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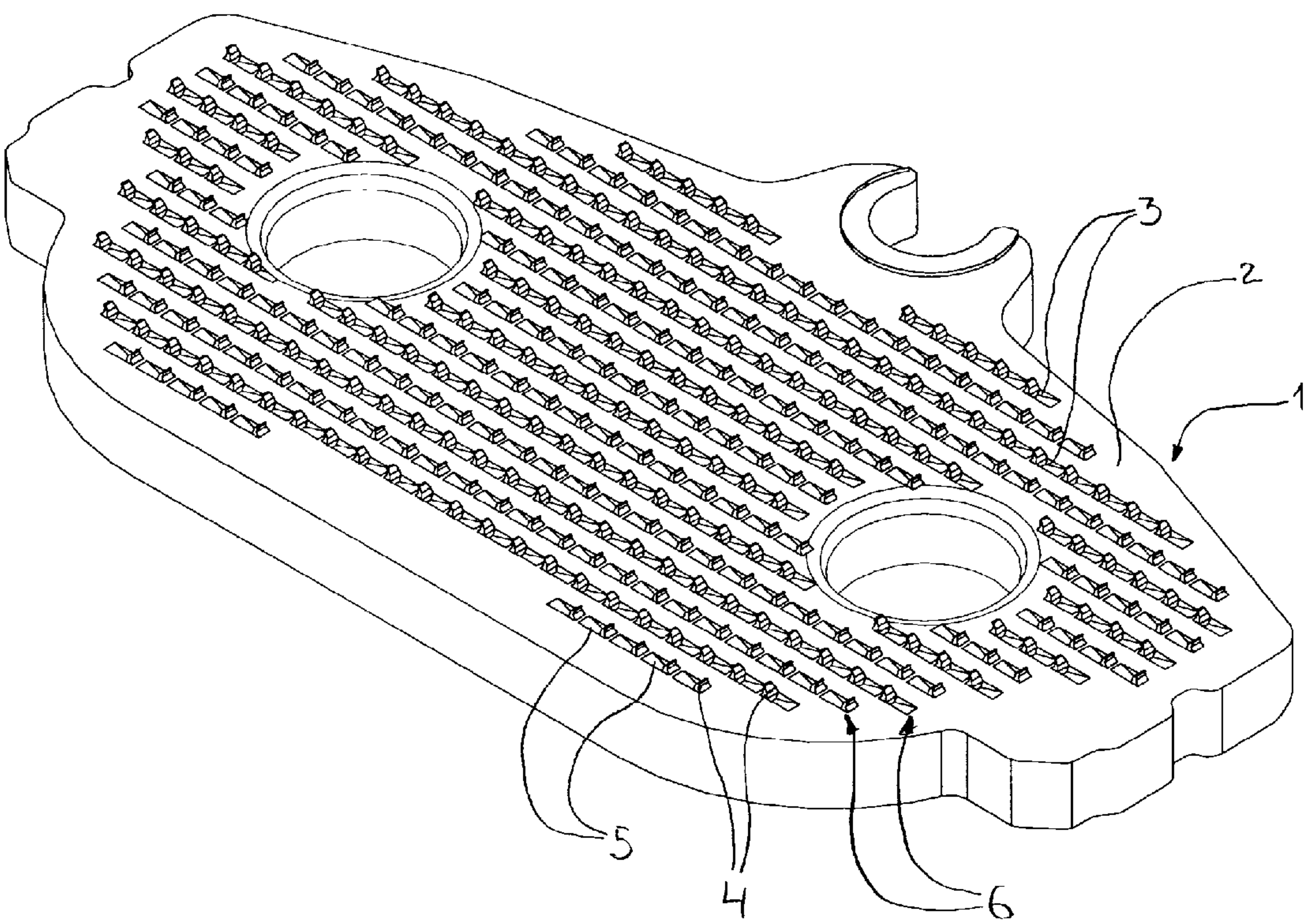
(54) **PORTE-SABOT D'UN FREIN A DISQUE, METHODE ET APPAREIL DE FABRICATION**

(54) **DISC BRAKE BACKING PLATE AND METHOD AND APPARATUS OF MANUFACTURING SAME**



Industrie Canada Industry Canada

Title: **DISC BRAKE BACKING PLATE AND METHOD AND APPARATUS FOR MANUFACTURING SAME**

Inventor: **Ray Arbesman**

BACKGROUND OF THE INVENTION

Field of the Invention

This invention relates to disc brakes for motor vehicles, and in particular to an improved disc brake backing plate, as well as a method and apparatus for manufacturing the backing plate.

Description of the Prior Art

Although disc brakes have been used on motor vehicles for many years, their use has increased substantially in recent years. In particular, there has been a significantly increased use of disc brakes on lower priced cars and trucks, with a consequent interest in methods of reducing the cost of manufacturing disc brakes and replacement parts therefor on the part of both motor vehicle manufacturers and suppliers of parts for disc brakes. This increased use has also led to a significant increase in the after-market for disc brake replacement and repair.

Disc brakes, as currently manufactured, combine two main parts, namely a backing plate and a friction pad. The backing plate is mounted in a brake assembly, and may be formed by stamping a suitable metal blank to produce a backing plate with a variety of bosses, holes, or other features for receiving and retaining the friction pad. The need to use high speed low cost manufacturing methods often results in irregularities in the backing plate which may lead to difficulties in attaching and/or retaining the friction pad on the backing plate during braking, when the friction pad is in contact with the rapidly turning brake rotor, or even during the pre-installation handling of the brake pad assembly.

There are a variety of known ways of attaching a friction pad to a backing plate. One such way is to attach the friction pad to the backing plates using rivets. One disadvantage of the riveting process is that it creates a rigid bond between the backing plate and the friction pad, which can, as a result of a sudden impact, lead to breaking of the friction pad. Furthermore, this process often requires one or more additional manufacturing steps with a consequent increase in cost. In addition, when the friction pad is worn down over time, the rivets become exposed and rub against the brake rotor, causing scoring on the rotor which is costly to repair.

Another, more recently developed method of mounting the friction pad on the backing plate is to use a pressurised molding process to mold the friction pad directly onto the backing plate. In this process, the friction pad may be prepared by blending the components of the friction pad into a pre-form or cake. A conventional pressurized molding system is used to mold the friction pad pre-form onto the backing plate. A layer of cement or glue if often applied to the contact surface of the backing plate to improve the adhesion between the backing plate and the friction pad.

As pressure is applied to the mold assembly, the pre-form becomes heated and begins to flow, filling the mold and covering the appropriate surface of the backing plate. In this process, the pre-form material is intended to flow into and around the various features to improve the bond between the backing plate and the friction pad.

The backing plate is subjected to a number of forces, such as the jarring of the moving vehicle, as well as vibration caused by the rotor and noise. The problem with the prior art processes and backing plates is that features, such as holes and bosses, stamped into the backing plate often provided insufficient shear and/or tensile strength in the bond between the friction pad and backing plate. When additional features are stamped into the backing plate to increase bond strength, additional manufacturing steps are required, adding to the cost.

The most common prior art features stamped into backing plates are circular holes. These holes often provide unsatisfactory results because, during the molding process, the pre-form cake does not completely fill all of the holes, which in turn, leads to deficient bonding between the backing plate and the pre-form. The incomplete hole fills can are clearly visible, and often raise quality concerns when inspected by buyers. The incomplete hole fills also have an aesthetically displeasing appearance, which can also make them less attractive to customers. Accordingly, it has become common practice in prior art backing plates to fill the incomplete hole fills with putty and to paint over them, to both hide the unsatisfactory molding results and to improve appearance. These additional manufacturing steps have the added disadvantage of increasing the cost of manufacturing the disc brake.

Furthermore, the holes stamped by prior art processes reduce structural strength of the backing plate, and make it more vulnerable to the various forces acting on it. These forces may distort the shape of the backing plate, leading to uneven wear on the friction pad, or can lead to structural failure of the backing plate.

Accordingly, there is a need for a disc brake backing plate and a method of manufacturing same which can provide improved bonding with the friction pad without increasing the cost of producing the backing plate

SUMMARY OF THE INVENTION

It is an object of the invention to provide a backing plate which provides an improved bond between it and the friction pad, as well as increasing the structural strength of the backing plate, without increasing the cost of producing the backing plate. In addition, it is an object of the invention to provide a method and apparatus for manufacturing the backing plate which reduces time and cost by requiring fewer manufacturing steps, while at the same time retaining the structural strength of the backing plate.

Further features of the invention will be described or will become apparent in the course of the following detailed description.

BRIEF DESCRIPTION OF THE DRAWINGS

In order that the invention may be more clearly understood, the preferred embodiment thereof will now be described in detail by way of example, with reference to the accompanying drawings, in which:

Fig. 1 is a perspective view of a preferred embodiment of a backing plate according to the present invention;

Fig. 2 is a perspective view of a preferred embodiment of an apparatus for manufacturing the backing plate according to the present invention;

Fig. 3A is a plan view of the apparatus;

Fig. 3B is a magnified view showing the knives and teeth of the apparatus shown in Fig. 3A;

Fig. 4 is an elevation view of the apparatus with the side plates removed;

Fig. 5A is a cross-sectional view showing the apparatus impacting the bottom of a conventional press;

Fig. 5B is a cross-sectional view showing the knives beginning to cut into a blank; and

Fig. 5C is a cross-sectional view showing the knives completing the cut into a blank.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

Fig. 1 shows a disc brake backing plate **1** according to a preferred embodiment of the present invention. The backing plate **1** has a conventional shape and any suitable thickness ($^{1}/_{8}$ - ½ of an inch), and is preferably manufactured from metal or a metal composite adapted to withstand the rigors of a conventional disc braking system. The circular holes shown on the backing plate are not necessary are included for illustrative purposes only. The backing plate has a contact surface **2** for molding a friction pad (not shown) thereto by a conventional molding process.

Any suitable number of retaining structures **3** are connected to the first surface of the backing plate. Preferably, the retaining structures are integrally formed by punching the backing plate, as described in more detail below. Each retaining structure includes a burr **4** projecting out of the first surface, which is located adjacent to a corresponding depression **5** defined in the contact surface **2**. Preferably, each burr is integrally formed by cutting the burr out of the first surface of the backing plate, which creates the corresponding depression **5**. Each burr preferably has a curved shape, which curves away from its corresponding depression.

The retaining structures **3** are preferably arranged in longitudinally disposed substantially parallel rows **6**. Preferably, the position of the burr **4** and depression **5** is identical for each row, but alternates with adjacent rows, as shown in Fig. 1. Preferably, the number of rows is sufficient to cover substantially the entire surface area of the backing plate **1** in order to provide maximum bond strength. The depth of the depressions and the height of the burrs depends on the bond strength required for a particular application.

The backing plate **1** according to the present invention does not need to be coated with an any adhesive to achieve the required bond strength with the friction pad.

The method of manufacturing the backing plate **1** according to the present invention comprises placing the backing plate on a flat surface under a conventional press and punching the contact surface **2** of the backing plate with a series of substantially parallel knives **10**. Referring to Fig. 2, the knives are preferably disposed substantially parallel to the longitudinal axis of the backing plate. Each knife has a plurality of preferably identical teeth **11** defined along a cutting edge thereof. Each tooth forms the depression **5** and burr **4** of one retaining structure **3**. The configuration of the teeth alternates from row to row, such that every other row has an identical configuration.

Fig. 2 shows the apparatus **12** for manufacturing the backing plate according to the present invention. The apparatus is mounted to a conventional press in any suitable manner for punching the backing plate **1**, as described above.

Referring to Figs. 2-4, the apparatus **12** includes a base plate **13** from which two side plates **14** are suspended by preferably four conventional screws **15**. Preferably, two transverse slide rods **16** are suspended from four support springs (not shown) which are each attached to one of the screws at one end and to an end of the slide rod at the other end. The slide rods are slidably secured to the knives **10** by preferably guide slots **17** defined in the knives, in which the rods locate. A biasing means, such as, for example, two return springs **18** are connected to each slide rod to bias the slide rods toward each other. A pressure plate **19** is disposed below the non-cutting edges of the knives. Preferably, a plurality of adjustment springs **20** are disposed between the base plate and the pressure plate to urge the two apart. Two block housings **21** are mounted transversely onto the base plate adjacent to the edges of the knives. A drive block **22** is mounted on each block housing by a slide bolt **23** which is disposed substantially parallel to the longitudinal axis of the knives. A slide block **24** is slidably mounted in each housing adjacent to the drive block.

Fig. 5A shows the initial step of operation of the apparatus **12.** A conventional press (not shown) drives the apparatus **12** onto a backing plate blank **25**, such that the slide block **24** preferably impacts the bottom surface of the press **26** before the knives **10** impact the blank. The impact against the bottom surface of the backing plate drives the slide block up relative to the drive block **22**, causing the slide block sliding surface **27** to exert a force on the drive block substantially parallel to the longitudinal axis of the knives. This force causes each drive block to move alternate knives along their longitudinal axis. Because only alternate knives contact each drive block before impact, adjacent knives are pushed in opposite directions by each drive block. Preferably, the knives are moving before the blank contacts the knives.

Referring to Figs. 5B and 5C, the impact of the knives **10** against the blank **25** may be regulated by the adjustment springs **20** (shown in Fig. 2). The adjustment springs allow the apparatus **12** to be mounted on presses having different force specifications. The adjustment springs effectively ensure that a constant force is exerted against the knives, regardless of the force applied by the press. As the knives are pushed down into the blank, they also slide along the slide rods **16** parallel to their longitudinal axis, such that adjacent knives are moving in opposite directions as they cut. These simultaneous downward and sliding movements cause each tooth **11** of a knife to form one retaining structure **3**.

The apparatus is able to complete an entire backing plate in one punch. After the press lifts the apparatus **12**, the slide block **24** is returned into its starting position by gravity, and the knives **10** and drive block **22** are returned to their starting positions by the slide springs **19**.

During the process of molding and securing the friction pad to the backing plate, the pre-form material is set into a mold and pressed against the backing plate. The material flows into and surrounds each retaining structure **3** to bond with the backing plate **1**. The retaining structures provide improved tensile strength, as well as providing improved shear resistance. The tensile and shear strengths can be varied by changing either the depth of the cut (i.e. the depression **5**), which also increases the height of the burr **4**.. These results are accomplished using a two step process, and without the need for additional features, such as holes, leading to a decreased manufacturing time and significant cost savings.

It will be appreciated that the above description relates to the preferred embodiment by way of example only. Many variations on the invention will be obvious to those knowledgeable in the field, and such obvious variations are within the scope of the invention as described and claimed, whether or not expressly described.

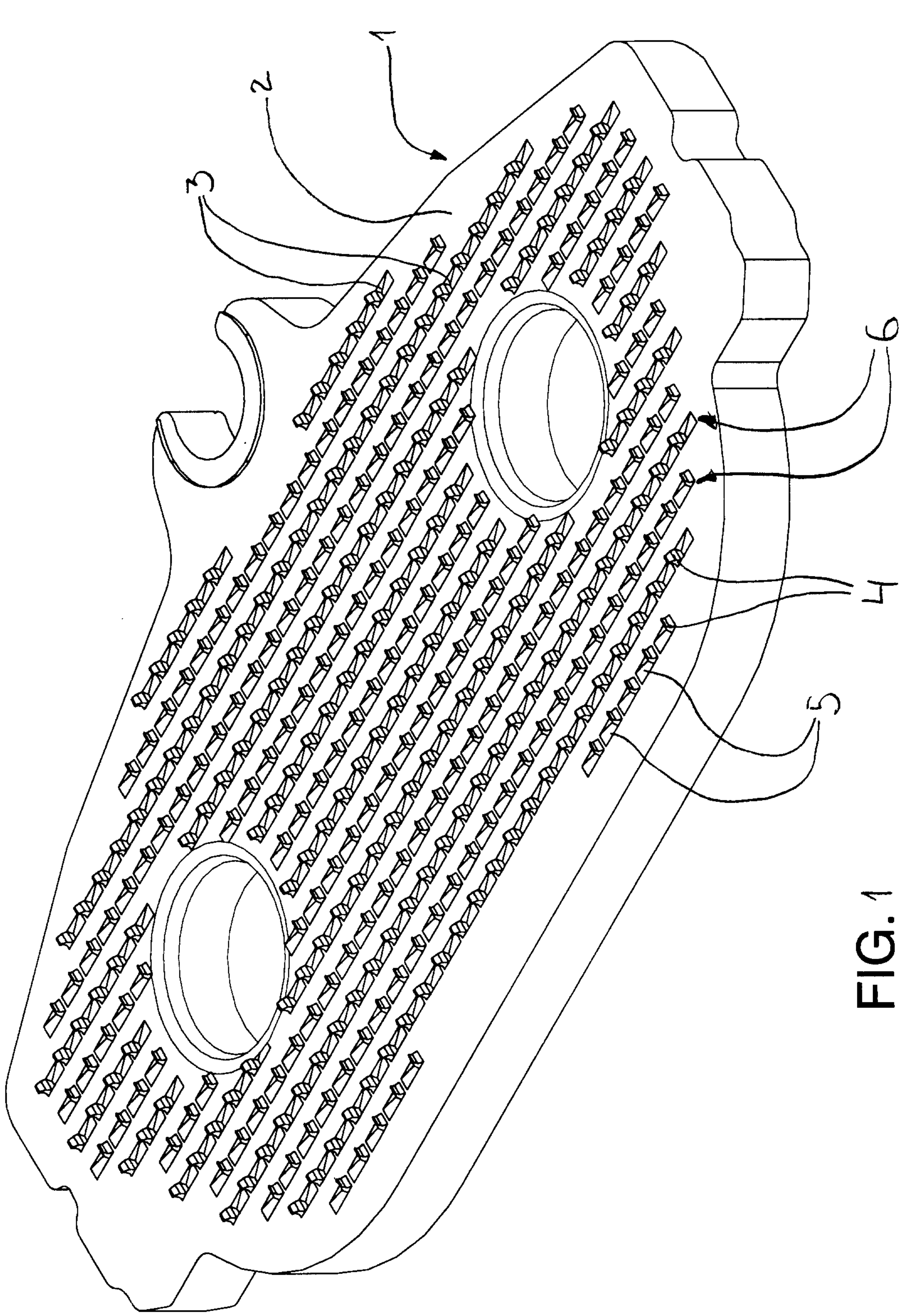


FIG. 1

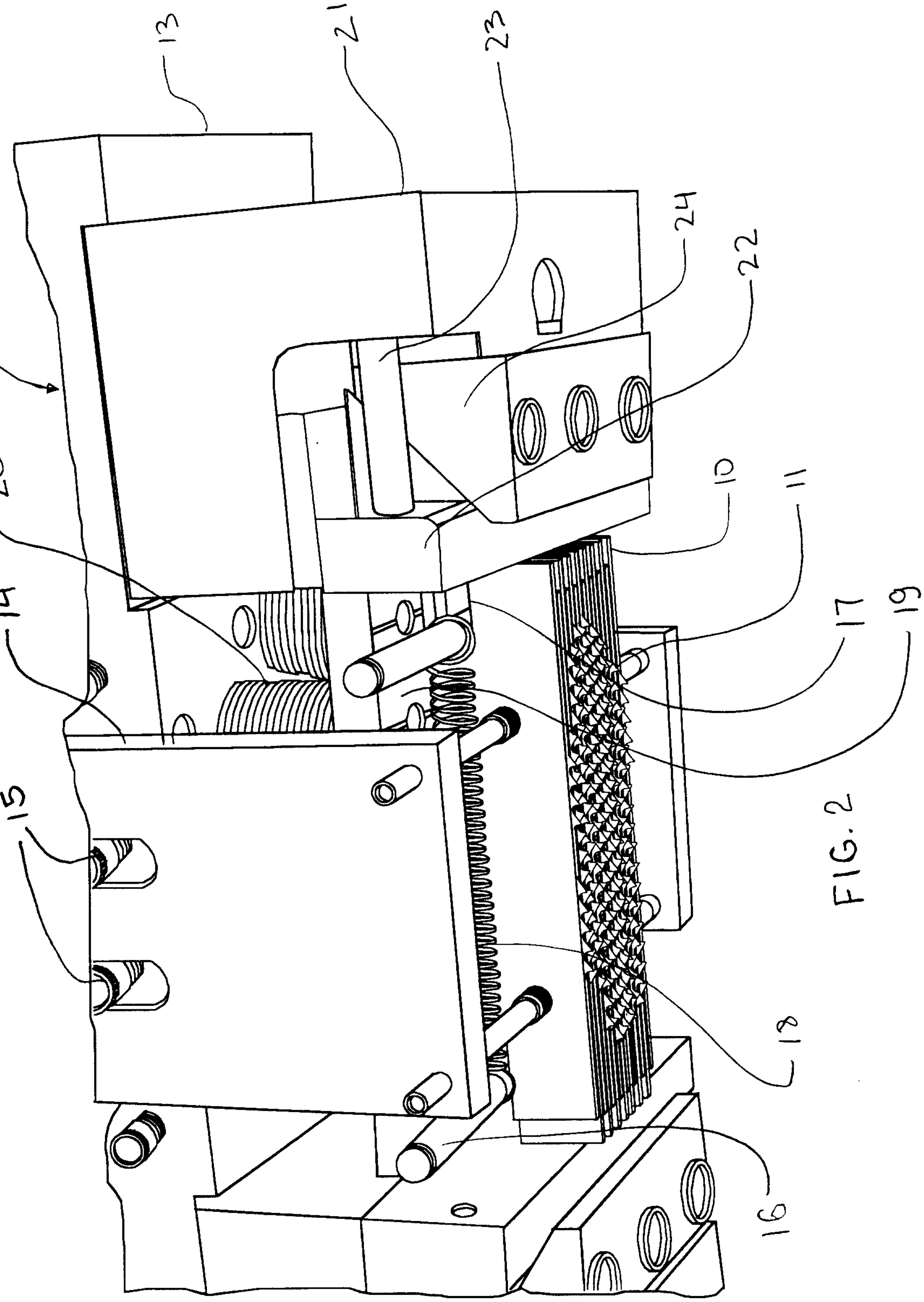


FIG. 2

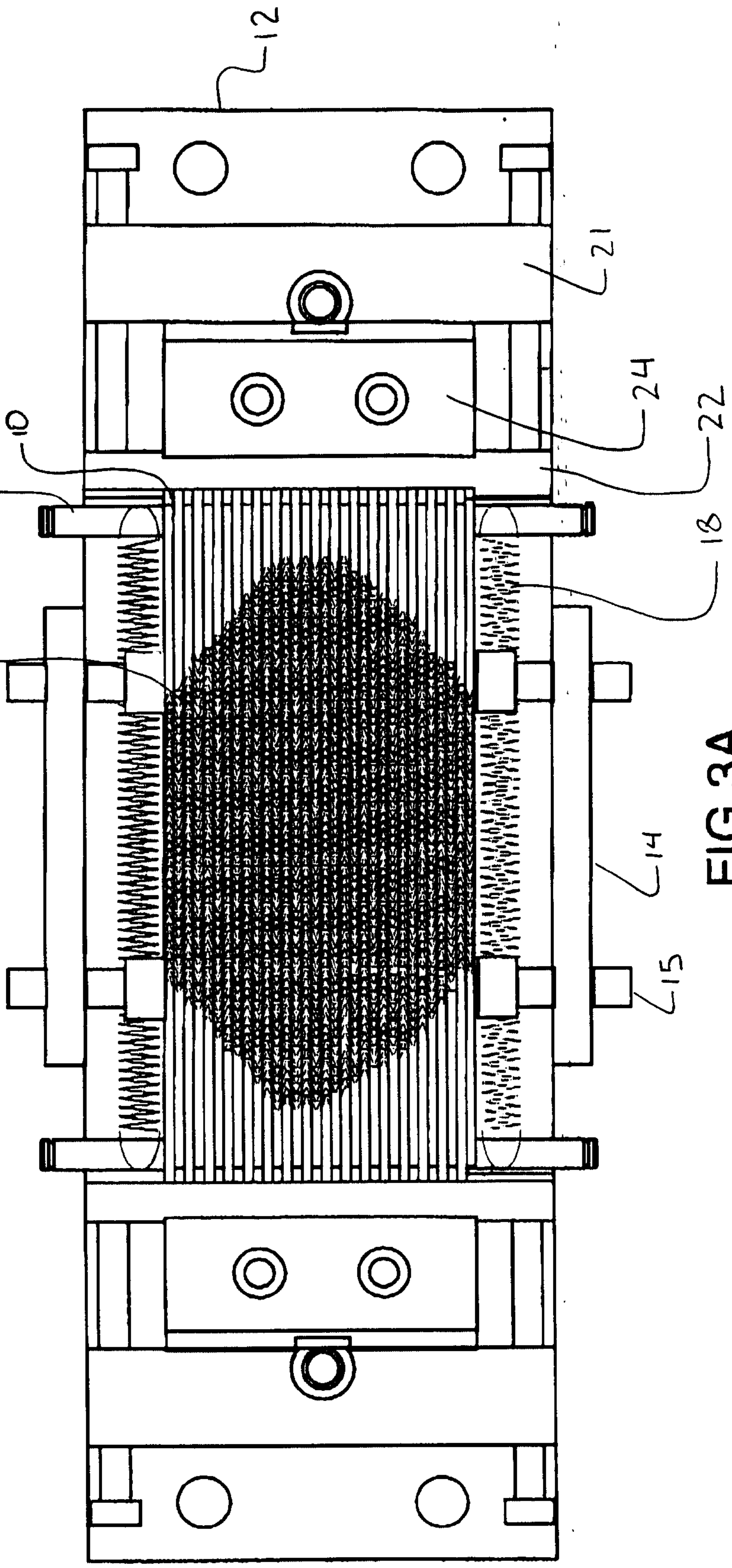


FIG.3A

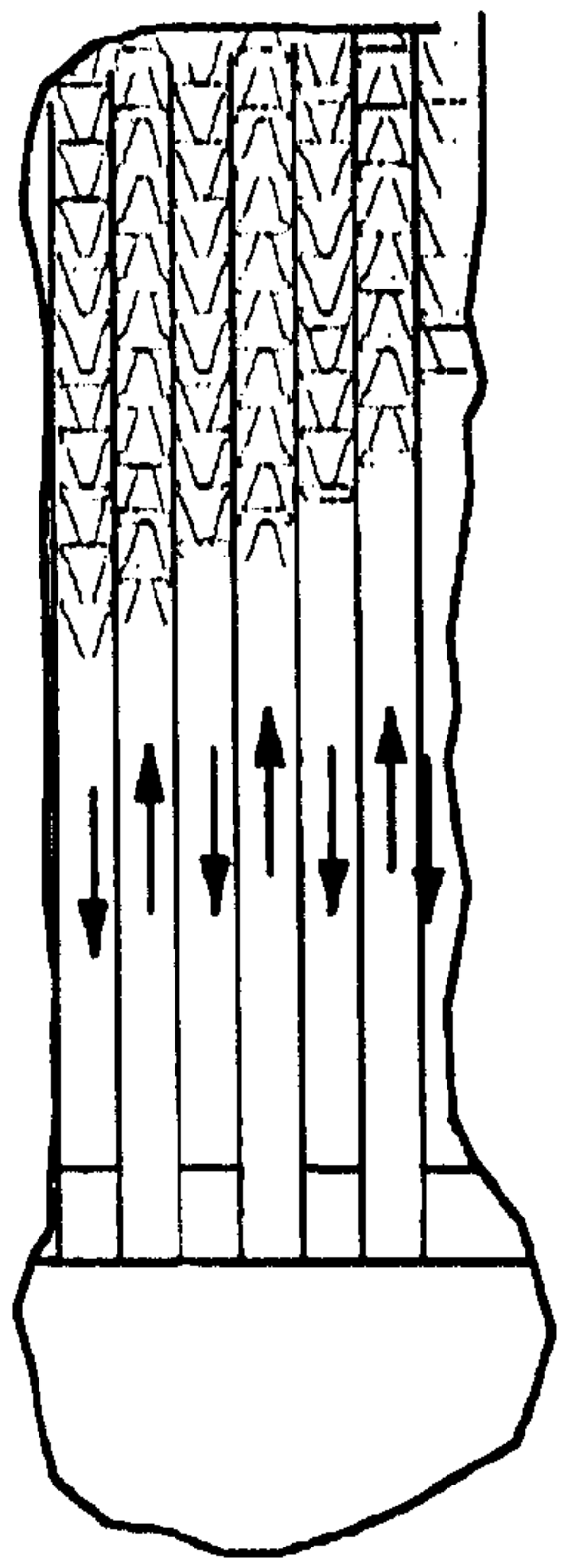


FIG.3B

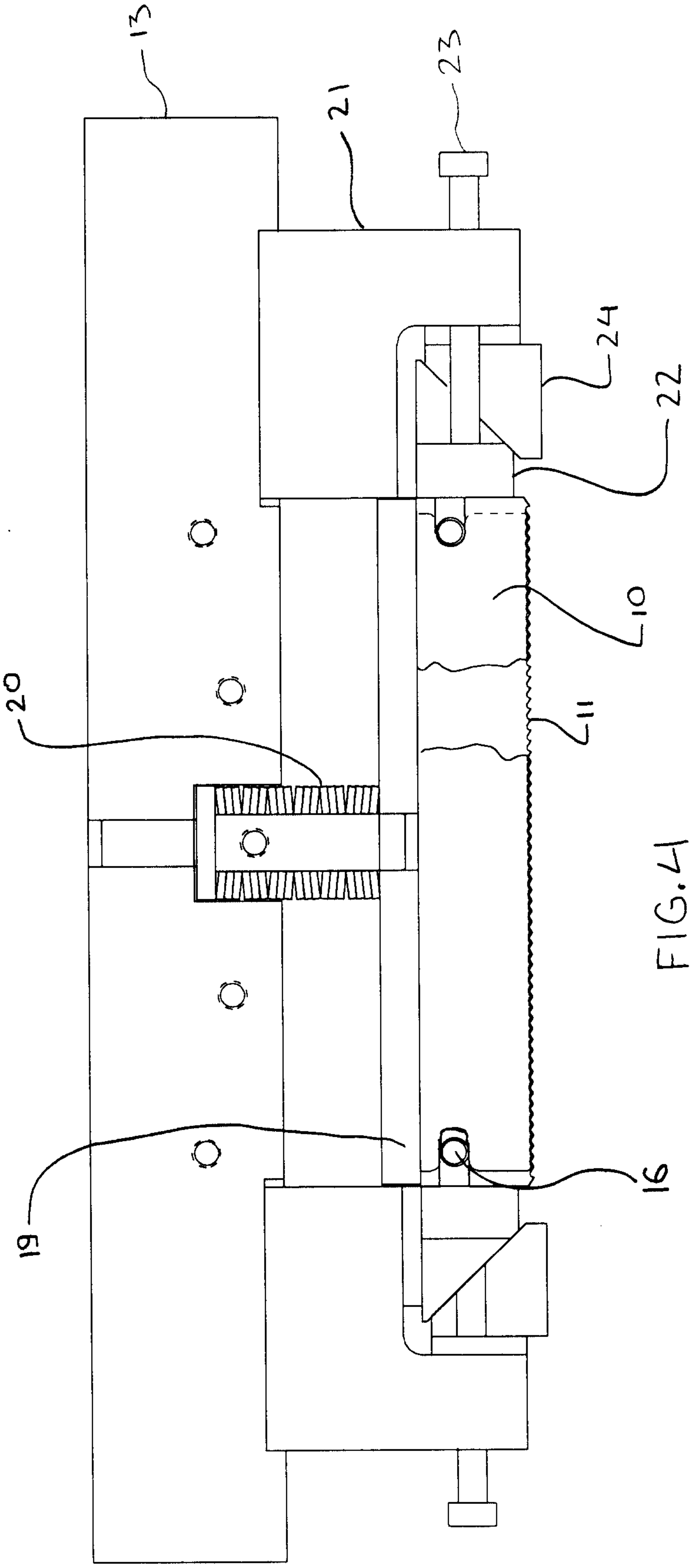


FIG.4

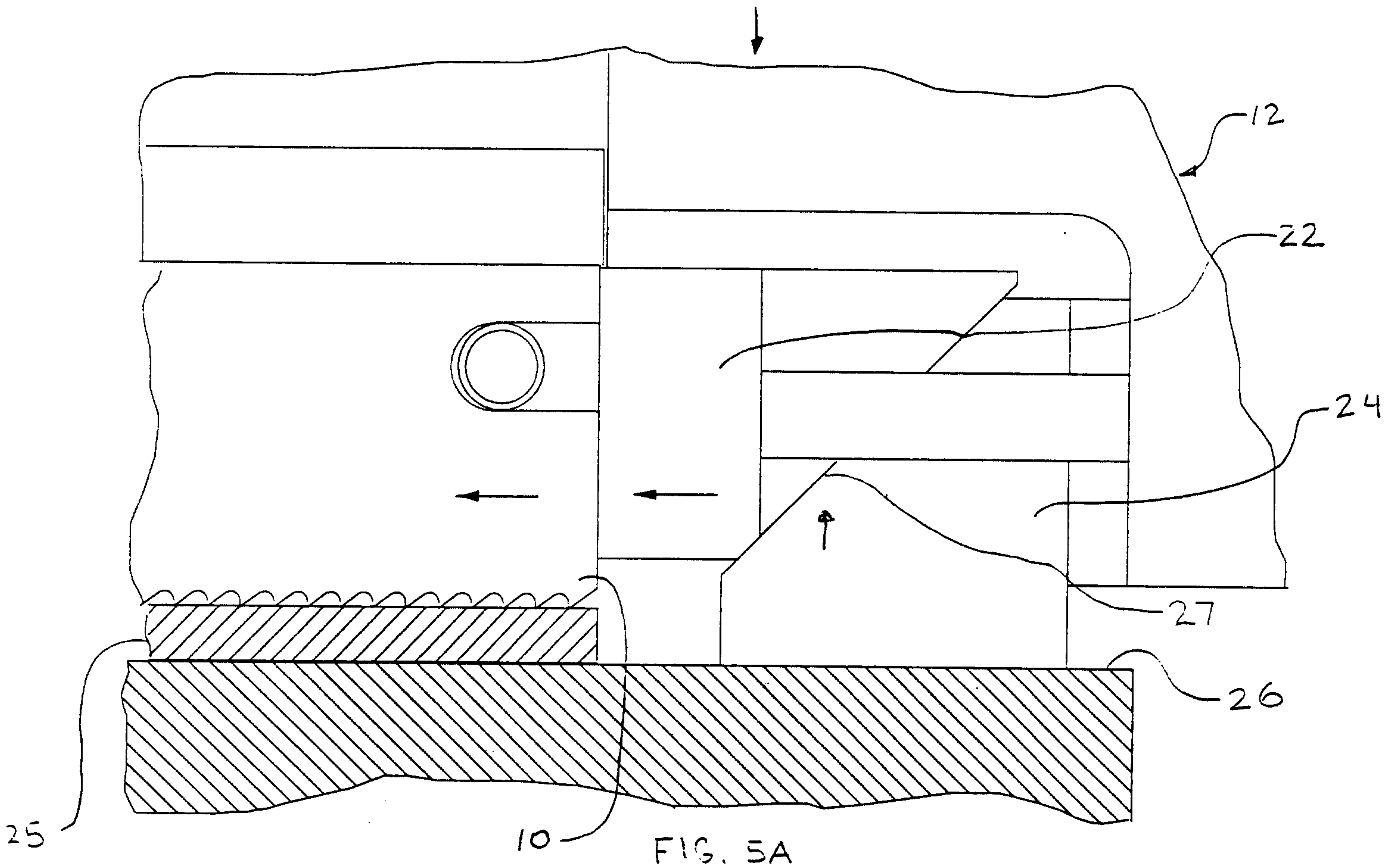


FIG. 5A

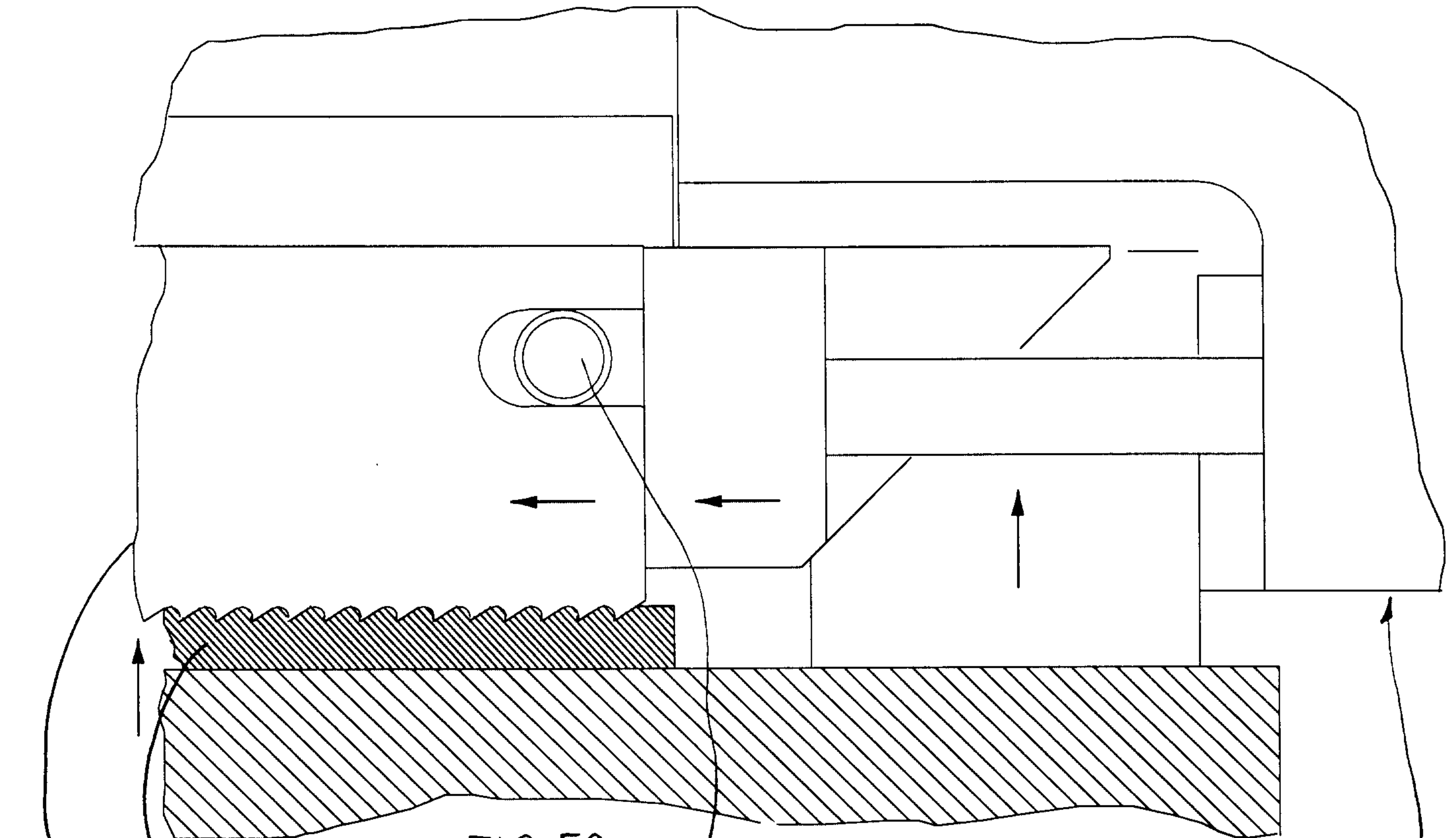


FIG. 5C

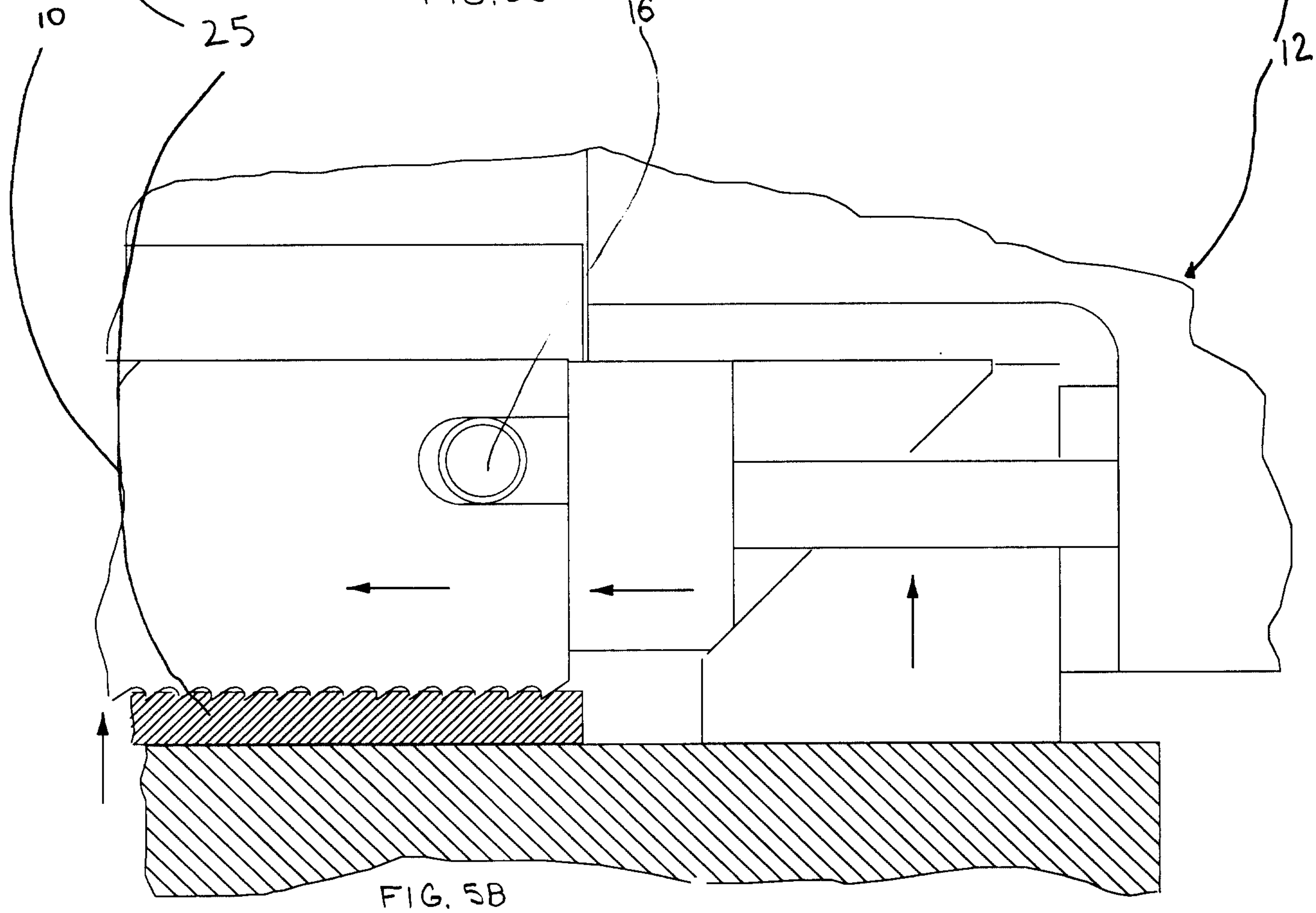


FIG. 5B