, the refrigerant compressor commences the compressing operation.

Simultaneously, compressed refrigerant gas in the refrigerant compressor produces a reaction force in the direction opposite to the rotational force of drive shaft 3. In other words, the rotational force in the opposite direction of the rotational direction of damper plate 14 is transmitted to hub 10. However, since damper plate 14 is rotatably fixed to hub 10 through elastic member 20 with vibration absorber portions 20a, 20b, even though hub 10 rotates in the direction opposite to the rotational direction of damper plate 14, drive

shaft 3 is prevented from receiving torsional resonance by the compression and transformation of the vibration absorber portions 20a, 20b of elastic member 20.

This invention has been described in detail in connection with the preferred embodiment, but is for example only and this invention is not restricted thereto. It will be easily understood by those skilled in the art that other variations and modifications can be easily made within the scope of this invention.

THE CLAIMS DEFINING THE INVENTION ARE AS FOLLOWS:

1. An electromagnetic clutch comprising, a first rotatable member arranged for rotation about a drive shaft, the first rotatable member having an axial end plate of magnetic material, a second rotatable member connected to the drive shaft, an annular armature plate of magnetic material disposed to face said axial end plate of said first rotatable member with an axial gap therebetween, said annular armature plate being capable of limited axial movement, and electromagnetic means associated with said axial end plate for attracting said armature plate to said axial end plate of said first rotatable member, a radial flange formed on said second rotatable member and provided with a plurality of pairs of first projecting potions on an axial end surface thereof, a damper plate disposed adjacent said armature plate and connected with said armature plate through a plurality of leaf springs, said damper plate having a plurality of pairs of second projecting portions each pair of which face and interfit a pair of said first projecting portions on said radial flange, and an elastic member positioned between each pair of interfitting pairs of said first and second projecting portions to absorb torsional and vibrational forces upon activation of said electromagnetic clutch.

2. The electromagnetic clutch of claim 1 further comprising a flange attaching means for attaching said radial flange to said damper plate in a manner that permits said damper plate to undergo limited rotational movement relative to said radial flange.

3. The electromagnetic clutch of claim 1 wherein each of said pairs of first projecting portions fit within a respective one of said pairs of second projecting portions, one of said elastic members fit between and interconnect each pair of said first and second projecting portions.

4. An electromagnetic clutch substantially as described herein with reference to the accompanying drawings.

DATED THIS 8TH DAY OF JULY 1987

SANDEN CORPORATION
By its Patent Attorneys:

CLEMENT HACK & CO.
Fellows Institute of Patent
Attorneys of Australia.

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FIG. 1

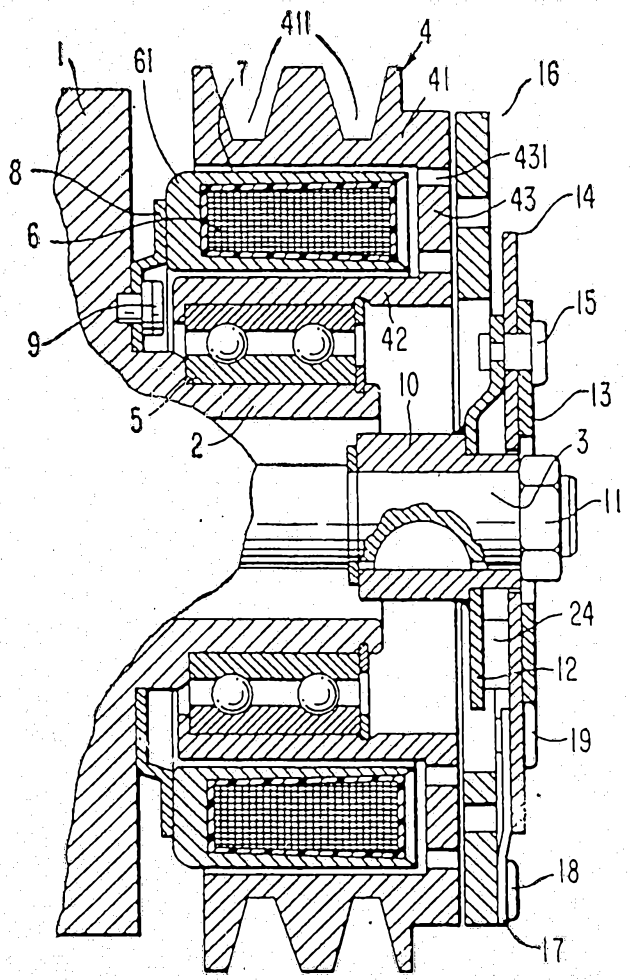

FIG. 2

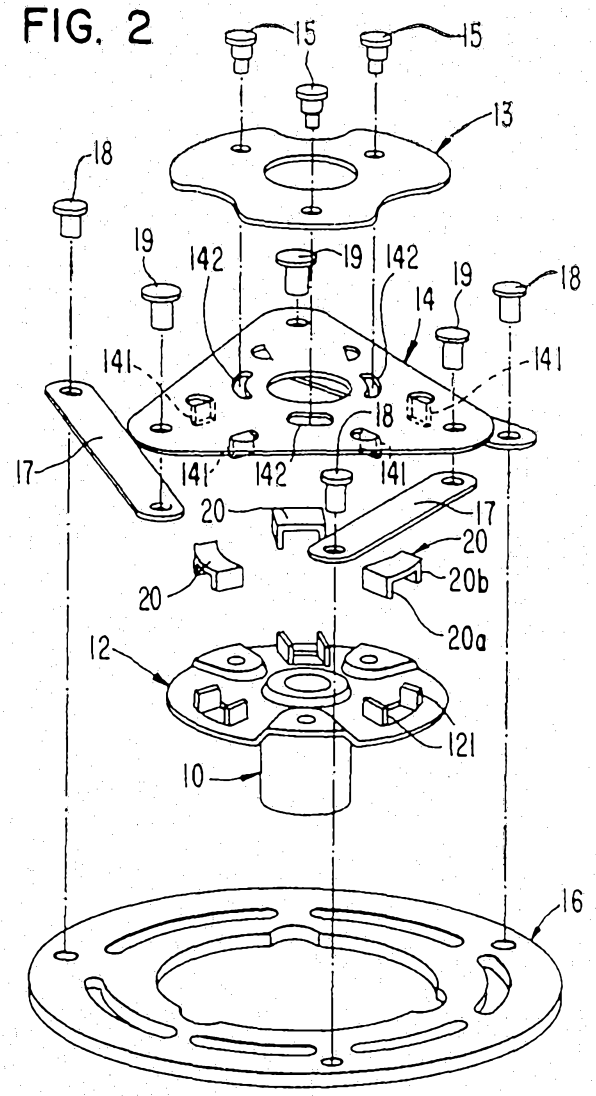
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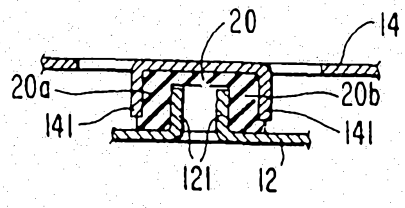
FIG. 3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