COMMONWEALTH OF AUSTRALIA  
The Patents Act 1952  
CONVENTION APPLICATION FOR A PATENT  

We, NITTO KOHKI CO. LTD. (NITTO KOHKI KABUSHIKI KAISHA) of 9-4, Nakaikegami 2-chome, Ohta-ku, Tokyo 146, Japan, hereby apply for the grant of a Patent for an invention entitled: "IMPROVEMENTS IN THE OUTER GLASS PIPES FOR SOLAR HEAT COLLECTOR PIPES" which is described in the accompanying complete specification. 
This application is a Convention application, and is based on an Application for a Patent or similar protection made under:- 

Our address for service is care GRANT ADAMS & COMPANY, Patent Attorneys, of 333 Adelaide Street, Brisbane, in the State of Queensland, Commonwealth of Australia.

DATED this 5th day of April, 1982.

NITTO KOHKI CO. LTD. (NITTO KOHKI KABUSHIKI KAISHA)  
By their Patent Attorneys,  
GRANT ADAMS & COMPANY,  

J.C. Adams  

TO:  
The Commissioner of Patents,  
Commonwealth of Australia.
COMMONWEALTH OF AUSTRALIA
Patents Act 1952

DECLARATION IN SUPPORT OF A CONVENTION APPLICATION FOR A PATENT

In support of the Convention application made for a patent for an invention entitled: "IMPROVEMENTS IN THE OUTER GLASS PIPES FOR SOLAR HEAT COLLECTOR PIPES"

I, TOSHIO MIKIYA
of 9-17, Todoroki 1-chome, Setagaya-ku, Tokyo, Japan,
do solemnly and sincerely declare as follows:

1. I am authorized by NITTO KOHKI Co. Ltd. (NITTO KOHKI KABUSHIKI KAISHA) the applicant for the patent to make this declaration on its behalf.

2. The basic application as defined by Section 141 of the Act was made in JAPAN on the 18th day of May, 1982, by NITTO KOHKI CO. LTD. (NITTO KOHKI KABUSHIKI KAISHA).

3. HIROSATO TAKEUCHI and TOSHIO MIKIYA of Nitto Kohki Co. Ltd., 9-4, Nakaikemami 2-chome, Ohta-ku, Tokyo, Japan, and 9-17, Todoroki 1-chome, Setagaya-ku, Tokyo, Japan, respectively are the actual inventors of the invention and the facts upon which the applicant is entitled to make the application are as follows:

   The applicant is the assignee of the invention from the actual inventors.

4. The basic application referred to in paragraph 2 of this Declaration was the first application made in a Convention country in respect of the invention, the subject of the application.

DECLARED at Tokyo, Japan, this 19th day of April, 1982.

(Toshio Mikiya - President)

Signature of Declarant

TO:
The Commissioner of Patents.

GRANT ADAMS & COMPANY
333 Adelaide Street,
BRISBANE, QUEENSLAND 4000.
AUSTRALIA.
1. An outer glass pipe for a solar heat collector pipe, comprising an outer glass pipe body formed of a straight glass pipe being open at both ends and a lid member provided therein with a small diameter opening, to which an exhaust pipe of a smaller diameter is attached to form a bottom member, said bottom member being air-tightly fixed to one open end of said outer glass pipe body on its peripheral edge, thereby closing said one open end.

2. An outer glass pipe for a solar heat collector pipe, comprising an outer glass pipe body formed of a straight glass pipe being open at both ends and a lid member provided therein with a small exhaust opening and an annular rib therearound, and an exhaust pipe of a small diameter attached to said opening to form a bottom member, said bottom member being air-tightly fixed to one open end of said outer glass pipe body on its peripheral edge, thereby closing said one open end.
COMMONWEALTH OF AUSTRALIA

The Patents Act 1952

82357/62.

Name of Applicant : NITTO KOHKI CO. LTD. (NITTO KOHKI KABUSHIKI KAISHA)

Address of Applicant : 9-4, Nakaikegami 2-chome, Ohta-ku, Tokyo, Japan.

Actual Inventors : HIROSATO TAKEUCHI and TOSHIO MIKIYA

Address for Service : GRANT ADAMS & COMPANY, Patent & Trade Mark Attorneys, 333 Adelaide Street, BRISBANE, QUEENSLAND, 4000 AUSTRALIA.

COMPLETE SPECIFICATION FOR THE INVENTION ENTITLED:

"IMPROVEMENTS IN THE OUTER GLASS PIPES FOR SOLAR HEAT COLLECTOR PIPES"

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

- 1 -
Background of the Invention

The present invention relates to improvements in the outer glass pipes for use with solar heat collector pipes.

Solar heat collector pipes of the type which are designed to protect the outer surface of heat receptor pipes with closed type straight glass pipes are now widely used for solar heat collector equipment. For example, the solar heat collector pipes of vacuum double structure or vacuum single structure have been proposed in the art. The former type collector typically comprises an inner pipe of smaller diameter, having one end closed by rounding and the other end left open, and an outer pipe of larger diameter, having one end closed by rounding and the other end left open, said outer pipe having said inner pipe inserted concentrically therethrough. A space between the outer and inner pipes is then maintained in an air-tight condition under reduced pressure. The latter type collector typically comprises a straight glass pipe having one end closed by rounding, in which a heat medium-filled tube is placed, such as various tubes inclusive of a U-shaped or hair pin tube. A space between the outer pipe and the tube is similarly maintained in an air-tight condition under reduced pressure. In either case, an exhaust glass pipe of a smaller diameter is attached to the closed end of the outer pipe so as to facilitate an air-tight sealing of said space. However, mounting such an exhaust pipe requires, in addition to rounding and other ordinary glass works, drawing, boring which has to be performed by skilled workmen, welding, etc., leading to a considerable rise of the price of product.

This is because a series of exhaust pipes are provided in the rounding step involved in the production of outer glass pipes, or separate exhaust pipes are attached to the bottoms of a series of rounded outer pipes as by welding. Additionally, if mishandling occurs in the step of mounting the exhaust pipes on the outer pipes, then the outer pipes
should entirely be disposed of, resulting in grave economical losses.

Thus, the prior art glass pipes for solar heat collector pipes of vacuum single or double structure leave much to be desired in view of production and economy inclusive of production cost. Furthermore, the least of mishandling is not permitted in the prior art production system for the foregoing reasons.

Summary of the Invention

A main object of the present invention is therefore to provide a novel outer glass pipe designed for use with solar heat collector equipment, which is both easy and inexpensive to manufacture, and makes great contribution to a lowering of the cost.

According to the present invention, this object is accomplished by the provision of an outer glass pipe for a solar heat collector pipe, comprising an outer glass pipe body formed of a straight glass pipe being open at both ends and a lid member provided therein with a small exhaust opening, to which an exhaust pipe of a smaller diameter is attached to form a bottom member. The bottom member being air-tightly fixed to one open end of said outer glass pipe body on its peripheral edge, thereby closing said one open end.

Thus, the inventive outer glass pipe can be manufactured only by air-tightly fixing to an open end of a straight pipe a lid member which is easily fabricated with no special skill.

Brief Description of the Drawings

This and other objects and features of the present invention will become apparent from a reading of the following explanation with reference to the accompanying drawings, in which:

Fig. 1 is a partly cut-away side view of a solar heat collector pipe equipped with the outer pipe according to the
Detailed Description of the Invention

As illustrated in Fig. 4, a straight glass pipe shown at 1 is used for the formation of an outer pipe, which is illustrated as open at both ends. One end 3 of the pipe 1 is closed with a circular glass lid member 2 shown in Fig. 5. The member 2 is provided in its center with a small exhaust opening 4, to which an exhaust glass pipe 5 of smaller diameter is welded to form a bottom member 6. The bottom member 6 is welded on its peripheral edge into said one end 3 of the pipe 1 to form a bottom portion 7.

As shown in Figs. 4 and 5, the circular glass lid member 2 forming a main part of said bottom member 7 has one surface, i.e., a surface facing said one end of the pipe 1, which is flattened. As shown in Fig. 5, the opposite surface of member 2 is provided with an annular groove 8 of a given width, which is positioned concentrically with respect to the central opening 4, and with an annular rig 9 of a given width, which is positioned adjacent to and in concentrical relation to said groove 8. The exhaust pipe 5
is attached to the surfaces of said groove 8 and said rib 9. Figs. 6 and 7 show an alternative bottom member 16 which is similar to the first bottom member 6 in that it has therein an annular groove 8, but is different therefrom in that a plurality of projections 19 are formed in place of the annular rib 9. Alternatively, the bottom member 6 may be welded on its peripheral edge onto the open end 3 as shown in Fig. 8.

Reference numeral 11 stands for an inner glass pipe through which a heating medium flows, and 12 a frame for solar heat collector equipment.

Reference will now be made to the reasons for provision of the annular groove 8 in the surface of the lid member 2, to which is attached the exhaust pipe 5. The exhaust pipe 5 has to be chipped off by electrical fusion using a heater or the like means, after an amount of air present in between the outer pipe and the inner pipe inserted therethrough and joined thereto has been exhausted. The heat radiating from the heater is transmitted exclusively to the portion of the pipe 5 to be chipped off, and is not substantially conveyed to the lid member 2, since the heater is spaced away from the surface of member 2 by a length corresponding to a depth D of Groove 8. In other words, the exhaust pipe 5 can be chipped off in a very short period of time with no fear of melting the lid member 2. In addition, since the exhaust pipe 5 can be chipped off at a position (as indicated by an arrow A in Fig. 1) as close to the lid member 2 as possible, the length of a projection 10, i.e., the portion of pipe 5 which has not been chipped off, can be reduced as much as possible. Such a projection is often referred to as an outer pipe tail in the art. It is thus possible to prevent an accident which may otherwise happen due to distortion of glass which occurs when an impact force is applied, viz., a breakdown of a portion of the outer pipe which is in the vicinity of the junction of the
the outer and inner pipes, as indicated by an arrow B in Fig. 1.

On the other hand, the annular rib 9 or a plurality of projections 19 are provided on the glass lid member 2 for the following reasons. When a solar heat collector pipe is mounted on the frame, said rib 9 or projections 19 serve as a seat for a spring 13 for pressing the collector pipe in the axial direction, so that its bottom can be placed in a stable state.

With the arrangement according to the present invention, an accident leading to mishandling of parts will not happen during preparation of the bottom member 6 or airtight installation thereof. In addition, the extent of damage due to mishandling, if any, will only be limited to the lid member 2 forming the bottom member or the exhaust pipe 5. Thus, it is not necessary in the present invention to dispose of the entire outer pipe.
CLAIMS
The Claims defining the invention are as follows:

1. An outer glass pipe for a solar heat collector pipe, comprising an outer glass pipe body formed of a straight glass pipe being open at both ends and a lid member provided therein with a small diameter opening, to which an exhaust pipe of a smaller diameter is attached to form a bottom member, said bottom member being air-tightly fixed to one open end of said outer glass pipe body on its peripheral edge, thereby closing said one open end.

2. An outer glass pipe for a solar heat collector pipe, comprising an outer glass pipe body formed of a straight glass pipe being open at both ends and a lid member provided therein with a small exhaust opening and an annular rib therearround, and an exhaust pipe of a small diameter attached to said opening to form a bottom member, said bottom member being air-tightly fixed to one open end of said outer glass pipe body on its peripheral edge, thereby closing said one open end.

3. An outer glass pipe for a solar heat collector pipe according to Claim 1 or 2, wherein said lid member is formed of glass.

4. An outer glass pipe for a solar heat collector pipe according to Claim 1 or 2, wherein said lid member is air-tightly welded to one of the open ends of said outer glass pipe.

5. An outer glass pipe for a solar heat collector pipe according to Claim 1 or 2, wherein said bottom member is air-tightly fixed on its peripheral edge into one open end of said outer glass pipe body.

6. An outer glass pipe for a solar heat collector pipe according to Claim 1 or 2, wherein said bottom member is air-tightly fixed on its peripheral edge onto one open end of said outer glass pipe body.
7. An outer glass pipe for a solar heat collector pipe according to Claim 1, wherein said lid member includes a groove and a plurality of projections extending therefrom and being positioned adjacent to said groove.

8. An outer glass pipe for a solar heat collector pipe according to Claim 2, wherein said lid member includes a groove concentrically arranged with respect to said annular rib.

9. An outer glass pipe for a solar heat collector pipe according to Claim 1 or 2, wherein said lid member includes at least one flat surface.

10. An outer glass pipe for a solar heat collector pipe according to Claim 1 or 2, wherein said exhaust pipe is centrally mounted with respect to said outer glass pipe.

11. An outer glass pipe for a solar heat collector pipe according to Claim 2, wherein said exhaust pipe has an outer diameter equal to the diameter of said exhaust opening.

12. An outer glass pipe for a solar heat collector pipe according to Claim 2, wherein said exhaust pipe has an inner diameter equal to the diameter of said exhaust opening.

13. An outer glass pipe for a solar heat collector pipe substantially as hereinbefore described with reference to the accompanying drawings.

DATED THIS 5th day of April, 1982.

NITTO KOHKI CO. LTD. (NITTO KOHKI KABUSHIKI KAISHA)

By their Patent Attorneys,
GRANT ADAMS & COMPANY
DRAWINGS