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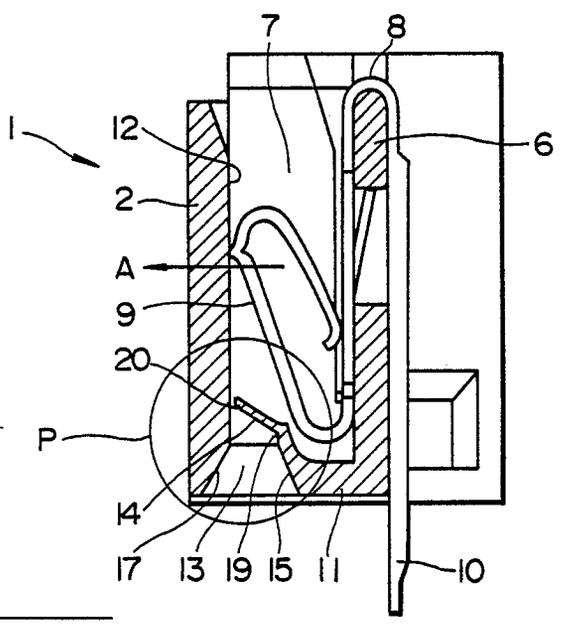
(54) Electrical connector.

(57) A bottom-entry circuit board mounted female connector (1) has an integrally molded dielectric housing (2) having a board engaging surface on bottom wall (11) and a plurality of terminal receiving cavities (7). A plurality of spring contact female terminals (8) are mounted one in each cavity (7). A plurality of inlet openings (13), for male terminals (24) (see Figs. 8 and 9) are defined in the wall (11). Barrier means in the form of an integral unitary flap member (14) hingeably connected to one side of each inlet opening (13) is provided to prevent wicking invasion of flux into the cavities (7) and electrical contact areas during flux treatment preparatory to wave soldering.

FIG.3



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ELECTRICAL CONNECTOR

The present invention relates to an electrical connector, and more particularly to an electrical connector for connecting printed circuit boards together.

As is well known, there are a variety of electrical connectors to connect printed circuit boards to each other. Generally, such an electrical connector comprises a male connector housing having a plurality of male terminal pins and a female connector housing having a plurality of female terminals with pin-engaging spring contact portions. The male connector housing is fixed to one printed circuit board, and the female connector housing is fixed to the other printed circuit board. Then, these printed circuit boards can be detachably connected to each other by mating the male and female terminals of the male and female connector housings. When these electrical connectors are fixed to printed circuit boards, an automatic soldering apparatus is used to jet out melted solder against the underside of the printed circuit boards and electrically connect the male and female terminals to the printed circuit boards one after another in lots in a process commonly referred to as a wave-soldering operation. Before the terminals of the female connector housings are soldered to the printed circuit boards, flux is applied to selected portions of the printed circuit boards to provide a solder resistant protective barrier for circuitry defined on the upper connector engaging surface of the circuit boards. The flux is liable to creep up into the female terminal contact areas through the inlets provided in the female connector housings for inserting the male terminal pins.

In an attempt to keep female terminals clean of flux, an electrical connector whose female connector housing has a membrane barrier at the inlet of each female terminal compartment has been proposed. The membrane barrier may be a thin closure having a cut at the center thereof. This thin closure is useful in preventing flux from creeping up to female terminals, but it has the following defects:

The closure must allow a male terminal pin to enter an associated female terminal when the male and female connector housings are mated with each other. During mating, the male terminal pin thrusts through the cut of the thin closure to break and open the cut wide. (1) This, however, requires an appreciable force to thrust and break the thin closure, and therefore, male terminals cannot be smoothly inserted in associated female terminals. (2) The thin membrane barriers are made as an integral part of the female housings, and therefore, the material of the female housing must be selected, considering what material is easy to be ruptured when reduced to a thin wall. This reduces the degree of freedom in selecting the material of the female terminal housing. (3) Finally, small broken pieces of the membrane material may be carried by the male terminal pin when the thin closure is penetrated by the male pin, and sometimes such small fragments are attached to the contact surface of the female terminal, causing poor electrical contact in the contact area.

SUMMARY OF THE INVENTION

An object of the present invention is to provide an improved electrical connector for printed circuit boards which connector permits the smooth insertion of its male terminals into its female terminals.

The present invention provides an electrical connector for printed circuit boards which includes: a female connector housing having a plurality of female terminal springs in terminal receiving cavities or compartments, the inlet of each compartment including barrier means to prevent invasion of flux into the compartment during a flux treatment preparatory to wave soldering characterized by said barrier means including a square or rectangular flap, one side of which is integrally connected to one wall of the compartment and the other three sides of which flap are close to, but free from, the corresponding walls of the compartment, the free end side of the flap opposite to said one hinged side of the flap closure confronting the wall of the compartment against which the female terminal spring resiliently pushes itself in the direction in which its resilient force is applied, and the remaining opposite (left and right) sides extending between said hinged end and free end (front and rear) sides.

Contrary to the idea of breaking a thin wall by a male pin, the central feature of the present invention resides in: using a closure flap integrally connected to the inlet of a female terminal compartment in the form of cantilever to close the inlet of the compartment, thereby preventing flux from creeping up to the female terminal in the compartment in applying flux to selected portions of an associated printed circuit board; and allowing the male terminal pin to enter the compartment by yieldingly bending the closure flap; thus assuring the smooth insertion of the male terminal pin into the female terminal.

With a connector of the present invention, a flap closure closes the inlet of each female terminal compartment to prevent flux from creeping up to

the female terminal in applying flux to selected portions of a printed circuit board preparatory to wave soldering. When the male and female connector housings are combined with each other, all male terminal pins of the male connector housing are inserted into the female terminal compartments of the female connector housing by bending the closure flaps of the compartments, not requiring an appreciable force such as required in rupturing a barrier membrane provided at the inlet of each female terminal compartment in the conventional electrical connector as earlier described. Each male terminal pin is pushed against one wall of the compartment by the associated female terminal spring, thereby making electrical connection therebetween.

In contradistinction to breaking the membrane barriers upon insertion of the male terminal pins into the inlets of the female terminals, in accordance with the present invention, the male terminal pins are inserted into corresponding female terminals by opening the closure-flap hinged to the inlets of the female terminal compartments, thus producing no broken pieces of barrier material and assuring good electrical contact between the male and female terminals when mated with each other.

One way of carying out the present invention will now be described in detail by way of example with reference to drawings which show one specific embodiment.

BRIEF DESCRIPTION OF THE DRAWINGS

FIGS. 1 to 7 show a female connector housing. Specifically, Fig. 1 is a plane view of the female connector housing, only one compartment being shown as having a female terminal inserted therein, and the other compartments as having no female terminals inserted therein for clear illustration of their closures;

FIG. 2 is a bottom view of the female connector housing;

FIG. 3 is a sectional view taken along the line Y-Y in FIG. 1;

FIG. 4 is a front view of the female housing;

FIG. 5 is a right side view of the female housing;

FIG. 6 is a sectional view of the female housing taken along the line Z-Z in FIG. 1; and

FIG. 7 is an enlarged view of the encircled part "P" of the female housing in FIG. 3.

FIG. 8 is a similar view to FIG. 7, but showing how a male terminal pin is inserted into an associated female terminal spring; and

FIG. 9 shows in section, how the male and female terminals are mated with each other.

With reference to the drawings, a female connector housing is indicated at 1. It is shown as comprising a rear wall 2, left and right side walls 3 and 4 integrally connected to the opposite ends of the rear wall, a plurality of partition walls 5 arranged at regular intervals and integrally connected to the rear wall and a plurality of terminal-mount partition walls 6 each integrally connected to and extending between adjacent partition walls 5 and between the left side wall 3 and the adjacent partition walls 5 and between the right side wall 4 and the adjacent partition wall 5, thus forming, in this particular embodiment, five female terminal mounting compartments 7. The number of the compartments may be selected as desired.

A female terminal spring 8 is mounted on each terminal-mount partition 6. As is best shown in FIG. 3, the bent resilient portion 9 of the female terminal 8 is put in the compartment space 7 to apply its resilient force against the inside surface 12 of the rear wall 2 in the direction as indicated by arrow A. The extending portion 10 of the general terminal 8 appears partly out of the bottom wall 1 of the female connector housing 1. Each compartment has an opening 13 made in the bottom wall 11 in the vicinity of the inside surface 12 of the rear wall 2. Also, the compartment has a closure flap 14 integrally connected to the bottom side in the form of cantilever.

Specifically, each terminal inlet 13 has a square opening large enough to permit insertion of a male terminal pin, which is square in section. As best shown in FIGS. 2 and 3, the terminal inlet 13 is defined by four inclined surfaces 15, 16, 17 and 18. One side 19 of the closure flap 14 is integrally connected to the edge of the front surface 15, and the other three sides 20, 21 and 22 of the closure flap 14 are close to, but free from the back, left and right surfaces 17, 16 and 18. Specifically, the side 20 of the flap 14 which confronts the inside surface 12 of the rear wall 2, is cut away from the back surface 17, and the opposite sides 21 and 22 which extend from the opposite ends of the side 20, are cut away from the left and right surfaces 16 and 18.

As shown in FIG. 3 the closure flap 14 is inclined at approximately 30 degrees with its side 20 up. The closure flap 14 holds this position until a male terminal pin 24 is inserted in the compartment, thus normally substantially closing the inlet of the compartment.

The material of which a female connector housing is made, is not limited to a specific material, but in one example it is Nylon 66. The intervals at which female terminals 9 are arranged in the terminal mounting spaces 7 can be selected as desired. In one example female terminals are arranged at intervals of 2mm, and then the thickness of the closure flap is preferably 0.1 or less

mm. As a matter of course the thickness of the closure flap 14 may vary with the size, shape and material of the female connector housing, the interval between female terminals and other factors.

Every compartment of the female connector housing 1 is closed by an associated closure flap 14, and therefore, no flux can creep into the inside of the compartment when flux is applied to selected portions of an associated printed circuit board "M" prior to soldering the female connector housing 1 thereto with an automatic soldering apparatus.

A male connector housing is fixed to another printed circuit board "N". Referring to FIGS. 8 and 9, it is described how the male terminal pins 24 of the male connector housing 23 are mated with the female terminal springs 9 of the female connector housing 1. First, the male terminal pins 24 are inserted in the inlets 13 of compartments 7 of the female connector housing 1, as shown in broken lines in FIG. 8. Then, the male terminal pins 24 are pushed in the compartments 7. Their closure flaps 14 are yieldingly bent, as shown in solid line in FIG. 8, thereby allowing the male terminal pins 24 to mate with the female terminal groups 9, as shown in FIG. 9.

Each closure flap 14 is integrally connected to the inlet edge of each compartment in the form of cantilever. Specifically, the closure flap 14 is fixed at one side 19 thereof, and is free at the other sides 20, 21 and 22. Therefore, the closure flap 14 will allow a male terminal pin 24 to enter the compartment without substantial resistance. When the male terminal pin 24 is inserted in the compartment 7, it is pushed against the surface 12 of the rear wall of the compartment 7 by the female terminal spring 8. Thus, the two printed circuit boards "M" and "N" are mechanically and electrically connected with each other.

In this particular embodiment, the closure flap 14 is inclined, thereby making it easy to open the closure flap, and at the same time assisting the male terminal pin 24 in moving on the inside surface 12 of the rear wall 2 of the compartment when the male terminal pin is being inserted in the compartment.

As may be understood from the above, the electrical connector described in detail with reference to the drawings prevents flux from creeping up into the female terminal compartments when applying flux to selected portions of an associated printed circuit board prior to soldering with an automatic soldering apparatus; it allows the male terminal pins to enter the female terminal compartments without resistance thanks to the use of closure flaps in the form of cantilevers; the use of closure flaps in the form of cantilevers in place of closures which are to be broke by male terminal pins, increases the degree of freedom in selecting the material of the female connector housing; and no broken pieces of closure flap material are carried by the male terminal pins to be attached to the female terminal contacts as is the case with the conventional electrical connector using closure flaps to be broken, and therefore good electrical contact is assured between male and female terminals when mated with each other.

Thus, the connector does not reduce the degree of freedom in selecting the material of the female housing and the anti-wicking flux barrier feature does not liberate debris in use into the contact areas of a female terminal, thereby assuring good electrical contact between male and female terminals.

Claims

1. A female connector which is to be printed circuit board-mounted to mate with male pin terminals associated with another circuit member, said female connector including a dielectric housing having a board engaging surface and a plurality of terminal receiving cavities, each cavity having an inlet opening at said board engaging surface and a plurality of female terminals mounted in said cavities, each female terminal having a spring contact portion in said cavity adapted to engage a contact portion of a male pin terminal inserted through said inlet opening and into the cavity; and barrier means in each said inlet opening for preventing invasion of flux into said cavities during a flux treatment preparatory to a wave soldering operation characterised in that said barrier means comprises a unitary integral flap member hingeably connected at one side to the inlet opening and having a free end side opposite said hinged side, said free end side confronting an opposed wall in said inlet opening such that said flap substantially covers said inlet opening, said flap being resiliently deflectable into said cavity upon insertion of a male terminal.

2. A female connector as in claim 1, wherein each terminal receiving cavity includes an inner facing sidewall abutment surface extending from said inlet opening into said cavity, each female terminal spring contact portion is biased against said side wall abutment surface to resiliently deflectably receive an inserted male pin terminal between the spring contact portion and said abutment surface and the free end of said flap member confronts said abutment surface in the inlet opening.

FIG. 1

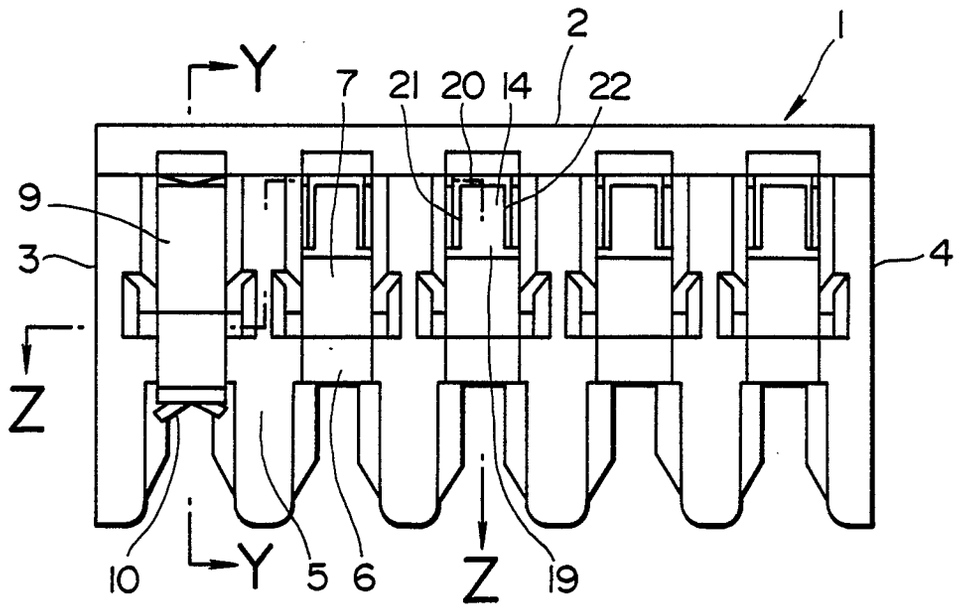
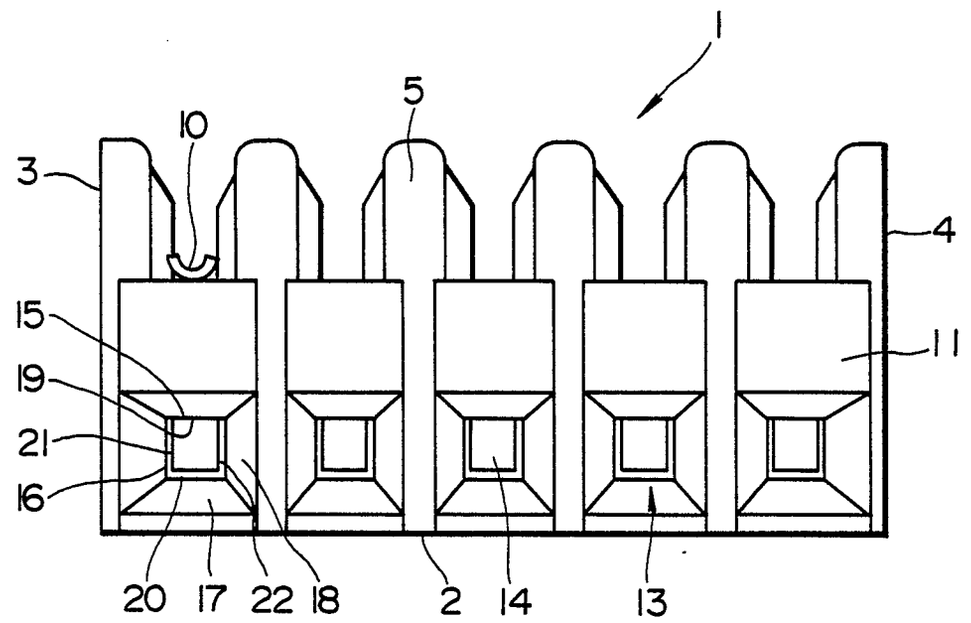

2
1
Y
7
21
20
14
22
9
3
4
Z
10
Y
5
6
Z
19

FIG. 2


1
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4
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11
19
21
16
20
17
22
18
2
14
13

FIG.3

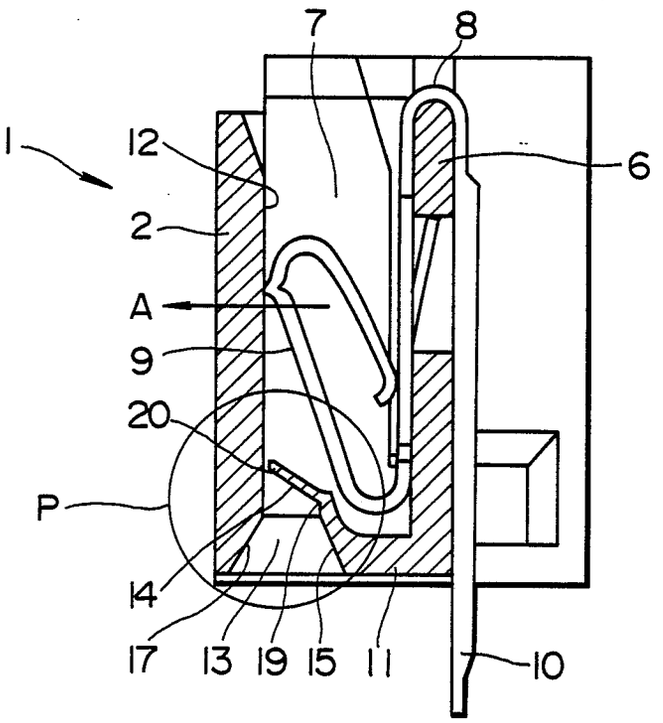

FIG.4

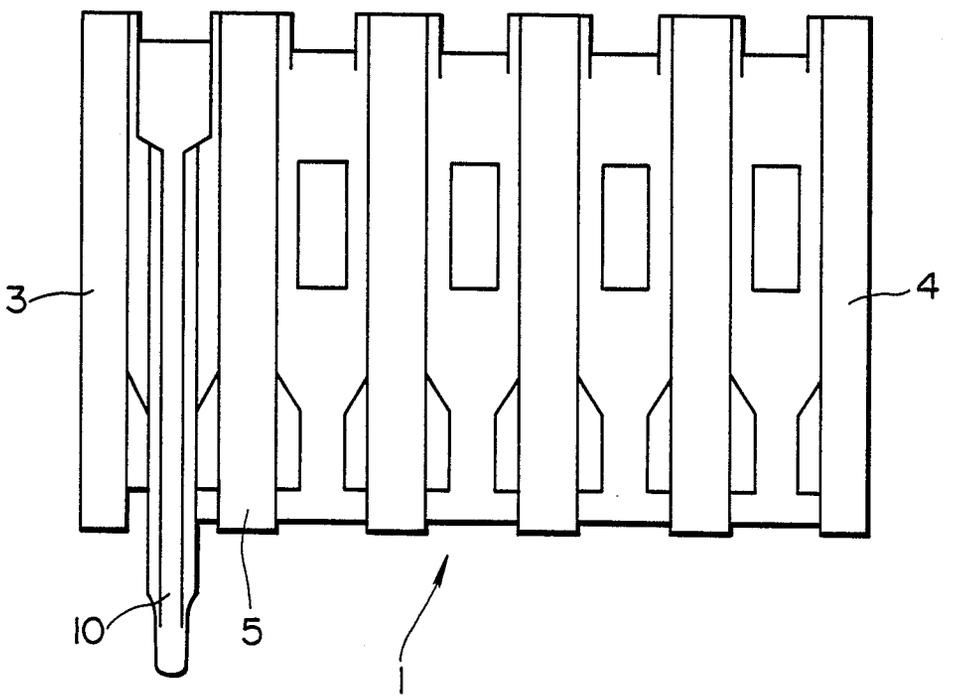

FIG.5

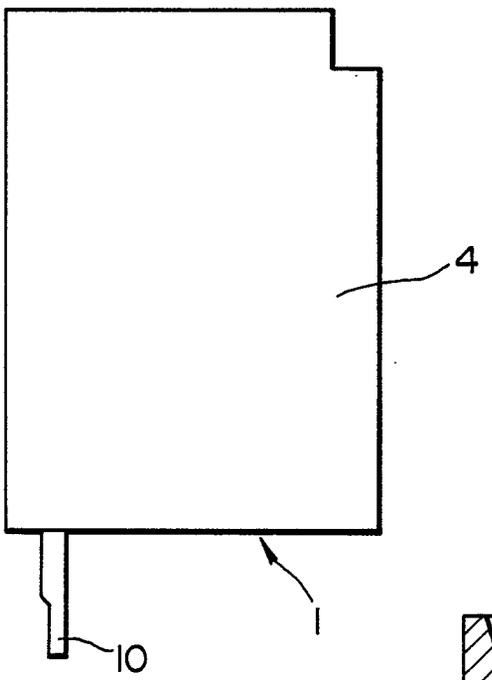

FIG.6

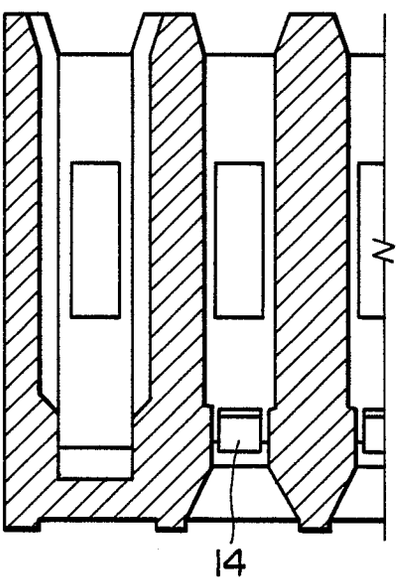

FIG.7

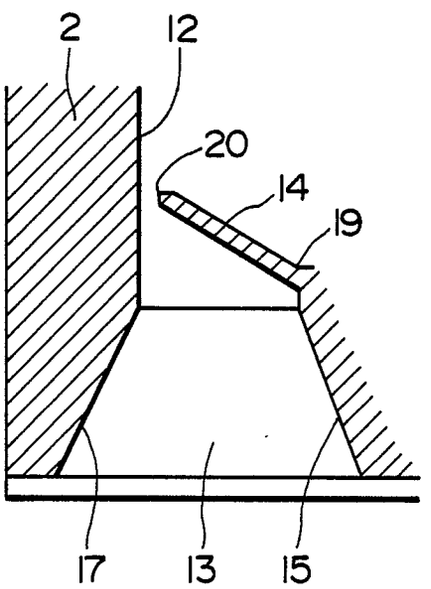

FIG.8

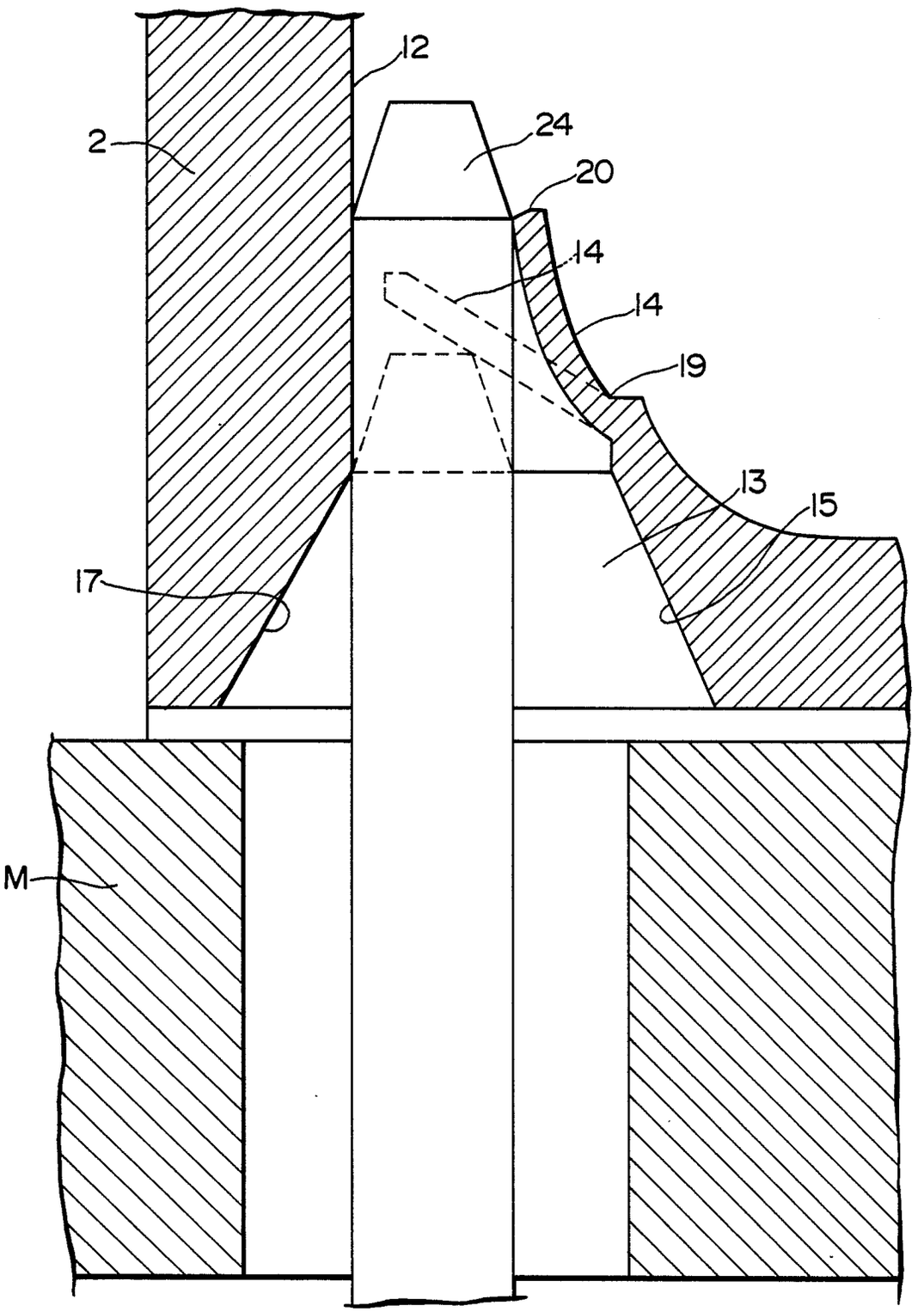

FIG.9