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(12) # EUROPEAN PATENT SPECIFICATION

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(54) **A sheet-metal bending machine.**

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PATENT ABSTRACTS OF JAPAN vol. 10, no. 299 (M-524)(2355) 11 October 1986 & JP-A-61 111 736 (MARU KIKAI KOGYO K.K.). 29 May 1986

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Description

The invention relates to a sheet-metal bending machine.

In particular, the machine is best applied in the bending of metal sheets of differing thicknesses, of satin-finish stainless steel, or prepainted sheets, or plasticated sheets and so on, which are destined for widely differing uses, such as, for example , in the construction of metallic furniture, the cases of household electrical appliances, shelves, etc., in which the bending zones of the sheet, the paint or the protective layer must be without defects.

The prior art embraces sheet-metal bending machines of different types able to avoid the formation of defects in the bending zone.

Said machines comprise a fixed supporting structure having two pressing elements: one fixed lower element, on which the sheet to be bent is placed, and one mobile upper element, which keeps the sheet pressed on to the lower element. A mobile frame, having a substantially c-shaped transversal section, is associated with the fixed element, which frame has two blades, one upper and one lower, which blades, following the raising or lowering of the mobile frame effect the bending of the sheet.

To avoid the formation of defects in the bending zone, and in order to be able to carry out bendings with different angles as well as roundings of the said bending angles, a movement of the mobile frame is envisaged, both away from and towards the sheet to be bent.

The prior art embraces a first type of machine in which said movement is realised by means of the use of manual adjustment systems. The well-known drawback of these machines is constituted by the fact that correct execution of the bending depends largely on the operator's ability.

The prior art embraces also a second type of machine, in which the bending blade's movement away from and towards the sheet is executed envisaging that the blades should be moved singly. That, as is well known, considerably complicates the machine from the point of view of construction. The machine also becomes extremely complex and expensive and difficult to control in that there are two movement directions to manage (one for each bending blade).

The prior art also embraces a third type, in which the movement towards and away from the blade is made by the entire mobile frame. The movement system in this case is constituted by hydraulic cylinders. The well-known drawback of such machines is that the hydraulic cylinders cannot carry out micrometric movements with great accuracy. In practice, therefore, the positioning of the mobile frame carrying the two blades is insufficiently precise and furthermore is difficult to manage.

In a fourth type of known machine, such as the object of US 4,722,214 the movement system of the entire mobile group away from and towards the metal sheet is realised in the following way.

The mobile group (having a c-shaped section) is provided with a pair of plate-shaped arms, hinged to the fixed support structure of the machine. A cam organ is positioned at the articulations of each of the two plate-shaped arms, which cam organ is set in rotation by a jack, by means of a lever.

The principal aim of the present invention is therefore that of overcoming the above-cited drawbacks relative to prior art machines, and of providing a sheet-metal bending machine capable of operating on sheets of different thicknesses, avoiding the formation of defects in the bending zones, and of realising bending angles with the possibility of rounding them: said machine is extremely simple from the point of view of construction, extremely precise, reliable and easy to manage from the operative point of view, and can be operated automatically.

This aim and others besides are all achieved by the machine of the invention, essentially comprising a fixed support structure bearing a lower pressing element on which the sheet to be bent is rested, and to which is associated an upper mobile pressing element, which press the sheet against the lower pressing element, said upper press element being borne by a mobile structure, the machine further comprising a mobile frame, borne by the said support structure, having a transversal section which is substantially c-shaped and which bears an upper blade and a lower blade, the said blades performing the bending of the metal sheet when the mobile frame is raised or lowered, hydraulic jacks being provided to perform the raising or lowering of the mobile group, the said mobile frame further being able to translate from and towards the metal sheet by means of an activation system formed by a cam organ to which a connection means is associated, which connection means is interpositioned between the said cam organ and the said mobile frame, characterised in that the said cam organ is constituted by a plurality of cam devices in line among themselves and positioned along a shaft, which shaft extends over the entire length of the mobile frame, the said shaft being able to perform rotation in both directions with rotation degrees determined by prefixed operative phases.

Further characteristics and advantages of the invention will better emerge from the detailed description which follows, of a preferred but not exclusive embodiment herein illustrated purely in the

form of a non-limiting example in the drawings, in which:

- Figure 1 shows schematically and in side view the present invention without its side-cover;
- Figure 2 shows schematically, in isometric projection, the posterior part of the machine with several parts taken away;
- Figures 3, 4, 5, and 6 show schematically four bending phases of the sheet effected by the lower blade.

With reference to the drawings, a support structure 1 has internally a chamber 2. The support structure 1 has a lower pressing element 3 on which the sheet 4 to be bent is placed, to which lower pressing element 3 a mobile upper pressing element 5 is associated which presses the sheet against the lower pressing element 3.

The upper pressing element 5 is borne by a mobile structure, hinged 7 to the support structure 1, which support structure 1 is able to perform vertical-plane oscillations by the activating of at least one double-acting hydraulic cylinder 8 which is fixed respectively to the mobile structure 6 and to the support structure 1.

Inside the chamber 2 a mobile frame 9 is housed, having a substantially c-shaped transversal section, and bearing an upper blade 10 and a lower blade 11.

The blades 10 and 11 effect the bending of the sheet 4 when the mobile frame 9 is raised or lowered: the blade 10 or the blade 11 interferes with the sheet 4 in proximity to the zone where it exits from the pressing elements 3 and 5, effecting thus the bending: the upper blade 10 effects the downwards bending, while the lower blade 11 performs the upwards bending.

The raising and lowering of the mobile frame 9 is performed by at least one double-acting hydraulic cylinder 12 constrained to the mobile frame 9 and to the support structure 1.

The mobile frame 9, which is pivoted on a shaft 13 positioned in the posterior part of the support structure 1, is also able to slide horizontally away from and towards the sheet 4 by means of a particular activating system. Said activating system comprises at least one cam device 14, formed by a plate element 15 splined on the shaft 13, to which shaft 13 a connecting element 16 to the mobile frame 9 is solidly fixed.

The mobile frame 9 is thus pivoted on the shaft 13 by the cam device 14.

The shaft 13, activated by known means, is able to perform rotations in both directions with excursions determined by pre-established operative phases for example, 100° in one direction and 100° in the opposite direction) controlled by a computer (not in the figures).

Said computer furthermore manages all the other movements of the machine, permitting of a programmable funtioning, according to the operative requirements , which is completely automatic.

In figures 3, 4, 5,and 6 four phases of bending of the sheet 4 are illustrated by way of example.

In fig. 3 the moment of positioning of the blade 11 in relation to the sheet 4 is represented.

In fig.4 the vertical activating of the blade 11 is represented, bringing about the formation of a bend greater than 90°.

In fig. 5 the horizontal activating of the blade 11 is represented (produced by the rotation of the shaft 13 and consequently of the cam device 14) bringing about the formation of a bend with a 90° angle.

In fig. 6 a further horizontal displacement of the blade 11 is represented , bringing about the formation of a bend with an angle of less than 90°.

It is notable that from the point of view of construction and functioning the present machine is very simple, and as a result of this will be very economical to run, and will cause few operative problems.

The invention therefore attains the pre-established aims.

Claims

1. A machine for bending sheet metal, comprising a fixed support structure (1) bearing a lower pressing element (3) on which a sheet (4) to be bent is rested, and to which is associated an mobile upper pressing element (5), which presses the sheet (4) against the lower pressing element (3), said upper pressing element (3) being borne by a mobile structure (6), the machine further comprising a mobile frame (9), borne by the said support structure (1), having a transversal section which is substantially c-shaped and which bears an upper blade (10) and a lower blade (11), the said blades (10 and 11) effecting the bending of the metal sheet (4) when the mobile frame (9) is raised or lowered, hydraulic jacks (12) being provided to perform the raising or lowering of the mobile frame (9), the said mobile frame (9) further being able to translate away from and towards the metal sheet (4) by means of an activation system formed by a cam device (14) to which a connecting element (16) is associated, which connecting means is interpositioned between the said cam device (14) and the said mobile frame (9), characterised in that the said cam device (14) is constituted by a plurality of cam devices (14) in a line and positioned along a shaft (13), which shaft (13) extends over the entire length of the mobile

frame (9), the said shaft (13) being able to perform rotations in both directions with rotation degrees determined by prefixed operative phases.

2. A machine as in claim 1, characterised in that the said connecting means is constituted by a plurality of connecting elements (16), each of which is associated to each cam device (14).

3. A machine as in claim 1, wherein said cam device (14) comprises a plate element (15) splined on said shaft (13).

4. A machine as in claim 1, wherein said activating means (12) envisaged for the effecting of the raising and lowering of the said mobile frame (9) comprise at least one double-acting hydraulic cylinder (12) constrained respectively to said mobile frame (9) aid to said fixed support structure (1).

Patentansprüche

1. Eine Blechbiegemaschine, enthaltend eine feststehende Trägerstruktur (1), welche ein unteres Presselement (3) trägt, auf die ein zu biegendes Blech (4) gelegt wird, und dem ein bewegliches oberes Presselement (5) zugeordnet ist, welches das Blech (4) gegen das untere Presselement (3) presst, wobei das genannte obere Presselement (5) von einer beweglichen Struktur (6) gehalten wird, wobei die Maschine ferner einen beweglichen Rahmen (9) enthält, gehalten von der genannten Trägerstruktur (1), welcher einen im wesentlichen C-förmigen Querschnitt aufweist, und der eine obere Klinge (10) und eine untere Klinge (11) trägt, die das Biegen des Bleches (4) ausführen, wenn der bewegliche Rahmen (9) angehoben oder gesenkt wird, wobei Hydraulikzylinder (12) vorgesehen sind, um das Anheben oder Senken des beweglichen Rahmens (9) zu bewirken, wobei der genannte bewegliche Rahmen (9) weiterhin in der Lage ist, sich von dem Blech (4) fort und zu diesem hin zu verschieben, und zwar mit Hilfe eines Antriebssystems, das aus einer Nockenvorrichtung (14) gebildet wird, welchem ein Verbindungselement (16) zugeordnet ist, angeordnet zwischen der genannten Nockenvorrichtung (14) und dem genannten beweglichen Rahmen (9), **dadurch gekennzeichnet**, dass die genannte Nockenvorrichtung (14) aus einer Anzahl von in Reihe angeordneten Nockenvorrichtungen (14) besteht, positioniert entlang einer Welle (13), welche sich über die gesamte Länge des genannten beweglichen Rahmens (9) erstreckt, wobei die genannte Welle (13) in der Lage ist, Umdrehungen in beiden Richtungen auszuführen, und zwar mit Umdrehungsgraden, die durch bestimmte Betriebsphasen festgelegt werden.

2. Maschine nach Patentanspruch 1, **dadurch gekennzeichnet**, dass das genannte Verbindungsmittel aus einer Anzahl von Verbindungselementen (16) besteht, von denen jedes einer jeden Nockenvorrichtung (14) zugeordnet ist.

3. Maschine nach Patentanspruch 1, **dadurch gekennzeichnet**, dass die genannte Nockenvorrichtung (14) ein plattenförmiges Element (15) enthält, das auf die genannte Welle (13) aufgezogen ist.

4. Maschine nach Patentanspruch 1, **dadurch gekennzeichnet**, dass die genannten Antriebsmittel (12), die dazu vorgesehen sind, das Heben und Senken des genannten beweglichen Rahmens (9) zu bewirken, wenigstens einen Hydraulikzylinder (12) mit Dopelwirkung enthalten, der jeweils an dem genannten beweglichen Rahmen (9) und an der genannten feststehenden Trägerstruktur (1) befestigt ist.

Revendications

1. Machine de pliage pour tôles, comprenant une structure de support fixe (1) portant un élément presseur inférieur (3) sur lequel prend appui la tôle à plier et auquel est associé un élément presseur supérieur mobile (5) lequel comprime la tôle (4) contre l'élément presseur inférieur (3), ledit élément presseur supérieur (5) étant soutenu par une structure mobile (6), la machine comprenant en outre un cadre mobile soutenu par ladite structure de support (1), ayant une section transversale sensiblement en forme de "C" et portant une lame supérieure (10) et une lame inférieure (11), lasdites lames (10 et 11) effectuant le pliage de la tôle (4) quand le cadre mobile (9) est déplacé vers le haut ou vers le bas, des vérins hydrauliques (12) étant prévus pour réaliser le déplacement vers le haut et vers le bas du cadre mobile (9), ledit cadre mobile (9) étant en outre susceptible de déplacement à l'écart de et vers la tôle (4) par un système d'activation prévoyant un dispositif à excentrique (14) auquel est associé un élément de liaison (16), ces moyens de liaison étant intercalés entre ledit dispositif à excentrique (14) et ledit cadre mobile (9),
caractérisée en ce que ledit dispositif à excentrique (14) se compose d'une pluralité de dispositifs à excentrique (14) disposés en ligne et positionnés le long d'un arbre (13) s'étendant

sur toute la longueur du cadre mobile (9), cet arbre (13) étant en mesure d'effectuer des rotations dans les deux sens selon des degrés de rotation établis par des étapes prédéterminées de travail.

2. Machine selon la revendication 1, caractérisée en ce que lesdits moyens de liaison comportent une pluralité d'éléments de liaison (16), chacun desquels est associé à chaque dispositif à excentrique (14).

3. Machine selon la revendication 1, caractérisée en ce que ledite dispositif à excentrique (14) comporte un élément formant plaque (15) emboîté sur ledit arbre (13).

4. Machine selon la revendication 1, caractérisée en ce que lesdits moyens d'actionnement (12) envisagés pour effectuer le déplacement vers le haut et vers le bas dudit cadre mobile (9) comportent au moins un cylindre hydraulique à double effet (12) engagé respectivement audit cadre mobile (9) et à ladite structure de support fixe (1).

FIG 1

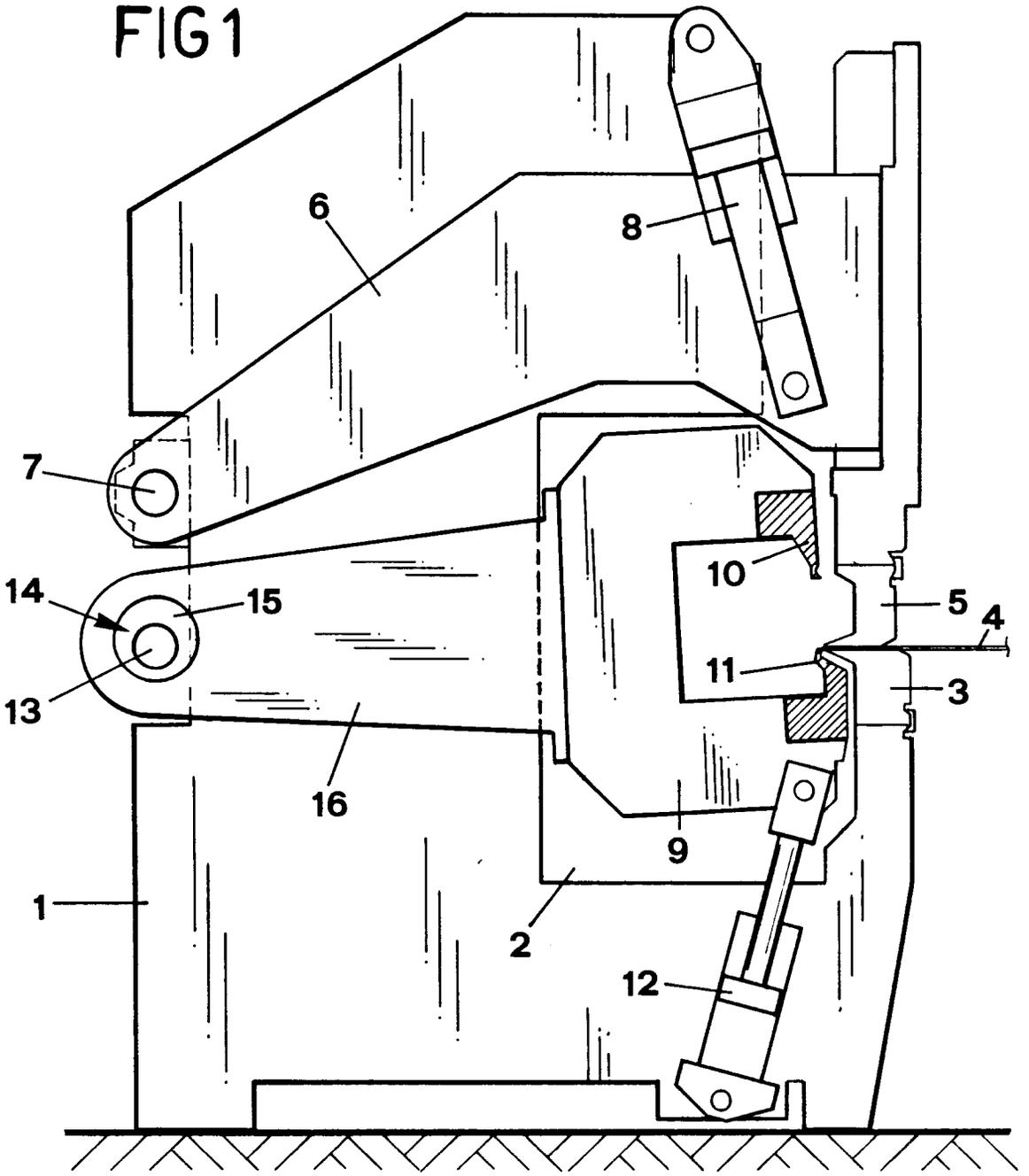

FIG 2

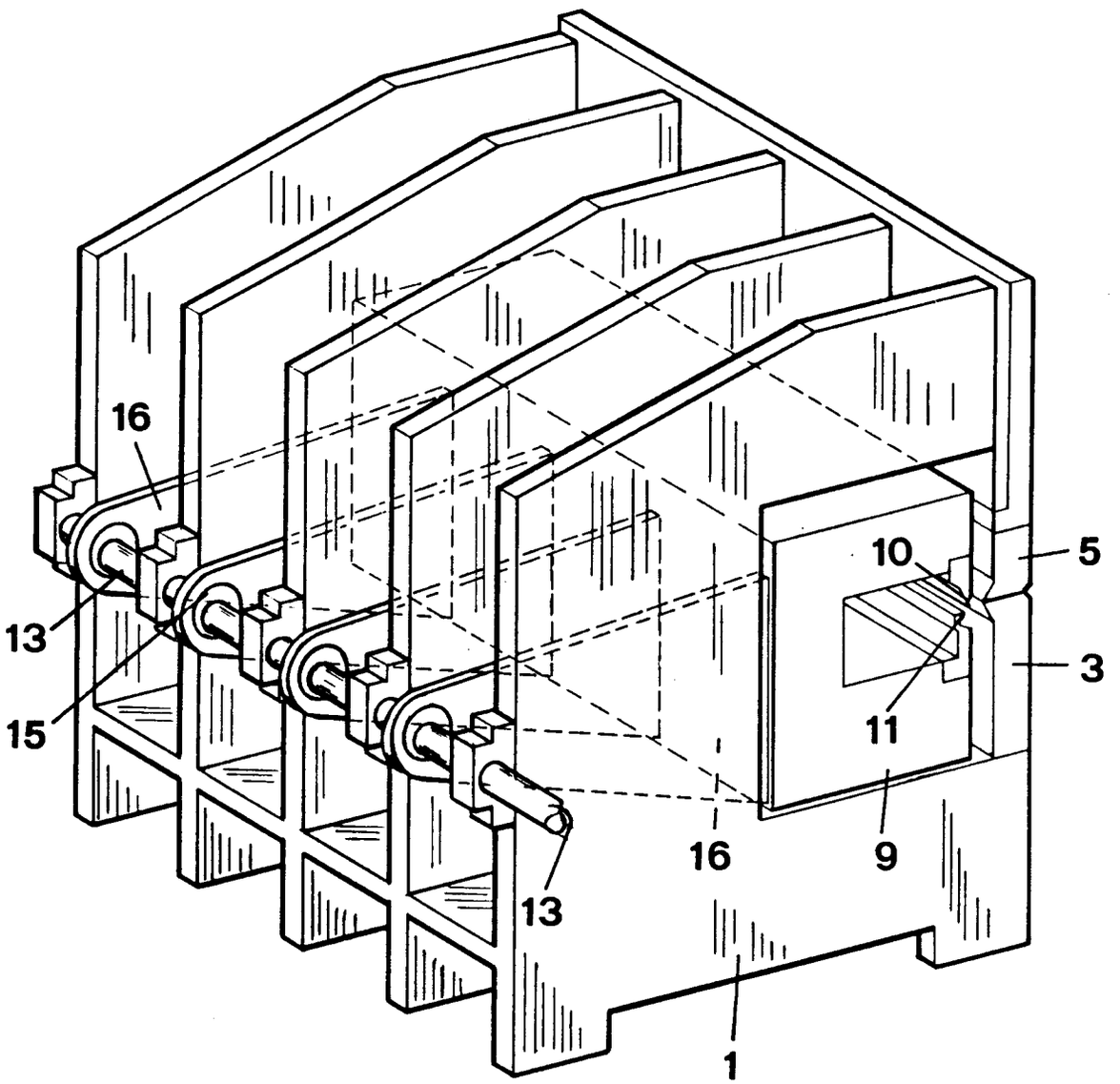

FIG3

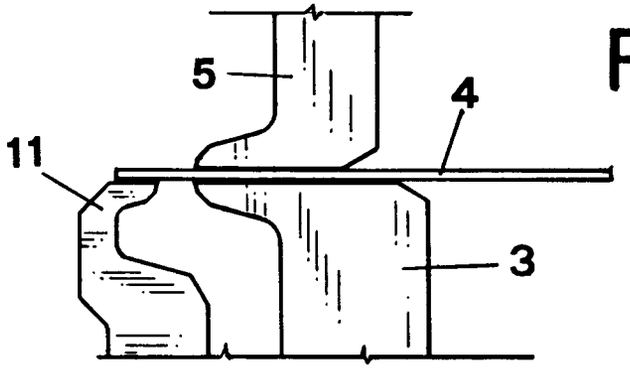

FIG4

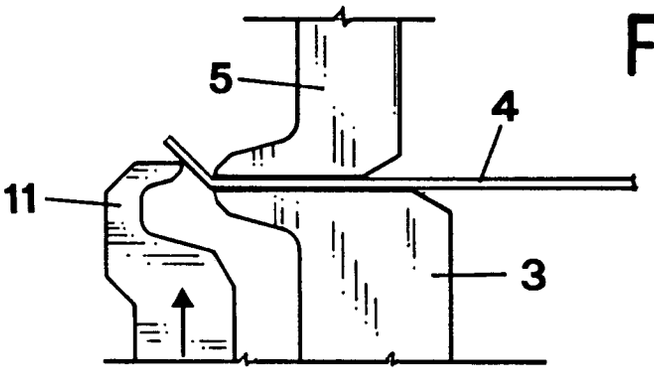

FIG5

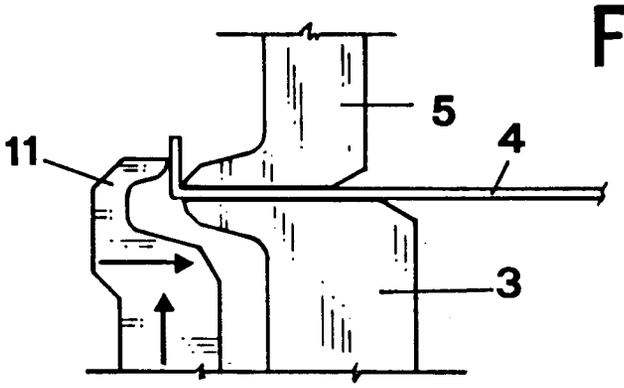

FIG6