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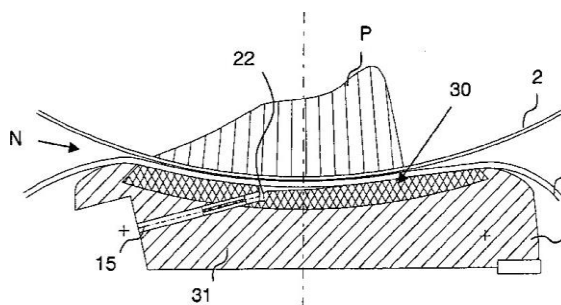
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The following information is taken from the documents submitted by the applicant

(54) Title: **Roll for a fiber web production machine**

(57) Abstract: Roll for a fibrous web manufacturing machine comprising a support element in the form of a shoe (5; 20), wherein this roll together with its counter roll (2) form a nip (N) and the nip pressure (P) in this nip is created by a loading piston (4) arranged in connection with the shoe (5; 20). The shoe (5; 20) of the roll comprises a replaceable wear part (30) which is arranged on the surface of the shoe (5; 20) facing the nip (N) and extends at least over the region of the surface of the shoe (5; 20) facing the nip (N) in which the nip pressure (P) acts.



Description

[0001] The present invention relates to rolls for fibrous web manufacturing machines, such as paper and cardboard machines. More specifically, it is the roll intended for a fibrous web manufacturing machine according to the preamble of claim 1 that is the object of the present invention.

[0002] A type of roll used in fibrous web manufacturing machines, in which support elements, i.e., support shoes, are used, is the controlled deflection roll, which has a stationary roll axis with a loading cavity for a pressure medium and a loading arrangement, such as a support shoe, and a roll shell rotatable about the roll axis, which is loaded by an internal loading arrangement, which is loaded/pressed radially against the inner surface of the roll shell in the loading cavity, the loading arrangement having depressions which are open towards the inner surface of the roll shell and which, together with the inner surface of the roll shell, form chambers into which pressure medium is guided. Controlled deflection rolls are generally used as nip rolls. The so-called shoe rolls already known are generally hydraulically deflection-controlled, zone-controlled rolls in which the shell is supported and loaded from the fixed roll axis by a hydrostatic load arrangement, such as a row of support shoes. The row of shoes is usually also divided into zones, and the loading pressure can be controlled transverse to the running direction of the fibrous web, i.e., transverse to the MD direction, i.e., in the CD direction, depending on the profiling requirement. In such a zone-controlled shoe roll, the zones may even each consist of an individual element of the loading arrangement, and the number of zones of the loading arrangement can reach up to more than 60 - with the shoe rolls marketed by the applicant under the trademarks SymCD™ and SymCDS™ acting as examples, or from groups each comprising some elements of the loading arrangement, the roll and the loading arrangement normally having eight zones - examples of which may include the shoe rolls marketed by the applicant under the trademarks SymZ™, SymZS™, SymZL™, and SymZLC™. In controlled deflection rolls, cast iron roll shells were used and leaded tin bronze was used as the bearing material of the shoes. For certain applications it was necessary to use steel shells. The leaded tin bronze slide shoes proved to be problematic in combination with steel shells, since these materials are not well suited as a pair of materials that are in mutual contact, and shoes sometimes seized up, damaging the inner surface of the shell and rendering it unusable.

The bearing material must be wear-resistant, not seize on the mating surface, of sufficient strength, fatigue-resistant, and, in order to withstand the edge pressures and allow hard particles to penetrate it, deformable to a certain degree. To meet these requirements, the sliding surface is sometimes coated with a polymer material.

[0003] Another type of roll with a support element, i.e., a shoe, that is used in fibrous web manufacturing machines is the shoe or extended nip roll, which comprises an axle part, which supports a stationary press shoe, and two end disks, which are rotatably mounted on the axle part, as well as an elastic shell surrounding the axle part, the edge regions of which are fastened to the end disks by means of fastening elements in such a way that the shell rotates together with the end disks, with the individual shell zones sliding one after the other over the surface of the press shoe. Extended nip rolls are used, for example, in the pressing region of the paper machine and for the calendering process. In the press zone of the extended nip press or the extended nip calendering, the elastic sleeve of the extended nip roll is forced into sliding contact with the press shoe with the help of the counter roll. One problem with extended nip presses is the belt damage resulting from various accumulations of material. When such accumulations occur, the lubricant film between the belt and the shoe is destroyed, causing the belt to be subjected to high shear stress and the belt to crack, resulting in a delamination of the belt and possibly damage to the counter roll. Such a situation often results in damage to the shoe, which then has to be replaced in its entirety. For this reason, the friction between the shoe and the belt (shell) must be kept to a minimum so that the shoe continues to function even in extreme situations of the kind described above.

[0004] An arrangement is known from the prior art in which an attempt was made to solve the aforementioned problems by applying a bracket structure to the shoes at the nip point, which consists of a bracket of a certain thickness extending over the entire transverse direction, i.e., the length of the nip. One shortcoming, however, is that this is a stepped design, so that it is not suitable for all shoes used in fibrous web manufacturing machines in conjunction with rolls, for example in conjunction with extended nip rolls. Such an arrangement is described, for example, in the US patent specification 6,045,492.

[0005] Attempts have also been made to solve problems by coating the inner surface of the shell with a suitable material, but this may be difficult for manufacturing reasons and is also not suitable for all

shoes that are used in fibrous web manufacturing machines in conjunction with rolls, such as in conjunction with extended nip rolls. Such a concept is described in the US patent specification 5,785,636.

[0006] The patent EP 1 394 424 describes an arrangement in which the entire upper part of the shoe between the support structure and the mating surface, or the upper part of the shoe including the support structure, is made of plastic. This is a rather costly arrangement, however, which, moreover, may not meet this requirement of applications that require high rigidity.

[0007] The main object of the present invention is to provide a roll for fibrous web manufacturing machines, in which the above-mentioned problems are eliminated or at least substantially reduced.

[0008] The characterizing features of the roll according to the invention listed in claim 1 address the challenges described above and the passages below.

[0009] The invention thus provides a replaceable wear part, in which the wear part of the support element/shoe can be replaced either in its entirety or in parts.

[0010] According to a preferred embodiment of the invention, the frame of the shoe/support element comprises a wear part that can be easily replaced in the event of damage.

[0011] In the invention, an advanced engineering plastic, for example polyether ketone (PEEK) polyamide-imide (PAI) or polyimide (PI), which is preferably supplemented with a small amount of polytetrafluoroethylene (PTFE) and/or graphite to improve the sliding properties, is used as the bearing material of the shoe of the roll of the fibrous web manufacturing machine. The new advanced thermoplastics have good wear resistance, do not seize onto the steel surface, and are deformable to a certain extent, so that they can withstand the edge pressures of the shoe well and also allow particles to penetrate them. They do not have particularly good rigidity, however, which is why the structure preferably comprises a rigid support part made of steel, for example. The replaceable wear part according to the invention is thus a part that functions as a bearing material that, including its possible reinforcement, is

replaceably attached to the remainder of the shoe structure by means of the nozzles of the support elements. This arrangement also has the advantage that expensive plastic is only required for the bearing part, while the reinforcing part is made of less expensive material, for example metal, preferably cast iron or steel, or a fiber-reinforced polymer composite. The reinforcing part and the bearing part are attached to each other, for example by screws, adhesive, or rivets, and the shoe's wear parts according to the invention are of course provided with the channels required for the oil flow.

[0012] In the invention, the part of the shoe that comes to rest against the belt is made of a plastic material whose friction with the belt is, in lubrication limit cases, substantially lower than that of the steel or other metal material currently used. The plastic part can extend in one piece over the entire length of the shoe (i.e., in the direction of the CD) or be made of sections, in which case only the damaged section needs to be replaced in the event of damage. The part is preferably attached to the frame by dovetail joints, screws, or other suitable means. The part has a thickness of at least 5 mm.

[0013] The replaceable part extends on the shoe surface from the start of the contact at least as far as the pressurized region, but the replaceable wear part can also extend over the entire surface.

[0014] A further advantage is that, compared to steel, plastic causes less damage to the counter roll in cases of damage in which the shoe rubs against the counter roll. The plastic also has a heat-insulating effect and thus prevents frictional heat from being transferred to the metal frame of the shoe, which prevents a temperature-related warping of the shoe, which could lead to profile problems.

[0015] In its other parts, the support element/shoe is typically made of metal, such as aluminum, steel, or aluminum bronze.

[0016] Below, the invention is described in detail with reference to some embodiments found to be advantageous and with reference to the accompanying drawings, the details of which, however, are not intended to narrowly limit the invention in any way. The figures show the following:

[0017] Fig. 1 is a schematic representation of an extended nip press corresponding to prior art;

[0018] **Fig. 2** is a schematic representation of a controlled deflection roll according to prior art;

[0019] **Fig. 3A-Fig. 3B** is a schematic representation of one embodiment of the invention in conjunction with an extended nip roll;

[0020] **Fig. 4A-Fig. 4C** is a schematic representation of one embodiment of the invention for a controlled deflection roll.

[0021] Unless otherwise indicated, the same reference symbols have been assigned to the corresponding parts in the drawings.

[0022] **Fig. 1** is a schematic representation of an extended nip press according to prior art and comprises an extended nip roll **1** and a counter roll **2**, which together form an extended press nip N, through which the paper or cardboard web is guided by a press felt (not shown). The extended nip roll **1** has a stationary axle part **3**, which is only partially shown in the drawing. The press shoe **5** and the support elements **4**, with which the press shoe **5** is pressed against the counter roll **2** in order to achieve the desired pressing pressure, are supported on this part. The axle part **3** is surrounded by an elastic hose-like shell **10**, which is attached to the two end plates **11** of the roll (only indicated). The end plates **11** are mounted in such a way that they can rotate around the axle part **3**. When the shell **10** rotates about the axle part **3**, the zones of the shell slide one after the other over the surface of the press shoe **5**.

[0023] **Fig. 2** shows a controlled deflection roll according to prior art with a shell **10** that is rotatable about a stationary axis **3**, which together with the surface of the counter roll **2** forms a nip N, where the nip load tends to cause a deformation on the shell **10**. A loading arrangement is inserted between the stationary axle **3** and the roll shell **10**, which has a row of hydraulic loading pistons **4** running in the transverse direction of the machine, i.e., in the direction of the CD, to compensate for the roll deflection and to press the roll shell against the counter roll. The roll can have several dozen such loading pistons **4**. A hydraulic loading chamber **4'** is formed on the stationary axle **3** for each loading piston **4**, into which a pressure medium, preferably hydraulic oil, is supplied via the supply channel **15**. Each loading piston **4** can be assigned its own supply channel **15**. The pressure medium can be supplied to the roll, for example via the central bore **15'** of the stationary axle **3**. The

pressure medium is fed into the loading chamber **4'** via the supply channel **15** in order to move the support element **20** radially to the axle **3**. The support element **20** consists of a loading piston **4** and one or more sliding elements **5** that are essentially firmly attached thereto. The pressure that is caused by the hydraulic medium in the loading chamber **4'** can be used to load/press the support element **20** against the inner surface of the shell **10**, so that the sliding surface of the sliding element **5** comes to rest against said inner surface of the shell **10**. A film of lubricant is placed between the sliding surface and the inner surface of the shell **10** by introducing the pressure medium through the capillaries **15"** of the support element **20** into the recesses **22** formed on the sliding surface and acting as lubrication chambers. The lubrication chambers **22** are separated from each other by "webs" **16** and can be arranged one behind the other in the transverse direction of the machine (CD direction).

[0024] **Fig. 3A-Fig. 3B** show one embodiment of the invention in connection with an extended nip roll. **Fig. 3A** shows the extended nip N formed by the extended nip roll and its counter roll **2**. The shoe of the extended nip roll is pressed against the counter roll **2** in order to create the desired nip pressure P within the elastic shell **10** or belt **10**. Lubricant is supplied to the recess **22** formed on the surface of the shoe **5** via the channel **15** formed on the shoe **5** to lubricate the nip N. As shown in **Fig. 3A-Fig. 3B**, the shoe **5** has a replaceable wear part **30**. This wear part **30** is inserted into a recess formed on the shoe **5** and is arranged in such a way that it extends on the surface of the shoe **5**, faces the inner surface of the elastic shell **10**, at least over the region in which the nip pressure acts. The wear part **30** in contact with the inner surface of the belt **10** is preferably made of a plastic, whose friction with the belt **10** in lubrication limit cases is significantly lower than that of the steel or other metal material currently used. The wear part **30** can extend in one piece over the entire length of the shoe **5** (in the CD direction) or be made of sections, in which case only the damaged section needs to be replaced in the event of damage. The wear part is preferably attached to the frame of the shoe **5** by dovetail joints, screws, or in another suitable manner that allows for it to be replaced. The wear part **30** has a thickness of at least 5 mm. The frame material of the shoe **5** is metal, for example aluminum, steel, or aluminum bronze. As can be seen from **Fig. 3A**, the replaceable wear part **30** extends on the surface of the shoe **5** starting from the beginning of the contact at least to the end of the pressurized region P but can also extend over the entire surface.

[0025] Fig. 4A-Fig. 4C clearly illustrates one embodiment for a controlled deflection roll according to the invention. The support element **20** comprises a surface part **32**, i.e., a bearing part, and a support part **31**. The support element **20** is attached to the loading piston **4** via the nozzles **17**, in which the medium channels, i.e., the capillaries **15**", run. The surface part **30** of the support element **20** acts as a bearing. The preferred material for the surface part is ThermoPlast, for example polyether ketone (PEEK) polyamide-imide (PAI) or polyimide (PI), which is preferably supplemented with a small amount of polytetrafluoroethylene (PTFE) and/or graphite to improve the sliding properties. To increase rigidity, the replaceable wear part in this embodiment has a rigid support part **31** made of metal, for example steel, or of composite material. The replaceable wear part **30** thus consists of the part **32** acting as bearing material, which, together with its support part **31**, is removably attached to the remainder of the shoe structure, for example by means of the nozzles **17**. The support part **31** and the bearing part **32** of the replaceable wear part **30** are attached to each other, for example by screws, adhesive or rivets.

[0026] The invention has been described above only with reference to some preferred embodiments, to the details of which, however, the invention is in no way intended to be narrowly limited.

Claims

1. Roll for a fibrous web manufacturing machine, comprising a support element in the form of a shoe (**5; 20**), wherein this roll (**1**) together with its counter roll (**2**) form a nip (N) and the nip pressure (P) in this nip is created by a loading piston (**4**) arranged in connection with the shoe (**5; 20**), **characterized in that** the shoe (**5; 20**) of the roll comprises a replaceable wear part (**30**) which is arranged on the surface of the shoe (**5; 20**) facing the nip (N) and extends at least over the region of the shoe (**5; 20**) which faces the nip (N) of the roll has a replaceable wear part (**30**) which is arranged on the surface of the shoe (**5; 20**) facing the nip (N) and extends at least over the region of the surface of the shoe (**5; 20**) facing the nip (N) in which the nip pressure (P) acts.

2. Roll according to claim 1, characterized in that the replaceable wear part (**30**) of the shoe (**5; 20**) of the roll is made of plastic.

3. Roll according to claim 1 or 2, characterized in that the plastic of the replaceable wear part (**30**) of the shoe (**5; 20**) of the roll is a thermoplastic, for example polyether ketone (PEEK) polyamide-imide (PAI) or polyimide (PI).

4. Roll according to any of claims 1 to 3, characterized in that the plastic of the replaceable wear part (**30**) of the shoe (**5; 20**) of the roll is supplemented with a small amount of polytetrafluoroethylene (PTFE) and/or graphite.

5. Roll according to any of claims 1 to 4, characterized in that the replaceable wear part (**30**) of the shoe (**5; 20**) of the roll is attached to the frame of the shoe (**5; 20**) by a dovetail connection.

6. Roll according to any of claims 1 to 5, characterized in that the replaceable wear part (**30**) of the shoe (**5; 20**) of the roll is formed integrally, i.e., in one piece, in the CD direction of the fibrous web manufacturing machine.

7. Roll according to any of claims 1 to 6, characterized in that the replaceable wear part (**30**) of the shoe (**5; 20**) of the roll in the CD direction of the fibrous web manufacturing machine is composed of several sections that are individually replaceable.

8. Roll according to claim 1, characterized in that the replaceable wear part (**30**) of the shoe (**5; 20**) of the roll comprises a surface part (**32**) made of plastic and a support part (**31**) made of metal.

9. Roll according to any of claims 1 to 8, characterized in that the replaceable wear part (**30**) of the shoe (**5; 20**) of the roll is attached to the remaining shoe structure via nozzles (**17**).

10. Roll according to any of claims 1 to 9, characterized in that the surface part (**32**) and the support part (**31**) of the replaceable wear part (**30**) of the shoe (**5; 20**) of the roll are fastened together by screws, adhesive, or rivets.

11. Roll according to claim 1, characterized in that the roll is an extended nip roll (**Fig. 1**).

12. Roll according to claim 1, characterized in that the roll is a controlled deflection roll (**Fig. 2**).

3 sheets of drawings to follow

Attached drawings

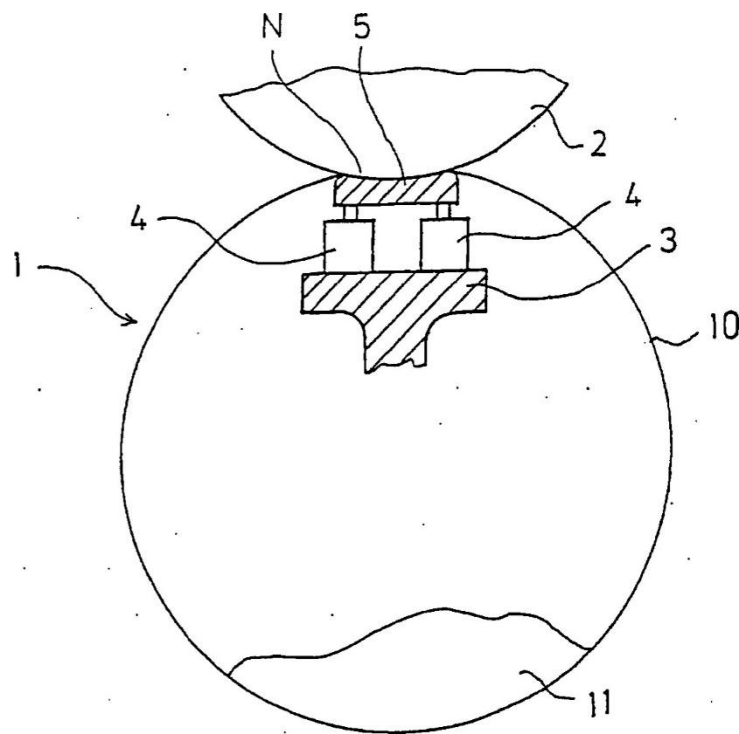


FIG. 1
Prior art

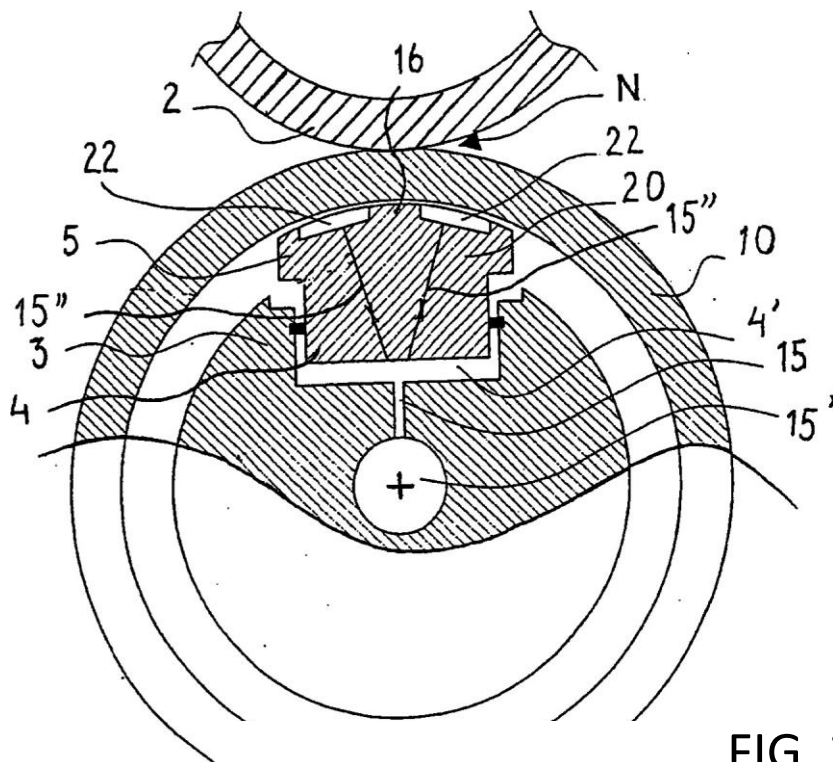


FIG. 2.
Prior art

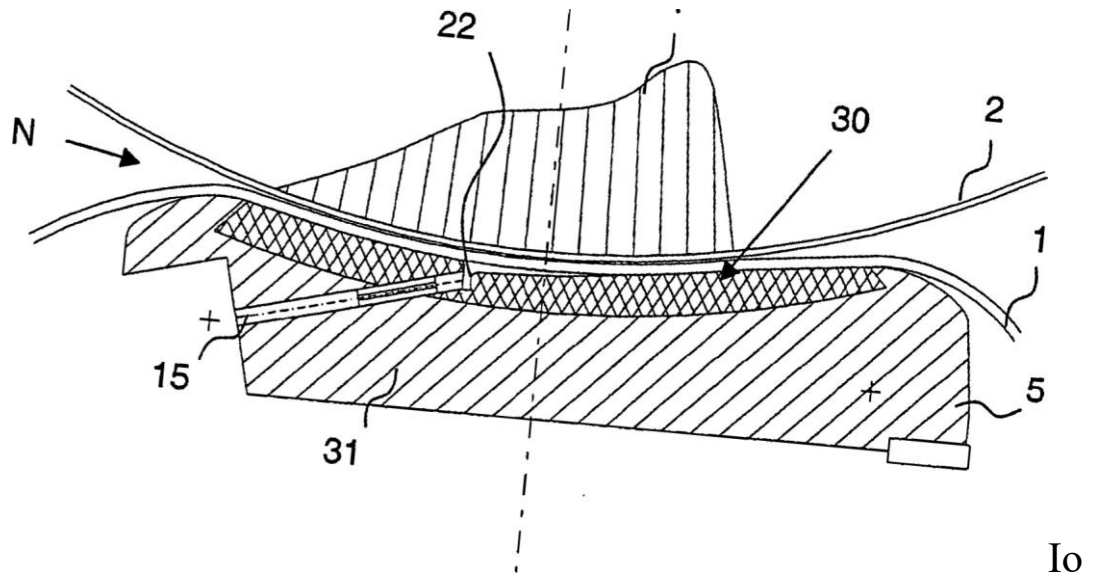
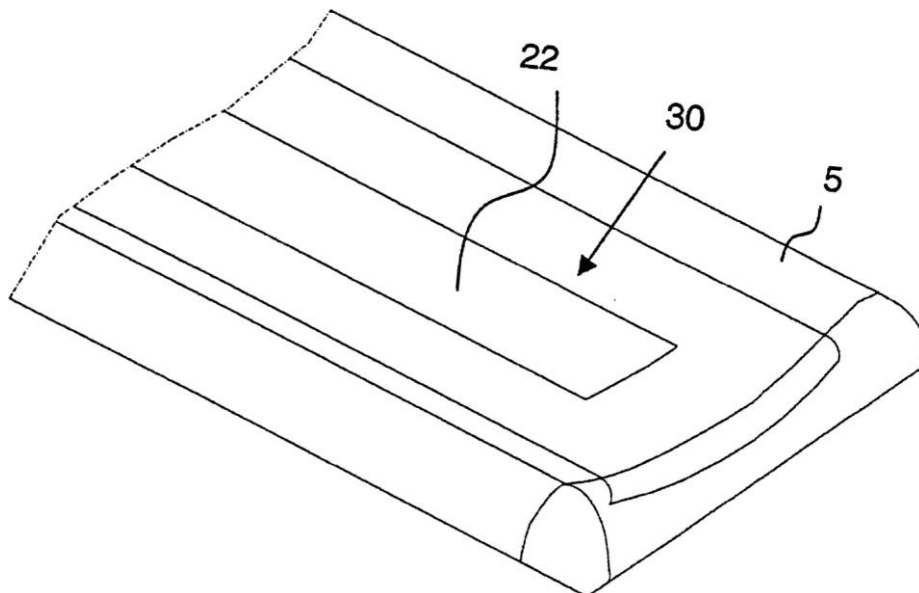


FIG. 3A



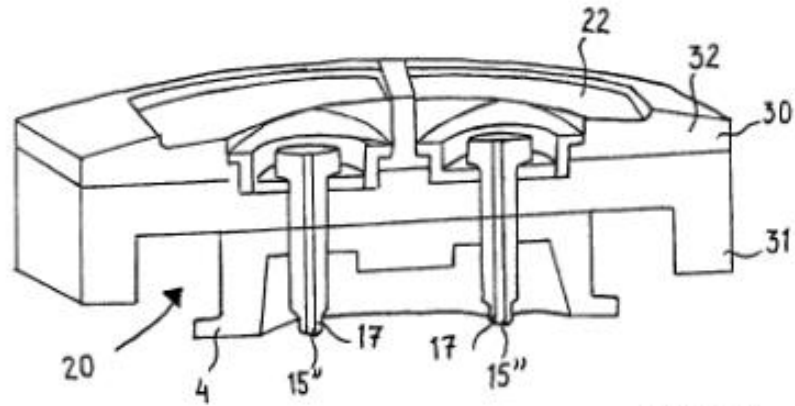


FIG. 4A

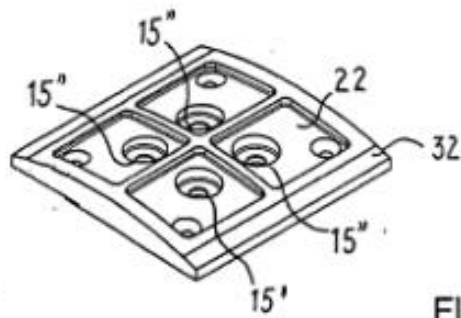


FIG. 4B

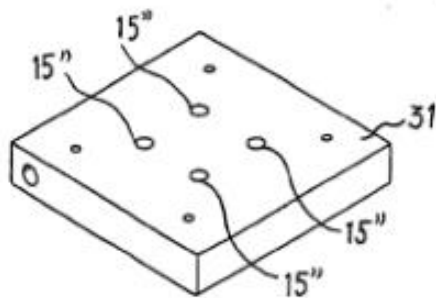


FIG. 4C

TRANSLATION CERTIFICATION

Date: January 17, 2025

To whom it may concern:

This is to certify that the attached translation is an accurate representation of the documents received by this office. The translation was completed from:

- German

To:

- English

The documents are designated as:

- DE_102007039364_A1_en-US.docx

Renzo Nunez, Project Manager in this company, attests to the following:

“To the best of my knowledge, the aforementioned documents are a true, full and accurate translation of the specified documents.”



Signature of Renzo Nunez