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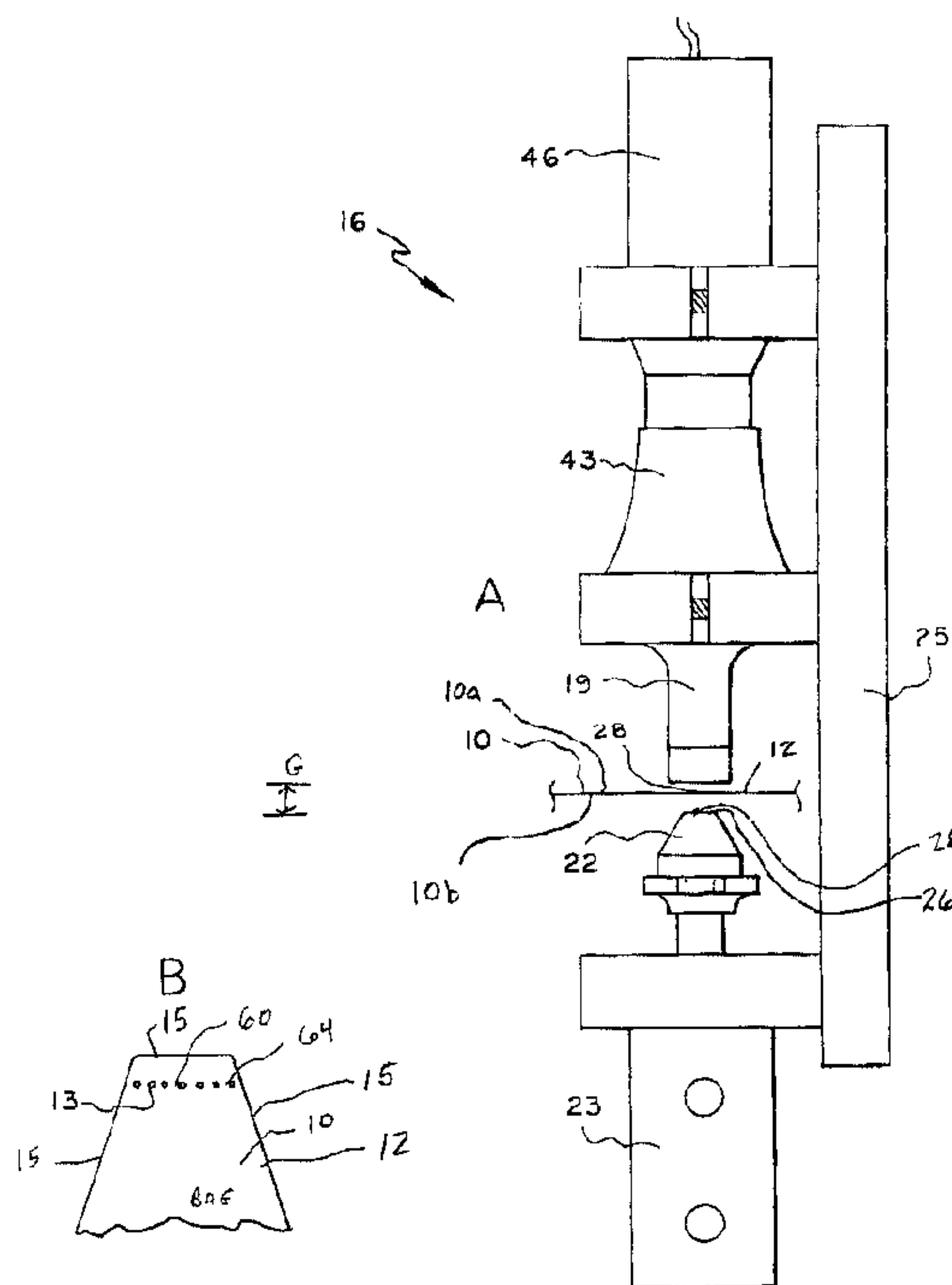
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(54) Titre : DISPOSITIF NON INVASIF POUR PERMETTRE D'OUVRIR UN EMBALLAGE SOUPLE, ET DISPOSITIF
CONNEXE

(54) Title: NON-INVASIVE TEAR MECHANISM FOR FLEXIBLE PACKAGING AND APPARATUS



(57) **Abrégé/Abstract:**

A non-invasive tear mechanism for a flexible packaging, the non-invasive tear mechanism comprises a horn side wall and an anvil side wall joined to the horn side wall. A plurality of junctions are formed in flexible packaging and form a line of weakness in the flexible packaging. The plurality of junctions that form the line of weakness allow the flexible packaging to be manually opened, and the junctions are non-invasive in that the flexible packaging is not cut or scored when the non-invasive tear mechanism is formed. An apparatus for producing a non-invasive tear mechanism in a flexible packaging comprising a carriage, a horn mounted on the carriage, an anvil mounted on the carriage and axially aligned with the horn. The anvil has an anvil work surface with a plurality of protuberances extending from the anvil work surface. An actuating rod is mounted on the carriage and used for moving the horn and anvil together and apart. The protuberances form the non-invasive tear mechanism when the horn is activated and the flexible packaging is fused at junctions that correspond with the protuberances.

ABSTRACT

A non-invasive tear mechanism for a flexible packaging, the non-invasive tear mechanism comprises a
5 horn side wall and an anvil side wall joined to the horn
side wall. A plurality of junctions are formed in
flexible packaging and form a line of weakness in the
flexible packaging. The plurality of junctions that
10 form the line of weakness allow the flexible packaging
to be manually opened, and the junctions are non-
invasive in that the flexible packaging is not cut or
scored when the non-invasive tear mechanism is formed.
An apparatus for producing a non-invasive tear mechanism
in a flexible packaging comprising a carriage, a horn
15 mounted on the carriage, an anvil mounted on the
carriage and axially aligned with the horn. The anvil
has an anvil work surface with a plurality of
protuberances extending from the anvil work surface. An
actuating rod is mounted on the carriage and used for
20 moving the horn and anvil together and apart. The
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the horn is activated and the flexible packaging is
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protuberances.

NON-INVASIVE TEAR MECHANISM FOR FLEXIBLE PACKAGING AND APPARATUS

10 Field of Invention

The present invention relates to a tear mechanism for a flexible packaging and an apparatus for creating the tear mechanism.

15 Background

Products and goods oftentimes are packaged in the flexible packaging, which is frequently made of plastic. The flexible packaging is used to hold food products, cement, fertilizer, fluids of all kinds, and
20 other materials.

However, the use of flexible packaging is not without problems. Indeed, many people attempt to open the flexible packaging with their fingers, only to find that the task is very difficult, because the plastic or
25 other material from which the flexible packaging is made has a high tensile strength. The flexible packaging may even stretch before the user gains access to the contents. Such rough handling of the flexible packaging is not desirable because the product housed inside the
30 flexible packaging could be damaged, as is frequently the case when, for example potato chip bags are opened.

In addition, people, in an attempt to open such packaging, have been known to resort to using their

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teeth to create a break in the flexible packaging. This can cause dental damage. People also resort to using various objects to puncture the flexible packaging, for example a pen or pencil when there is no sharp cutting instrument handy. As a result of using such articles, the person could unintentionally jab himself or herself.

Past attempts to overcome this problem have made use of expensive materials and fabrication techniques. For example, lasers have been used in an attempt to burn the flexible packaging in order to create a way to gain access to the interior of the flexible packaging. However, lasers typically burn completely through the flexible packaging and are difficult to control. Thus, the laser undesirably causes invasive openings to be formed in the flexible packaging. In addition, lasers are dangerous, especially in a factory setting, and they are expensive to purchase and require expensive support equipment.

Thus, there is a need for a tear mechanism for flexible packaging that is inexpensive. There is a need for the tear mechanism be to reproducible, such that the flexible packaging having the tear mechanism can be mass produced. Also, there is a need for the tear mechanism to be easy to manually open, so that the need for scissors and knives is eliminated. Also, the tear mechanism has to be such that it does not compromise the seal of flexible packaging containing, for example, perishable items. Additionally, there is also a need for an apparatus that can form the tear mechanism in the flexible packaging.

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Summary

The present invention satisfies the above-described needs by providing a non-invasive tear mechanism for flexible packaging that is formed by an apparatus comprising an ultrasound horn and anvil. The tear mechanism is non-invasive in that there is no hole, opening, or scoring of the flexible packaging. The flexible packaging comprises a horn side wall and an anvil side wall which are joined together, and the non-invasive tear mechanism is formed in the flexible packaging. The non-invasive tear mechanism comprises spaced apart junctions that are formed in a substantially straight line in the flexible packaging. Thus, the spaced apart junctions form a line of weakness in the flexible packaging, such that when the bag is torn in the vicinity of the spaced apart junctions it tears along a substantially straight line defined by the junctions.

The invention also includes an apparatus used for making the non-invasive tear mechanism in a flexible packaging or bag. The apparatus comprises a carriage, an ultrasonic horn joined to and carried by the carriage, and an anvil joined to and carried by the carriage. The anvil has a work surface. The horn further comprises a transducer and a booster. The anvil is movable toward and away from the ultrasonic horn by a limiting actuator, for example a pneumatic, hydraulic, mechanical, or electrical actuator. An actuating rod is provided and the anvil defines a cavity used for receiving the actuating rod therein. The actuating rod

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used for reciprocating the anvil toward and away from the ultrasound horn. The apparatus also has a guiding post and the anvil defines an opening into which the guiding post is received so that the anvil is guided by the guiding post when it is reciprocated by the actuating rod.

A pattern of protuberances extends from the anvil work surface. The pattern of protuberances extending from the anvil work surface is used for creating the non-invasive tear mechanism in the flexible packaging, when the anvil work surface and ultrasonic horn are moved into position on both sides of the flexible packaging and the ultrasonic horn is activated. In particular, the pattern of protuberances formed in the anvil work surface is used for producing the spaced apart junctions in the flexible packaging that form a line of weakness in the flexible packaging. The flexible packaging can be manually torn open along the line of weakness by applying shearing force or tension force to the flexible packaging at the line of weakness. Knives and scissors are not required to gain access to the interior of the flexible packaging.

It is noted that the line of weakness is not so weak that the product contained within the flexible packaging bursts out of the flexible packaging during the normal handling of the flexible packaging by a user.

It is further noted that the tear mechanism is non-invasive in that there are no punctures or openings formed in the tear mechanism or in the vicinity of the tear mechanism, and there are no score lines or openings

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in either of the horn side wall or anvil side wall of the flexible packaging. Thus, product housed inside the flexible packaging cannot escape out of the flexible packaging to the surrounding environment through the non-invasive tear mechanism. Likewise, contaminants from the outside environment cannot seep into the flexible packaging through the non-invasive tear mechanism and contaminate the product stored therein. This advantageously keeps the product inside the flexible packaging sterile, regardless of the outside environment conditions.

The protuberances in the pattern of protuberances can have various shapes, for example an X-shape, a circle, a diamond, a rectangle, a polygon, and similar shapes. The pattern of protuberances extending from the anvil work surface can all be the same shape, or could have a number of different shapes. Additionally, the pattern of protuberances can be otherwise arranged, for example in a curve. In such an embodiment, the non-invasive tear mechanism would comprise junctions that together are arranged in a curved shape, thus forming a curve of weakness in the flexible packaging.

Brief Description of The Drawings

The invention is illustrated in the drawings in which like reference characters designate the same or similar parts throughout the figures of which:

FIG. 1A is a front elevational view of an apparatus for producing the non-invasive tear mechanism;

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FIG. 1B is a top plan view of a portion of a flexible packaging having the non-invasive tear mechanism;

FIG. 2 is a side elevational view of the apparatus
5 for producing the non-invasive tear mechanism;

FIG. 3 is a top plan view of the anvil of the apparatus for producing the non-invasive tear mechanism;

FIG. 4 is a side elevational view of the anvil of the apparatus for producing the non-invasive tear
10 mechanism;

FIG. 5 is a bottom plan view of the anvil of the apparatus for producing the non-invasive tear mechanism;

FIG. 6 is an end elevational view of the anvil of the apparatus for producing the non-invasive tear
15 mechanism;

FIG. 7 is a perspective view of the horn side wall of the flexible packaging and anvil side wall of the flexible packaging before they are joined to form the flexible packaging;

FIG. 7A is a top plan view of the flexible packaging having a fill opening;
20

FIG. 7B is a top plan view of the flexible packaging having a non-invasive tear mechanism;

FIG. 7C is a front elevational view of the flexible packaging having a non-invasive tear mechanism;
25

FIG. 7D is a right side elevational view of the flexible packing having a non-invasive tear mechanism;

FIG. 7E is a sectional view of the non-invasive tear mechanism taken along cut line A-A of FIG. 7B;

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Referring generally to FIGS. 1-6 and initially to FIGS. 1A, 7 and 7A, a bag or flexible packaging 10 is provided. The flexible packaging 10 has a horn side wall 10a and an anvil side wall 10b which are joined together along a peripheral junction 15. There is a fill opening 15a in the peripheral junction 15 where the horn side wall 10a and anvil side wall 10b are not joined. The fill opening 15a, shown in FIG. 7A, is used for filling the flexible packaging 10 with product 100 as will be described presently.

A non-invasive tear mechanism 13 (FIG. 1B) is formed in the flexible packaging 10 by an apparatus 16 as shown in FIGS. 1A and 2A. The tear mechanism 13 is non-invasive in that there is no hole, scoring, or opening associated with the tear mechanism 13 in the flexible packaging 10. That is, there is no hole, opening or scoring made in the horn side wall 10a or in the anvil side wall 10b of the flexible packaging 10 when the non-invasive tear mechanism 13 is formed. Thus, the material 12 from which the flexible packaging 10 is made retains its integrity, and nothing from the surrounding environment can enter the flexible packaging 10 through the non-invasive tear mechanism 13, and nothing from the interior of the flexible packaging 10 can escape into the surrounding environment through the non-invasive tear mechanism 13. The non-invasive tear mechanism 13 is thus suitable for use in flexible packagings 10 used for holding perishables such as food products, as well as non-perishable goods, for example cement or fertilizer.

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The flexible packaging 10 can be made out of a plurality of different materials 12 including, but not limited to, plastics, plastic films, plastic films made out of low density polyethylene (LDPE), high density polyethylene (HDPE), polyester (PET), oriented polypropylene (OPP), biaxially oriented polypropylene (BOPP), nylon, biaxially oriented nylon, and laminated materials such as poly to poly, prop to poly, nylon to poly, prop to prop, pet to poly, and the like. The materials 12 may include 3, 5, and 7 layer coextruded films including substrates formed out of any of the materials set forth above. The plastic film may also comprise polyolefin.

The material 12 comprises films having a thickness of about 1.5 millimeters to about 4.0 millimeters. Thus, the horn side wall 10a and anvil side wall 10b may each comprise a thickness of about 1.5 millimeters to about 4.0 millimeters. As will be evident to those of ordinary skill in the art, other materials and the thicknesses of the horn side wall 10a and anvil side wall 10b may also be suitable for use in the present invention in other applications.

As shown in FIGS. 1A and 2, the non-invasive tear mechanism 13 is produced by an ultrasonic horn 19 and an anvil 22. In a preferred embodiment, the horn 19 and anvil 22 are mounted on a carriage 25 which provides for adjustment of the position of the horn 19 and anvil 22 in all axes. There is a gap, designated G in FIG. 1, defined between the horn 19 and the anvil 22. The anvil 22 also has a work surface 26 and a pattern of

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protuberances 28 extends from the work surface 26 of the anvil 22. In a preferred embodiment, the pattern of protuberances 28 is formed in a substantially straight line. As will be described presently, the pattern of
5 protuberances 28 can be otherwise embodied.

In order to produce the non-invasive tear mechanism 13 in the flexible packaging 10, the flexible packaging 10 is moved into position in the gap designated G defined between the horn 19 and the anvil
10 22. The flexible packaging 10 may be brought into position manually or by use of a conveyor (not shown). Conveyors and the use of conveyors to move and position sheets and films of material 12 is well known to those having ordinary skill in the art.

15 The work surface 26 of the anvil 22 is brought into position adjacent the anvil side wall 10b of the flexible packaging 10. The anvil 22 is brought into position by an actuator cylinder 23 that houses an actuating rod 23a which is received in a cavity 31
20 defined in the anvil 22, as shown in FIGS. 1, 2, 4 and 6. The actuator cylinder 23 can be hydraulic, pneumatic, or mechanical, such actuator cylinders 23 well known to those having ordinary skill in the art. The actuator cylinder 23 is joined to the carriage 25.
25 FIG. 4 shows the anvil 22 is provided with a cavity 31 for attachment to an actuating rod 23a that is actuated by the above-described actuator 23 for moving the anvil in the direction of arrow 33 (FIG. 2).

In other embodiments, the anvil 22 and horn 19
30 may be brought together by a means for positioning that

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moves the horn 19 and anvil together 22 with a scissors type action, or mechanical moves the horn 19 and anvil 22 together.

5 The anvil 22 may also be provided with an opening 36 to provide a guide for maintaining the alignment of the anvil 22 during its reciprocating motion as it forms the non-invasive tear mechanisms 13. The anvil 22 slides back and forth along a post 39 (FIG. 2) by means of the opening 36 defined in the anvil 22 to
10 maintain alignment.

In a preferred embodiment, the horn 19 is part of a 20 kilohertz (kHz) heavy duty ultrasonic probe including a titanium booster 43, a transducer 46, and a titanium horn assembly. One example of this type of
15 probe is Model No. 41C30, available from Dukane Corporation, located in St. Charles, Illinois. Other ultrasonic horns and frequencies may also be suitable. For example, in other embodiments, the ultrasonic frequency may be in the range of between about 20 kHz to
20 about 80 kHz. It is noted that the ultrasonic horn 19 functions by generating heat from high frequency mechanical motion, and this heat is used for fusing layers of material 12 together. Ultrasonic horns well are known to those having ordinary skill in the art.

25 Then, once the horn 19 and anvil 22 are brought together, the horn 19 is actuated and generates an ultrasonic pulse. The ultrasonic pulse causes the layers (horn side wall 10a and anvil side wall 10b) of the flexible packaging 10 that is positioned between the
30 horn 19 and anvil 22 to fuse together in a pattern

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corresponding to the pattern of protuberances 28 disposed on the work surface 26 of the anvil 22. Thus, the anvil side wall 10b and horn side wall 10a are fused together at each protuberance 28a in the pattern of protuberances 28. Where the horn side wall 10a and anvil side wall 10b are fused together in this manner, junctions 60 are formed in the flexible packaging 10.

The junctions 60 are spaced apart, and each junction 60 corresponds with a protuberance 28a that extends from the anvil work surface 26. It is noted that there is no opening, hole, scoring, or slit in the flexible packaging or bag 10 after the non-invasive tear mechanism 13 has been formed in the above-described manner.

The spaced apart junctions 60 are in a substantially straight line, as shown in FIG. 3, and form a line of weakness 64 in the flexible packaging 10. The junctions 60 are formed in this substantially straight line because, as shown in FIGS. 2, 3, and 6, the pattern of protuberances 28 extending from the work surface 26 of the anvil 22 is in a substantially in a straight line.

It is noted that the horn 19 and anvil 22 do not contact one another when the junctions 60 are formed in the flexible packaging 10.

It is noted that in other embodiments, the ultrasonic horn may be replaced with a hot knife, a heated tool, a microwave generation device, or a radio frequency generating device, so long as it can fuse the horn side wall 10a and the anvil side wall 10b at the

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junctions 60. Such devices are well known to those having ordinary skill in the art.

To open the flexible packaging 10, the line of weakness 64 is subjected to manually applied shearing forces as indicated by arrow SF in FIG. 7I, tensions forces as indicated by arrow TF in FIG. 7H, or a combination of shearing and tension forces as shown in FIG. 7J. The flexible packaging 10 will tear along the line of weakness 64 when such forces are applied, and the interior of the flexible packaging 10 can thus be accessed in this manner.

Shown in FIG. 3 is a preferred embodiment wherein the pattern of protuberances 28 is linear. Such a linear arrangement produces a substantially linear arrangement of junctions 60 in the flexible packaging 10 and a substantially linear line of weakness 64. Additionally, each protuberance 28a has a geometrical shape. In a preferred embodiment the each protuberance 28a in the pattern of protuberances 28 is X-shaped.

The non-invasive tear mechanism 13 thus advantageously allows food products, fluids, pastes, non-food products, cement, and the like to be stored internally in the flexible packaging 10 without leaking out of the non-invasive tear mechanism 13 to the surrounding environment. At the same time, environmental contaminants, fluids, and substances cannot move, migrate, seep, or flow into the interior of the flexible packaging 10 through the non-invasive tear mechanism 13. It is noted that the line of weakness 64 is not so weak that the product 100 housed in the

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flexible packaging 10 bursts out of the flexible packaging 10 during the normal handling of the flexible packaging 10 by a user.

FIGS 7-7J show the method of forming the non-invasive tear mechanism 13, and opening the non-invasive tear mechanism 13. FIG. 7 shows the horn side wall 10a and the anvil side wall 10b before they are joined to form the flexible packaging 10. FIG. 7A shows the anvil side wall 10a and a horn side wall 10b joined along a peripheral junction 15. There is a fill opening 15a in the peripheral junction 15 where the horn side wall 10a and anvil side wall 10b are not joined. The peripheral junction 15 can be formed by conventional means known to those having ordinary skill in the art, for example by ultrasonic welding. The fill opening 15a is used for allowing access to the interior of the flexible packaging 10, so that the flexible packaging 10 can be loaded or filled with product 100 after the non-invasive tear mechanism 13 has been formed in the flexible packaging 10.

Then, the non invasive tear mechanism 13, as shown in FIG. 7B, is formed in the flexible packaging 10 in the manner described above by moving the flexible packaging 10 between the anvil 22 and horn 19 and closing the two together, and activating the horn 19. FIG. 7C shows a side elevational view of the flexible packaging 10, showing the non-invasive tear mechanism 13 extending from the horn side wall 10a. FIG. 7E shows a sectional view of the non-invasive tear mechanism 13 taken along cut line A-A of FIG. 7B. The junctions 60

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of the non-invasive tear mechanism 13 each extend a distance, designated T in FIG. 7E, above the exterior surface 27 horn side wall 10a of the flexible packaging 10. In a preferred embodiment, the distance T may be
5 between about 20 percent to about 30 percent of the combined thicknesses of the horn side wall 10a and anvil side wall 10b. Accordingly, there are recesses 65 formed in flexible packaging 10 at the junctions 60, as shown in FIG. 7E. In other embodiments, the distance T
10 could be more or less depending on a particular application or particular customer order. FIG. 7D is a right side elevational view of the flexible packaging 10 and the non-invasive tear mechanism 13.

After the non-invasive tear mechanism 13 has
15 been formed in the flexible packaging 10, the flexible packaging 10 is loaded or filled with product 100 through fill opening 15a. The filling process can be part of an automated assembly line wherein product is automatically loaded into the flexible packaging 15, such automatic
20 loading of flexible packaging 10 known to those having ordinary skill in the art. After filling the flexible packaging 10, the fill opening 15a is closed or sealed. The sealing can be by way of conventional means, for example ultrasonic welding. FIGS. 7F-7J all show the
25 sealed flexible packaging 10 loaded with product 100.

After the flexible packaging 10 is loaded and sealed, external contaminants cannot gain access to the interior of the flexible packaging 10 through the non-invasive tear mechanism 13, because the non-invasive
30 tear mechanism 13 does not have any no holes, openings,

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or scoring. Likewise, product 100 housed in the flexible packaging 10 interior cannot move out of the flexible packaging 10 through the non-invasive tear mechanism 13, since there are no openings, holes, or score lines. Thus, there is no way for product 100 to leak out of the packaging 10, and there is no way for contaminants to seep into the flexible packaging 10 through the non-invasive tear mechanism 13.

FIG. 7E is a sectional view taken along cut line A-A of FIG. 7B. As shown in FIG. 7F, product 100 internal to the flexible packaging 10 is free to move between the junctions 60 that form the line of weakness 64 as indicated by the arrows 62 shown between the junctions 60. This is due to the fact the junctions 60 that join the horn side wall 10a and anvil side wall 10b are at spaced intervals that mimic the pattern of protuberances 28 formed in the anvil 22 work surface 26. Thus, where the non-invasive tear mechanism 13 is formed in the flexible packaging 10, spaces 24 are defined by the horn side wall 10a, the anvil side wall 10b, and the junctions 60. Product 100 can thus move between the spaced apart junctions 60 through these spaces 24, but the product 100 remains internal to the flexible packaging 10 until the non-invasive tear mechanism 13 is torn.

As shown in FIGS. 7I-7J, to open the flexible packaging 10, the user applies tension force TR, or shearing force SF, or a combination of both to the flexible packaging 10 in the vicinity of the noninvasive tear mechanism 13. When force is applied to flexible

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packaging 10 at the non-invasive tear mechanism 13, the non-invasive tear mechanism 13 tears at the junctions 60 and along the line of weakness 64. The flexible packaging 10 is thus easily opened without the use of
5 scissors or knives.

In other embodiments, the geometrical shape of each protuberance 28a and the spacing between each protuberance 28a may be varied infinitely. For example, the shapes of each of the protuberances 28 may include
10 dots, squares, polygons, diamonds, stars, X-shapes, or the like. The distances between each of the protuberances 28a can be as shown in the figures, or the distance may be more or less, depending on the particular application or customer requirement. All of
15 these embodiments are within the scope of the present invention.

Another embodiment is shown in FIGS. 8A and 8B. The pattern of protuberances 28b extends from the working surface 26 of the anvil 22 in a curved
20 arrangement, as shown in FIG. 8B. FIG. 8A is a top plan view of a flexible packaging 10 having a non-invasive tear mechanism 13a made with the anvil 22 having the curved pattern of protuberances 28b. As shown, the non-invasive tear mechanism 13a comprises junctions 60 which
25 are formed in a curved shape thus forming a curve of weakness 64a in the flexible packaging 10.

In other embodiments the flexible packaging 10 can be rectangular shaped, circular shaped, triangular shaped, or may have any shape as required for a
30 particular application.

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Advantageously, the non-invasive tear mechanism 13 can be used for ensuring food safety. For example, the typical loaf of bread sold at a store comes in a bag that has a simple wire tie that is used for sealing the open end of the bag. The other end of the bag is sealed by conventional means, for example ultrasonic welding. However, anyone could unwind the twist tie and open the bread bag and contaminate and/or tamper with the bread, and then re-wind the twist tie around the bread bag. No one would be able to detect this undesirable food tampering. Such activity cannot be carried out if the bread is sealed in flexible packaging 10 employing the non-invasive tear mechanism 13. For example, if the bread is loaded into a flexible packaging 10 having the non invasive tear mechanism 13, it would be impossible for someone to tamper with the bread undetected, because the non-invasive tear mechanism 13 would be torn. The non-invasive tear mechanism 13 can thus advantageously alert consumers of possible product tampering. The bread bag having a non-invasive tear mechanism 13 could be used in combination with tradition wire ties, so that an end user could manually open the non-invasive tear mechanism 13 to access the bread, and then use the wire tie to keep the bread bag closed thereafter. Thus, the non-invasive tear mechanism 13 advantageously allows for tamper resistant food storage.

The non-invasive tear mechanism 13 also advantageously decreases the likelihood of worker injury in the food, restaurant, and fast food industries, and

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advantageously decreases the likelihood of food contamination. For example, the flexible packaging 10 could be loaded with condiments, frostings, sauces, and the like. A worker could quickly and easily manually
5 open the flexible packaging 10 in the above-described manner by manually tearing the non-invasive tear mechanism 13. The worker does not need a knife, scissors, or any other sharp instrument to open the flexible packaging 10. As a result, the likelihood of a
10 worker being injuring trying to open product containers is decreased, and the likelihood of a the product becoming contaminated while the worker attempts to open the product packaging is decreased. Thus, the non-invasive tear mechanism 13 advantageously eliminates the
15 need for knives, scissors, and other dangerous instruments to open the flexible packaging 10. As a result, the non-invasive tear mechanism 13 provides for a safer and more sanitary workplace.

It is noted that a flexible packaging 10
20 having the non-invasive tear mechanism 13 can be used for holding non-food materials too. For example, the flexible packaging 10 can hold cement, fertilizers, rock salt, chemical solutions, paint, fluids, and pastes.

While the non-invasive tear mechanism 13 has
25 been described in connection with certain embodiments, it is not intended to limit the scope of the non-invasive tear mechanism to the particular forms set forth, but, on the contrary, it is intended to cover such alternatives, modifications, and equivalents as may
30 be included within the spirit and scope of the non-

- 20 -

invasive tear mechanism as defined by the appended claims.

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Claims

What is claimed:

- 5 1. An apparatus for forming a non-invasive tear mechanism in a flexible packaging, the apparatus comprising:
- a) a carriage,
 - b) a horn joined to the carriage,
 - 10 c) an anvil joined to the carriage and axially aligned with the horn and the anvil having an anvil work surface,
 - d) an actuator joined to the carriage and used for moving the horn and anvil together and apart, and
 - 15 e) a pattern of protuberances disposed on the anvil work surface the pattern of protuberances for forming the non-invasive tear mechanism.
2. The apparatus according to claim 1 wherein the
- 20 pattern of protuberances is for forming the non-invasive tear mechanism in the flexible packaging.
3. The apparatus according to claim 1 wherein the ultrasonic horn is used for generating an ultrasonic
- 25 pulse to fuse the flexible packaging in a pattern corresponding to the pattern of protuberances.
4. The apparatus according to claim 1 wherein the pattern of protuberances is in a substantially straight
- 30 line.

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5. The apparatus according to claim 1 wherein the pattern of protuberances is curved.

6. The apparatus according to claim 1 wherein each
5 protuberance in the plurality of protuberances has a shape.

7. The apparatus according to claim 6 wherein the shape comprises at least one of a dot, an X-shape, a
10 diamond, a circle, and a polygon, and a curve.

8. The apparatus according to claim 1 wherein the plurality of protuberances are used for producing spaced apart junctions in the flexible packaging when the anvil
15 and horn are brought together and the horn is activated.

9. The apparatus according to claim 1 wherein the horn comprises a transducer in electronic communication with a titanium booster to produce a desired ultrasonic
20 frequency.

10. The apparatus according to claim 1 further wherein the anvil defines a recess and the actuator comprises a rod and wherein the rod is receivable in the anvil
25 recess.

11. The apparatus according to claim 1 further comprising a guiding post joined to the carriage and wherein the anvil defines an opening and wherein the
30 guiding post is positioned in the opening such that the

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anvil is guided by the guiding post when it is reciprocated by the actuating rod.

12. The apparatus according to claim 1 wherein the
5 pattern of protuberances formed in the anvil work surface is used for forming a line of weakness in the flexible packaging.

13. A non-invasive tear mechanism for a flexible
10 packaging, the non-invasive tear mechanism comprising:

- a) a horn side wall,
- b) an anvil side wall joined to the horn side wall to form the flexible packaging,
- c) a plurality of junctions formed in flexible
15 packaging joining the horn side wall and anvil side wall, and
- d) a line of weakness formed along the plurality of junctions and the plurality of junctions used for allowing the flexible packaging to be manually opened.

20

14. The non-invasive tear mechanism for a flexible packaging according to claim 13 wherein the plurality of junctions are fluid tight.

25 15. The non-invasive tear mechanism for a flexible packaging according to claim 13 wherein the plurality of junctions are substantially linear.

16. The non-invasive tear mechanism for a flexible
30 packaging according to claim 13 wherein the plurality of

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junctions have a curved shape.

17. The non-invasive tear mechanism for a flexible packaging according to claim 13 wherein the horn side
5 wall and anvil side wall comprise plastic film.

18. The non-invasive tear mechanism for a flexible packaging according to claim 17 wherein the plastic film comprises coextruded plastic films.

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19. The non-invasive tear mechanism for a flexible packaging according to claim 13 wherein spaces are defined between the junctions, horn side wall and anvil side wall.

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20. The non-invasive tear mechanism for a flexible packaging according to claim 17 wherein the plastic film comprises polyethylene.

20 21. A method for producing a flexible packaging having a non-invasive tear mechanism, the method comprising:

a) providing a flexible packaging having a horn side wall and an anvil side wall,

25 b) providing an apparatus and providing the apparatus with a horn and an anvil mounted on a carriage,

c) providing the anvil with a work surface and providing the work surface with a pattern of protuberances,

30 d) moving the flexible packaging between the horn

- 25 -

and the anvil and moving the horn and anvil together and activating the horn and fusing the flexible packaging at the plurality of protuberances to form spaced apart junctions.

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22. The method of producing a non-invasive tear mechanism according to claim 21 further wherein the spaced apart junctions form a line of weakness.

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23. The method of producing a non-invasive tear mechanism according to claim 21 wherein the activated horn generates a frequency that is in the range of about 20 kHz to about 80 kHz.

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24. The method of producing a non-invasive tear mechanism according to claim 21 further comprising providing the pattern of protuberances in a substantially straight line.

20

25. The method of producing a non-invasive tear mechanism according to claim 24 further comprising providing the plurality of protuberances in a curved shape.

25

26. The method of producing a non-invasive tear mechanism according to claim 24 further comprising providing each of the protuberances with dot shape.

27.

The method of producing a non-invasive tear

30

mechanism according to claim 21 further comprising using

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a plastic film for the horn side wall and the anvil side wall.

28. The method of producing a non-invasive tear
5 mechanism according to claim 27 further wherein the plastic film comprises coextruded plastic films.

29. The method of producing a non-invasive tear
mechanism according to claim 28 wherein the coextruded
10 plastic film comprises multiple layers.

30. The method of producing a non-invasive tear
mechanism according to claim 27 wherein the plastic film
comprises polyolefin.

15

31. A non-invasive tear mechanism comprising:

a) a flexible packaging,

b) a plurality of junctions formed in the flexible
packaging and wherein each of the junctions are fused,

20 and

c) a line of weakness formed along the plurality
of junctions and the plurality of junctions is used for
allowing the flexible packaging to be manually opened.

25 32. A non-invasive tear mechanism according to claim 31
wherein the plurality of junctions are spaced apart from
one another.

33. A non-invasive tear mechanism according to claim 31
30 wherein the flexible packaging comprises a thickness and

- 27 -

a horn side wall and an anvil side wall and further wherein the plurality of junctions extend about 20 percent to about 30 percent of the thickness above the horn side wall.

5

34. The non-invasive tear mechanism according to claim 31 wherein the plurality of junctions are in a substantially straight line.

10 35. The non-invasive tear mechanism according to claim 31 wherein the plurality of junctions are curved.

36. The non-invasive tear mechanism according to claim 31 wherein the flexible packaging comprises plastic.

15

37. non-invasive tear mechanism according to claim 36 wherein the plastic comprises polyethylene.

20 38. An apparatus for forming a non-invasive tear mechanism in a flexible packaging having sides, the apparatus comprising:

a) an anvil,

b) a horn,

25 c) a means for positioning joined to the horn and the anvil and used for moving the anvil and the horn toward and away from one another, and

d) a pattern of protuberances formed on the anvil work surface the pattern of protuberances for forming the non-invasive tear mechanism in the flexible
30 packaging when the means for positioning moves the horn

- 28 -

and anvil together on either side of the flexible packaging and is activated.

39. The apparatus according to claim 1 wherein the horn
5 is an ultrasonic horn that generates a frequency of
about 20 kHz to about 80 kHz.

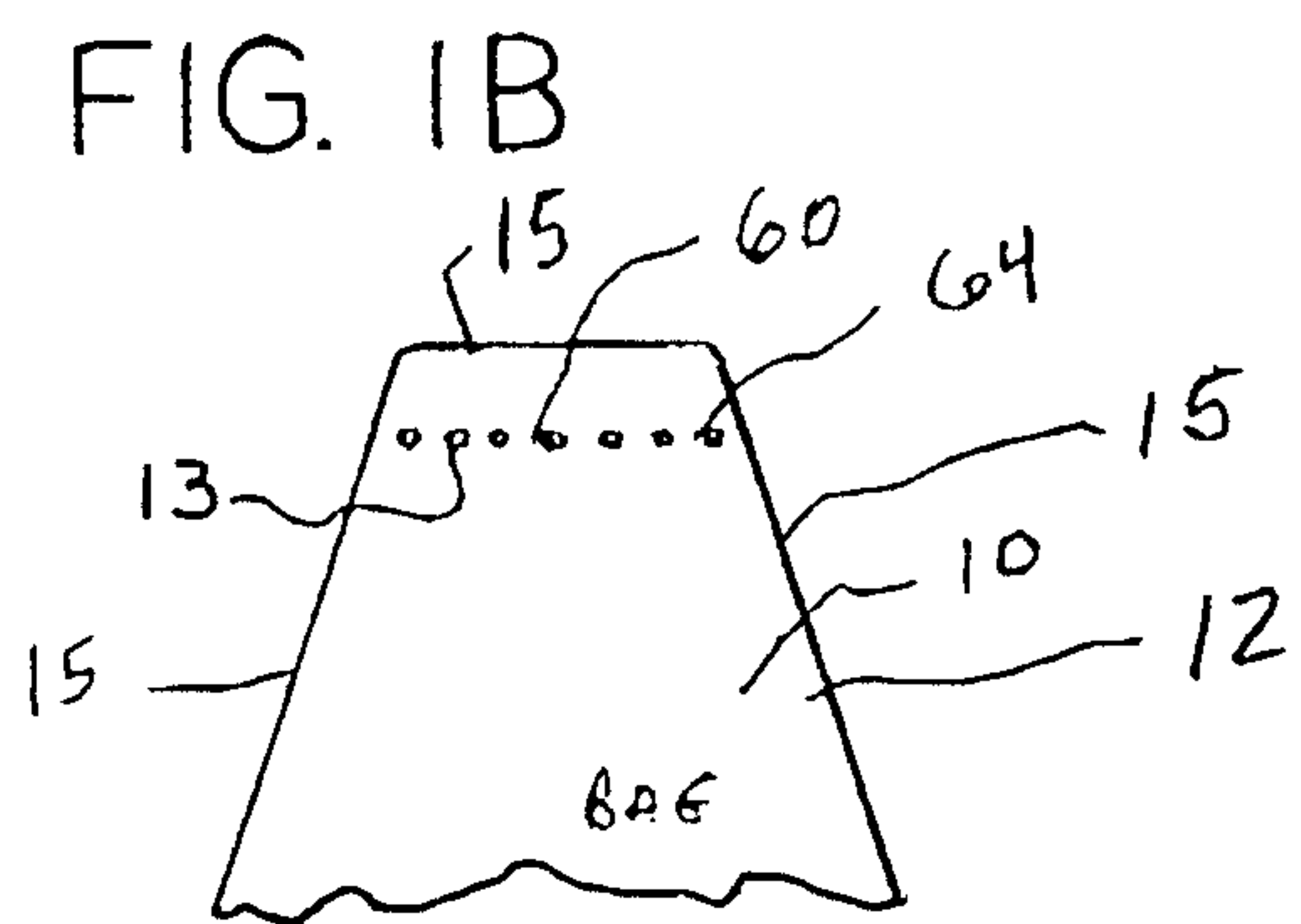
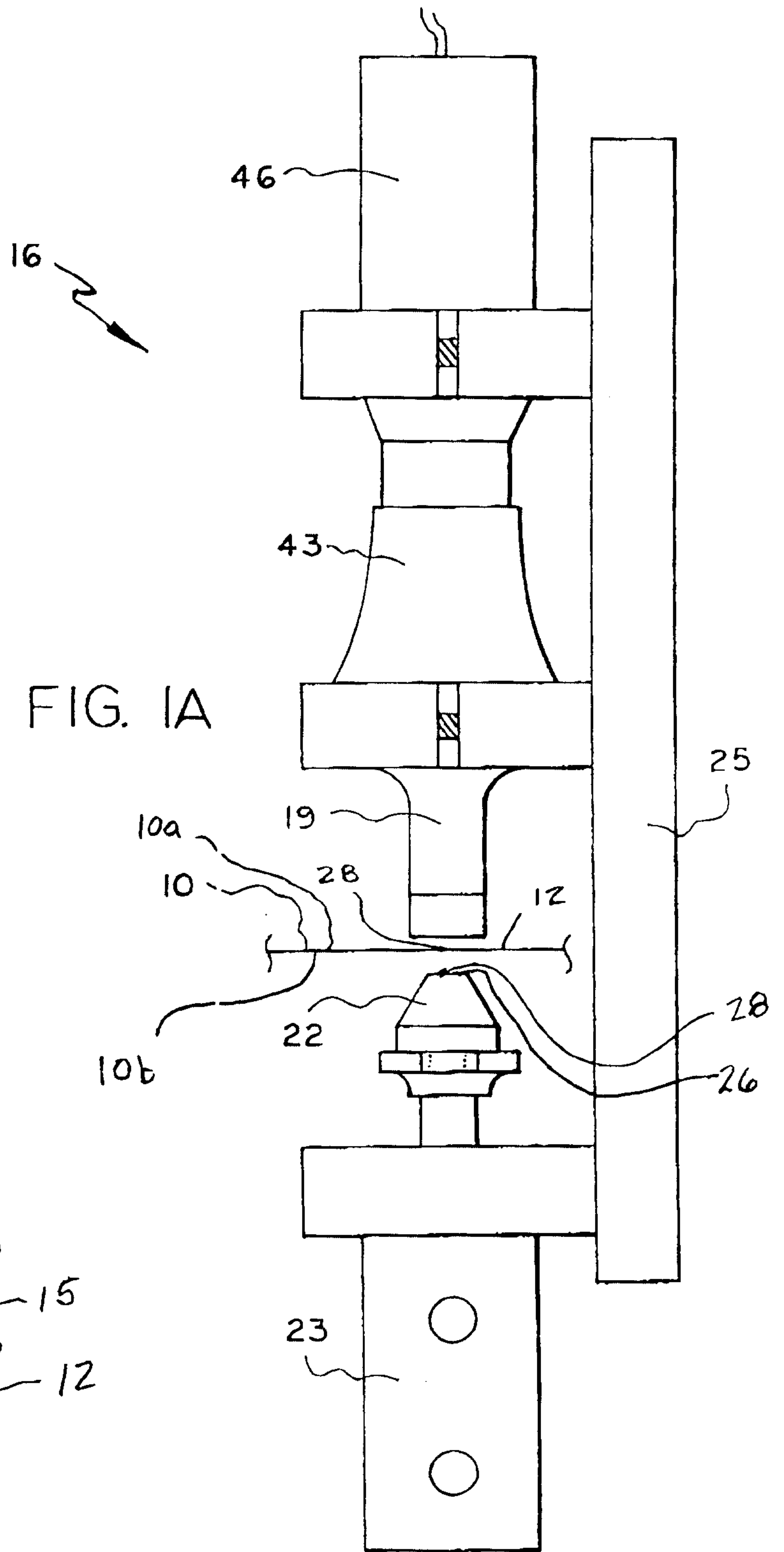
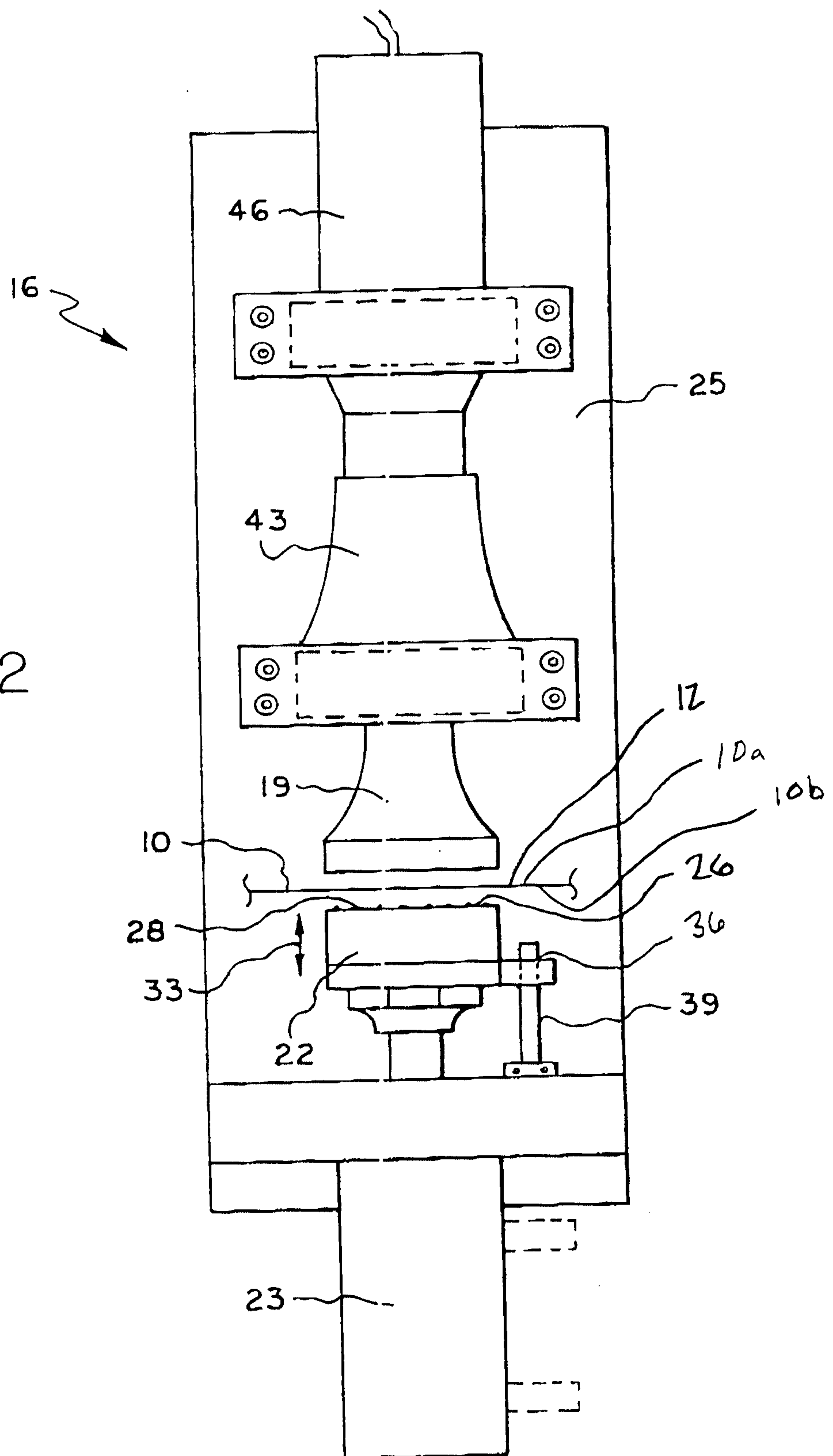


FIG. 2



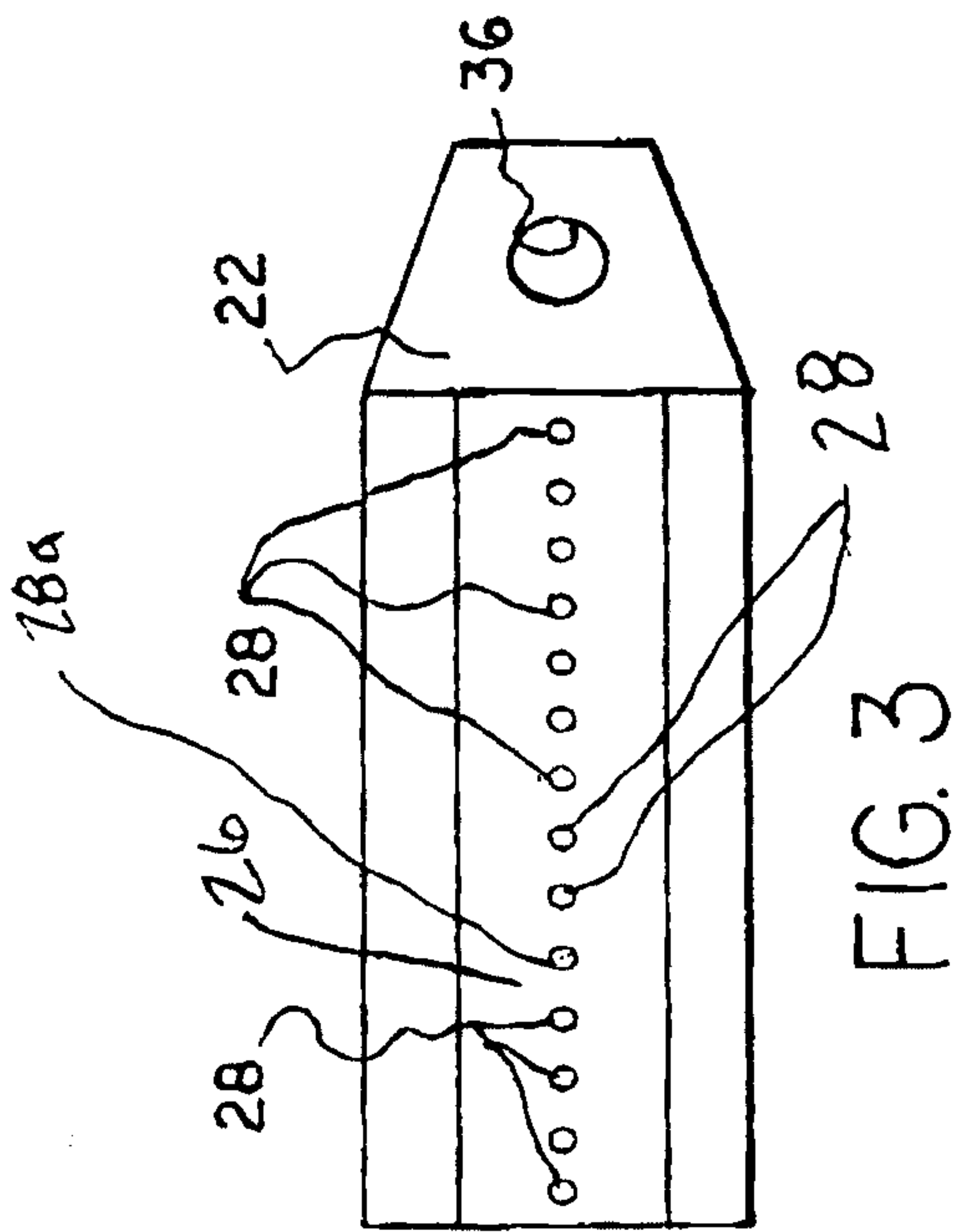


FIG. 3

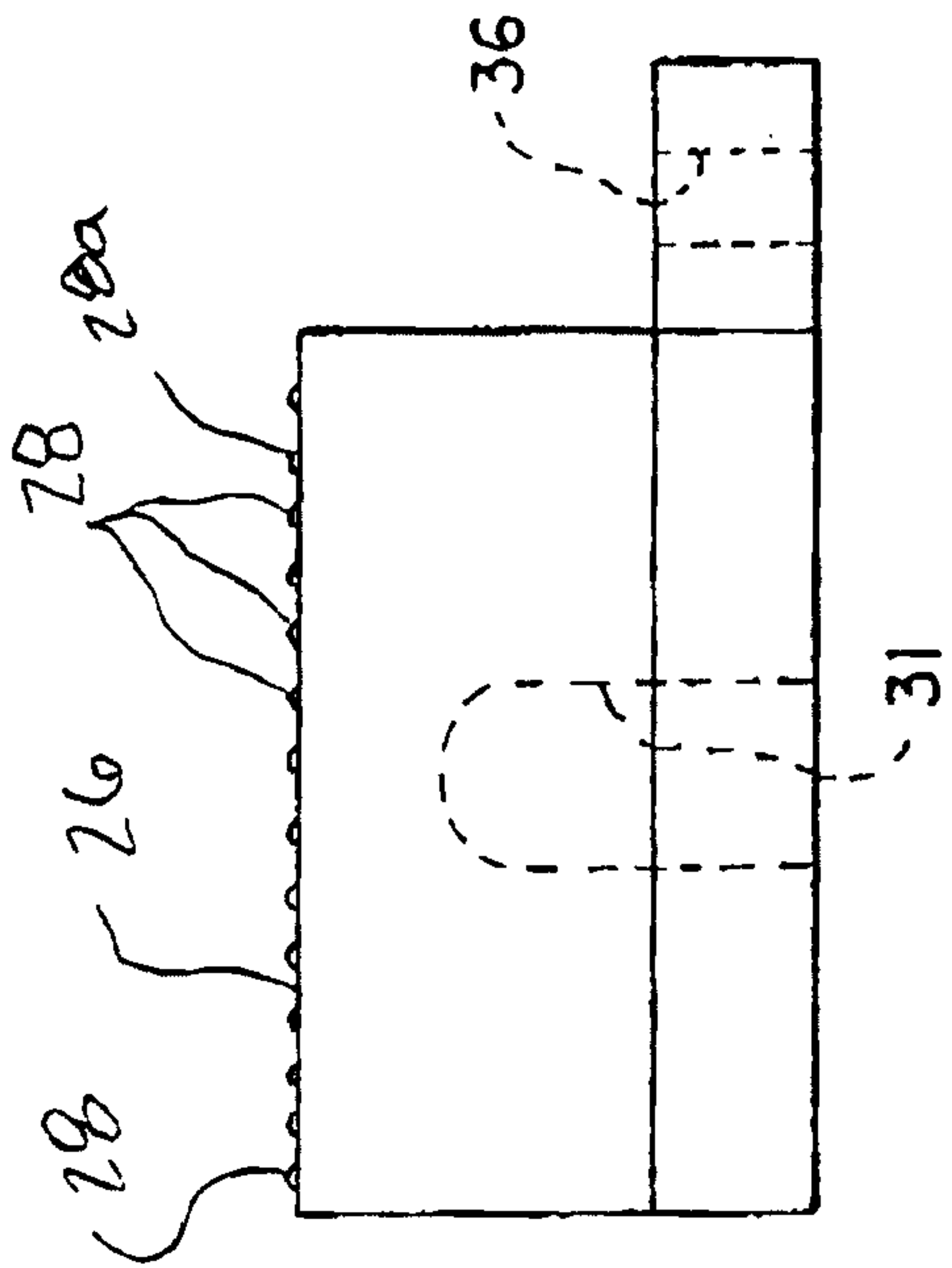


FIG. 4

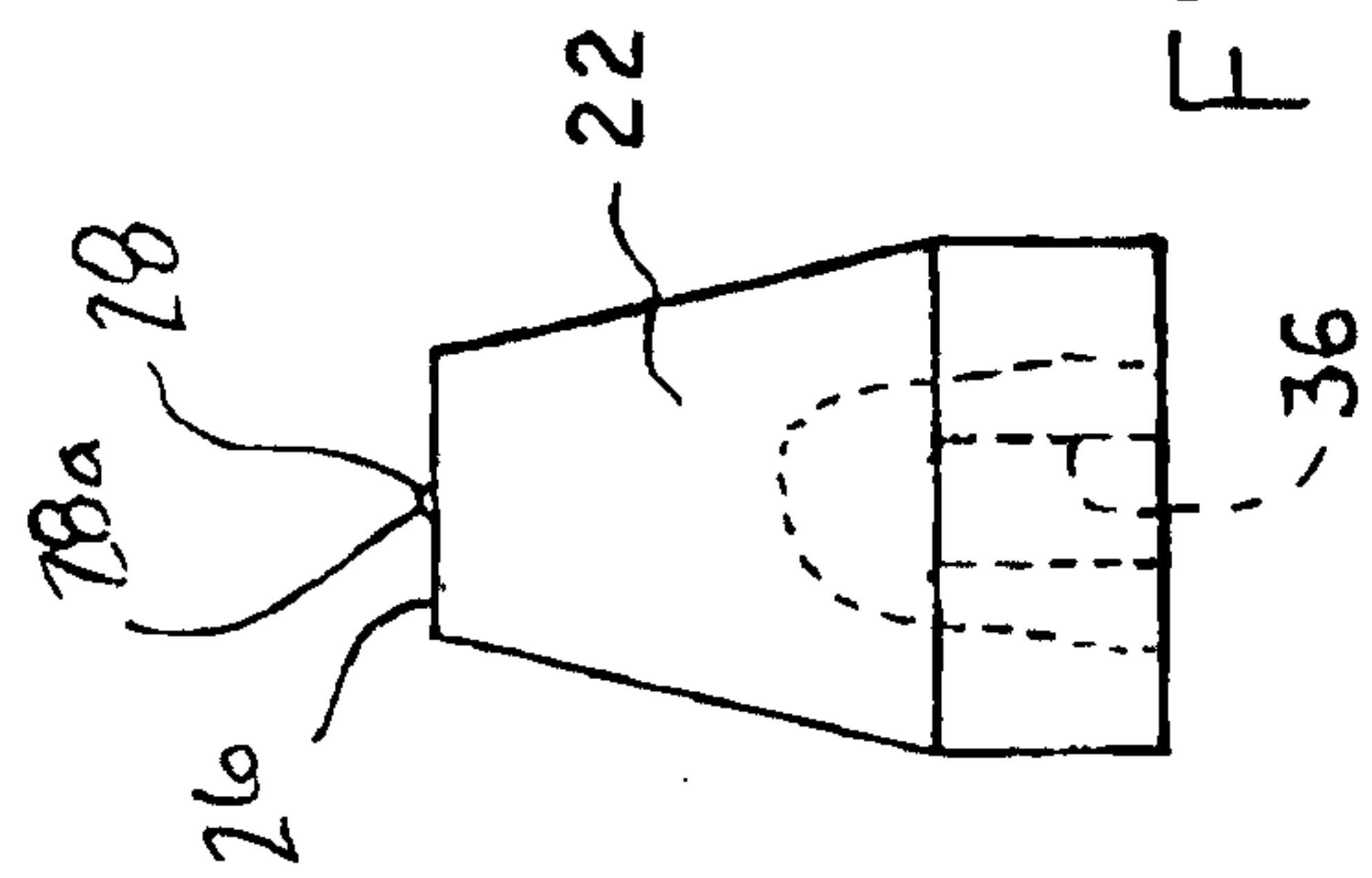


FIG. 6

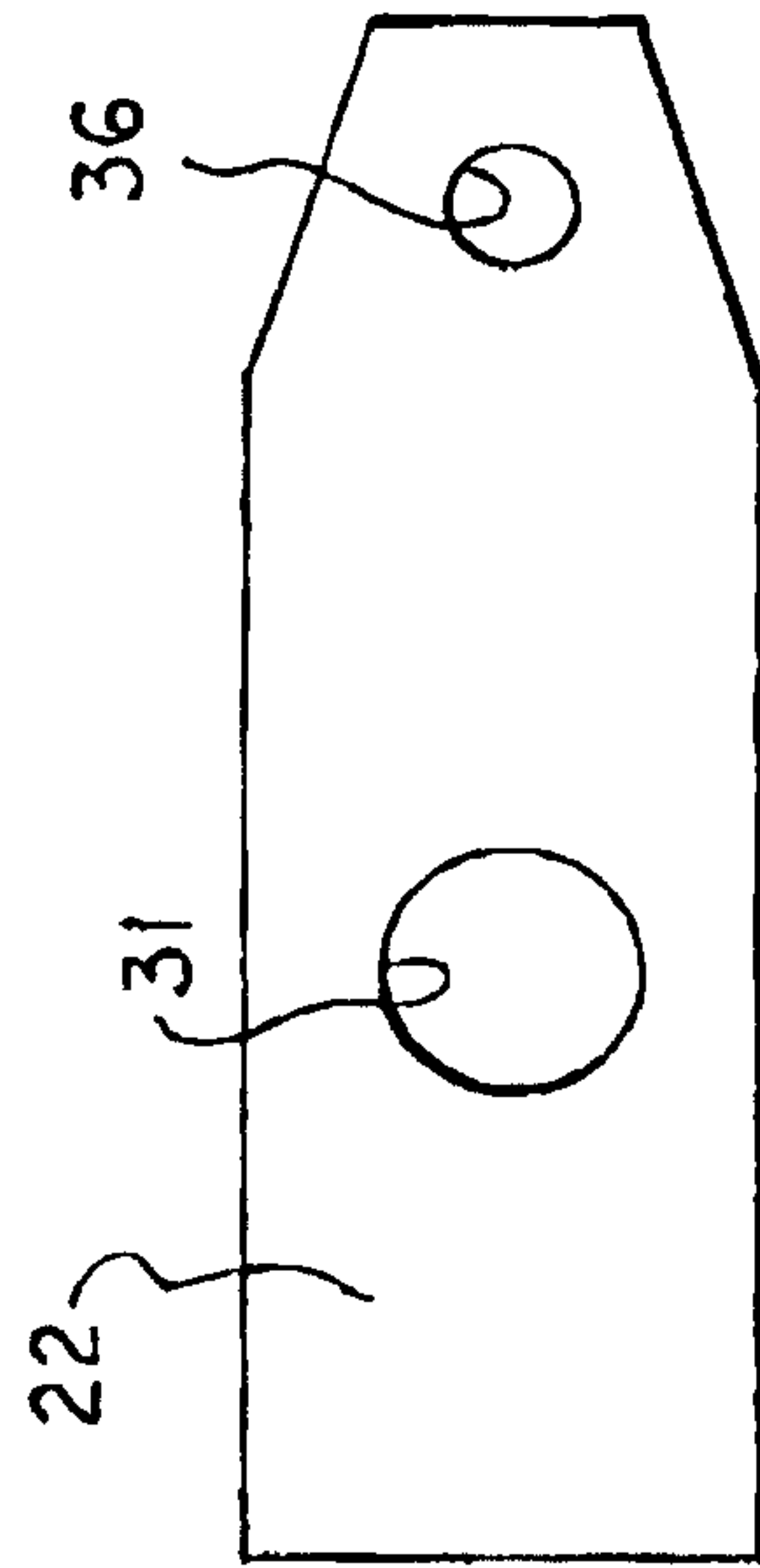


FIG. 5

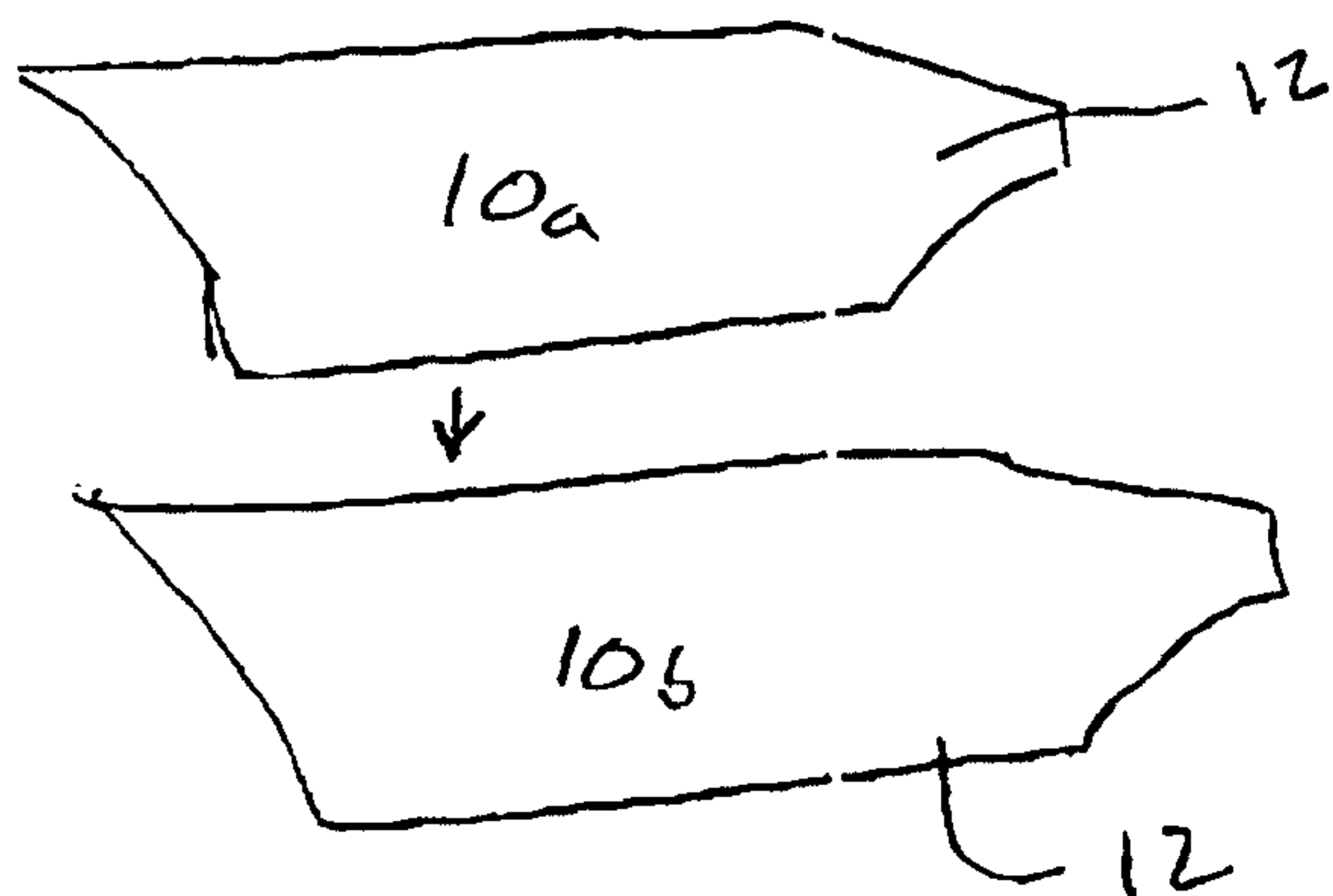


FIG. 7

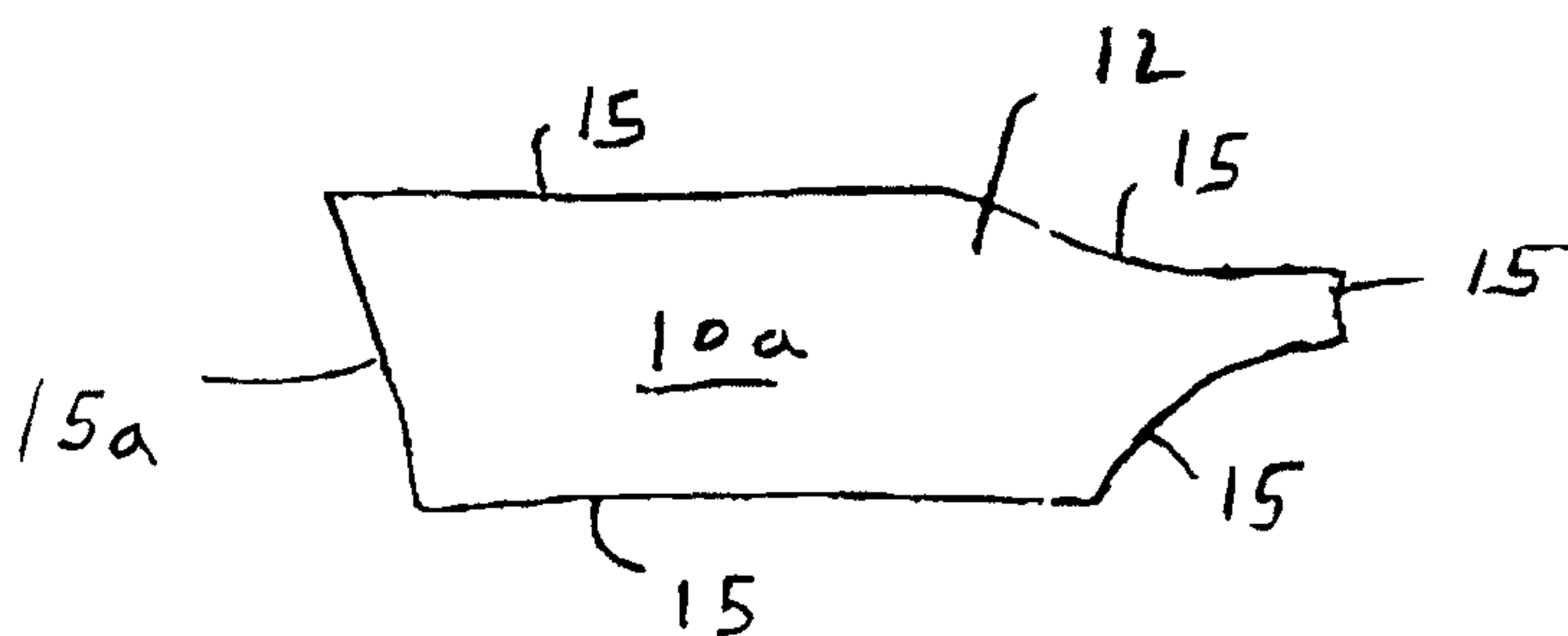


FIG. 7A

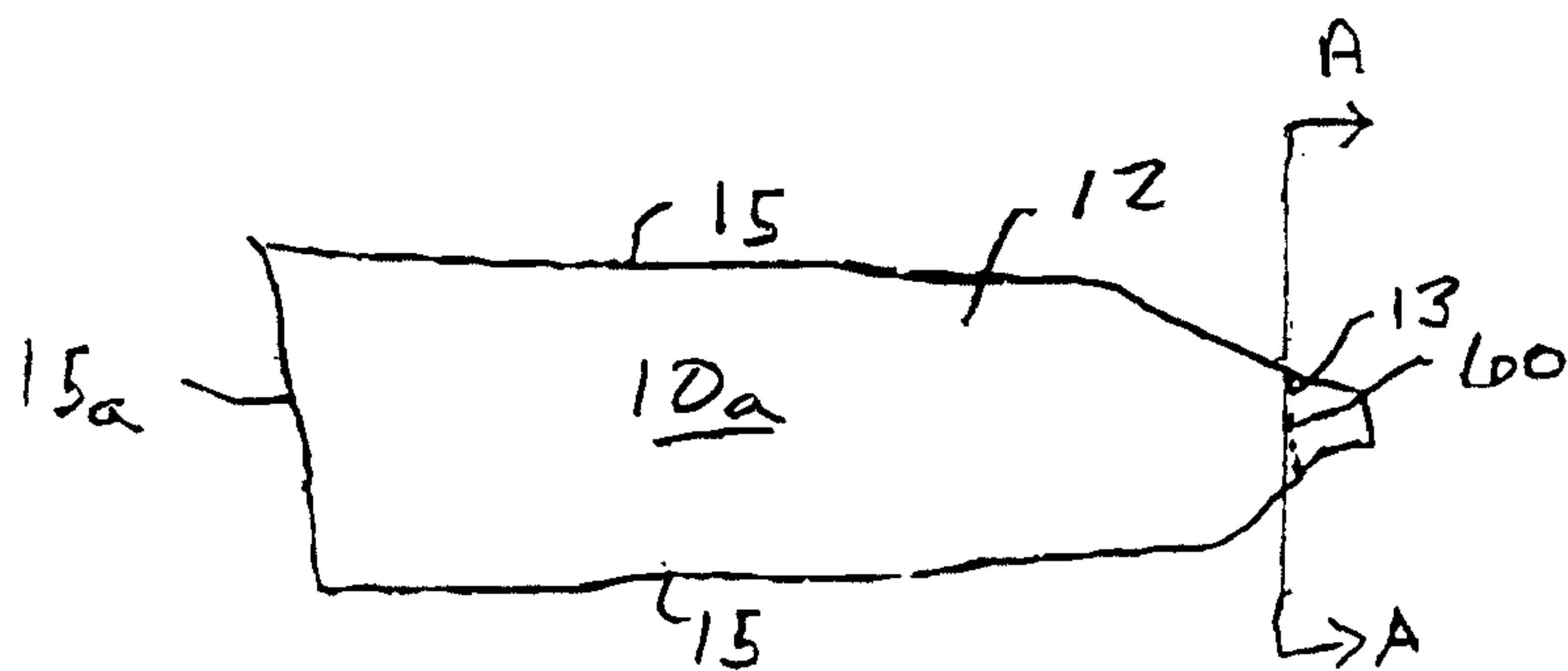


FIG. 7B

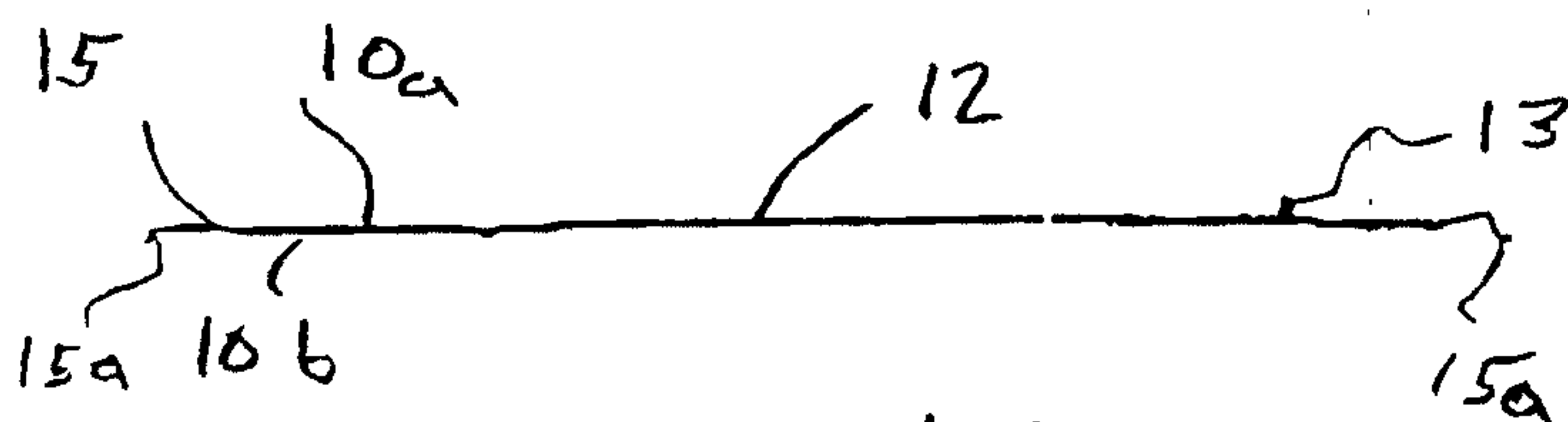


FIG. 7C

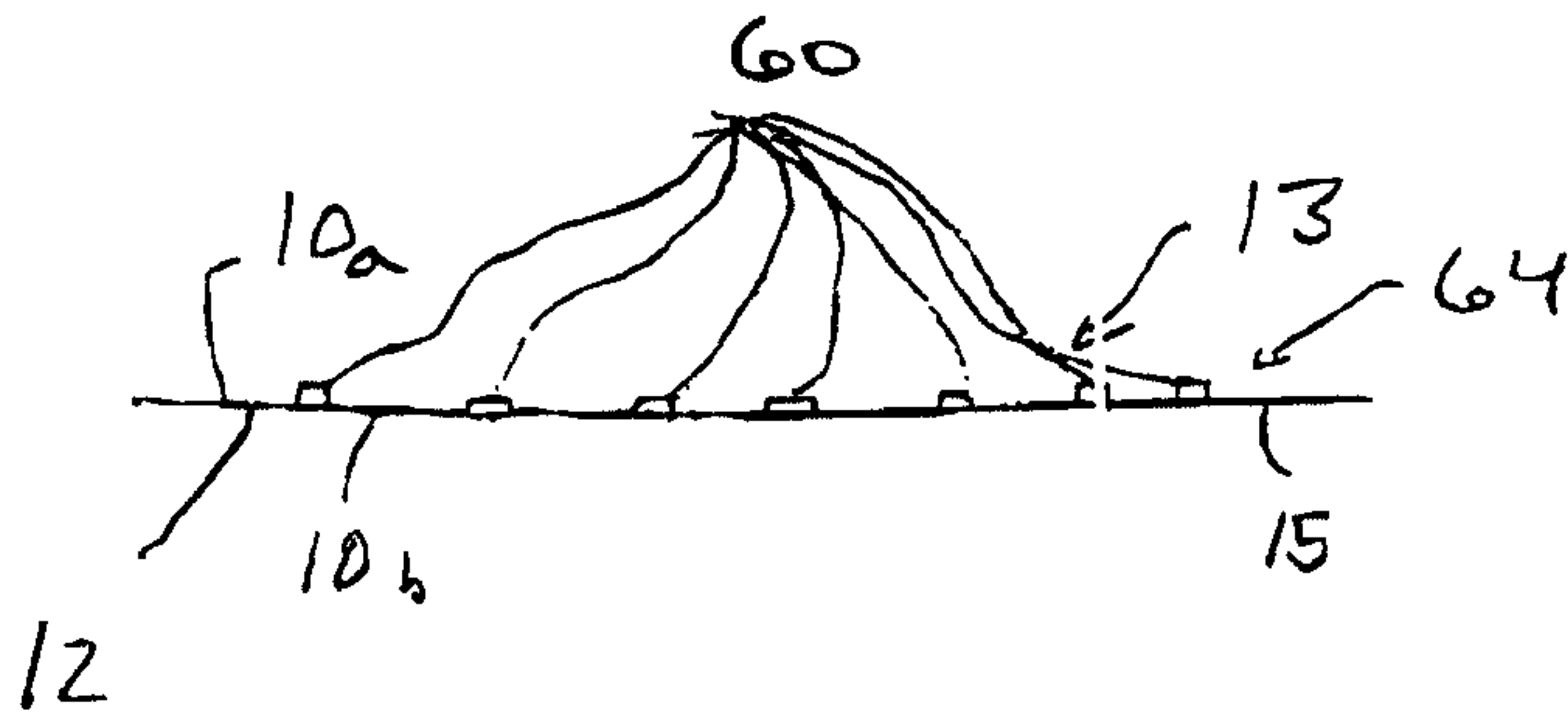


FIG. 7D

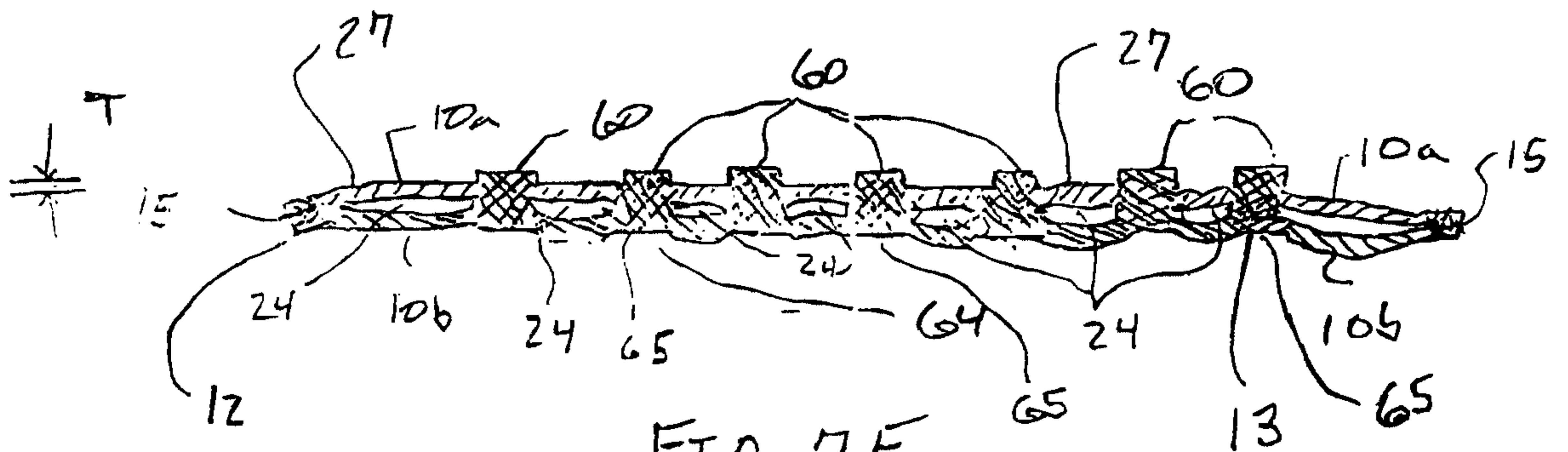


FIG. 7E

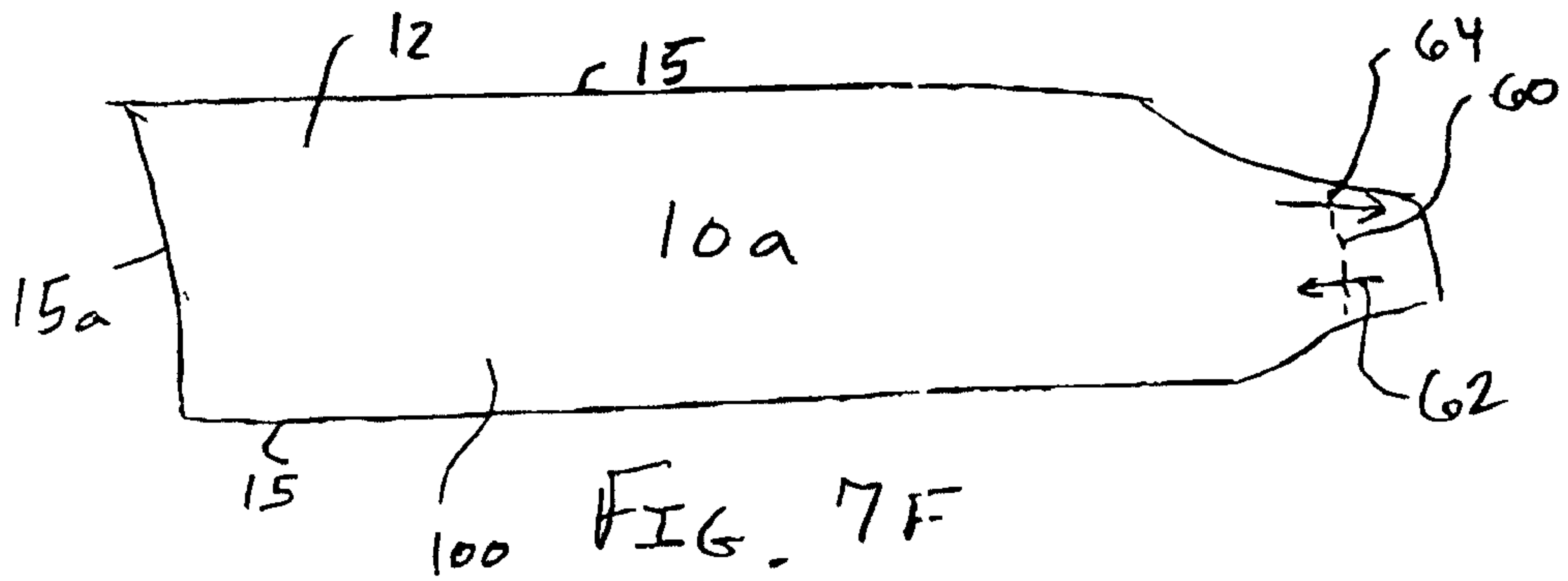


FIG. 7F

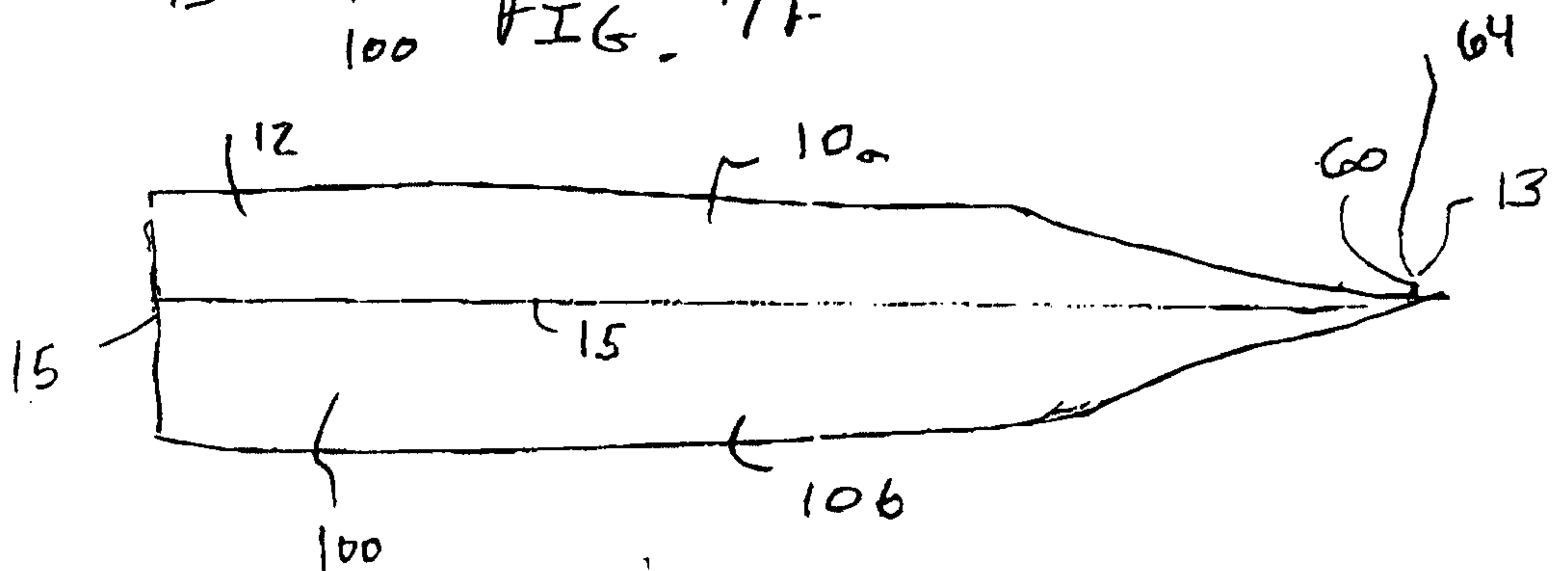


FIG. 7G

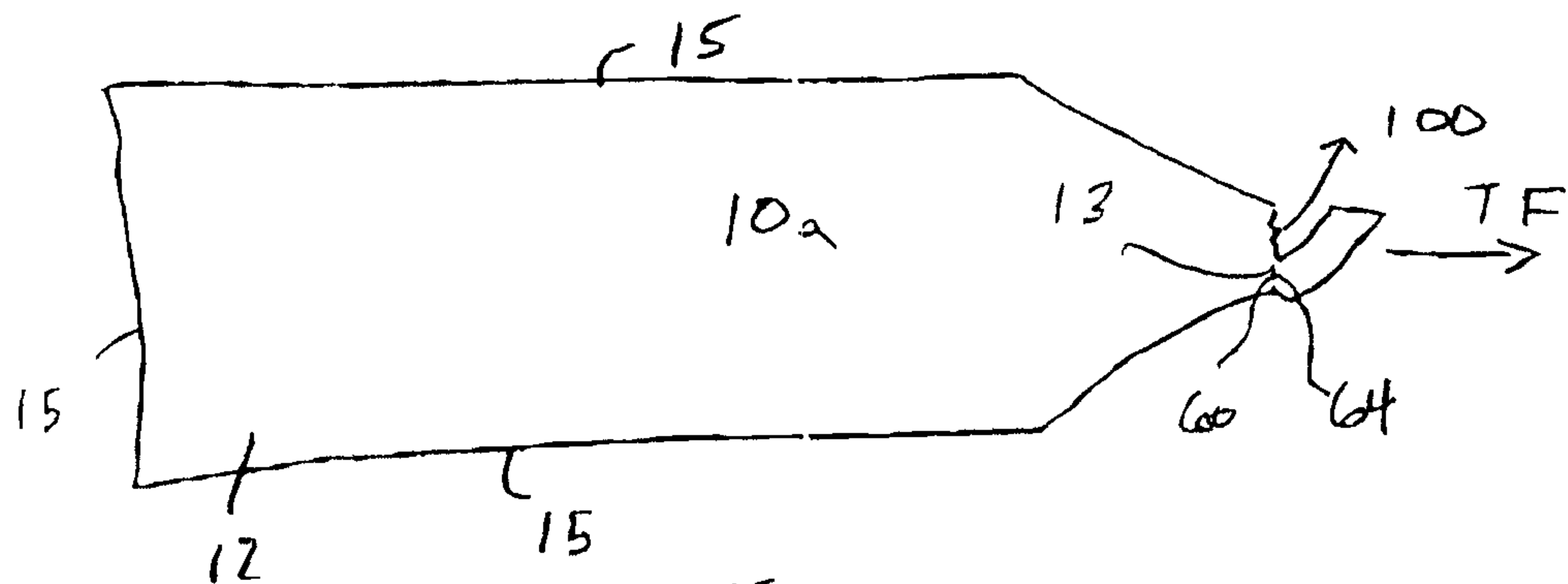


FIG. 7H

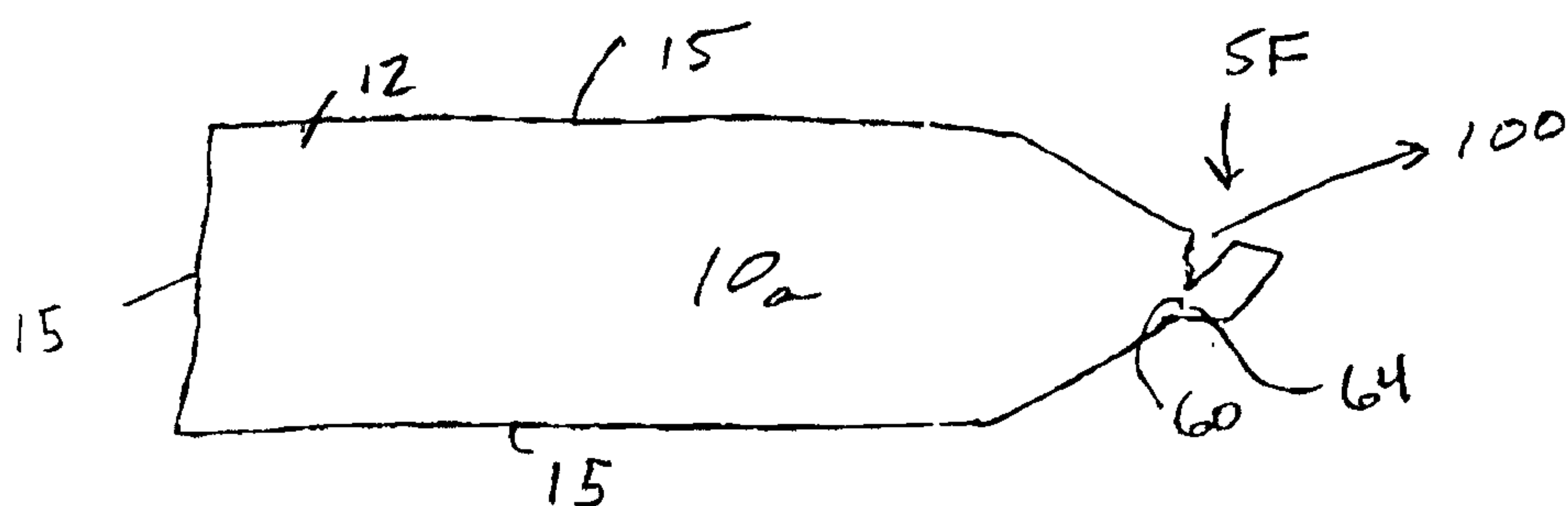


FIG. 7I

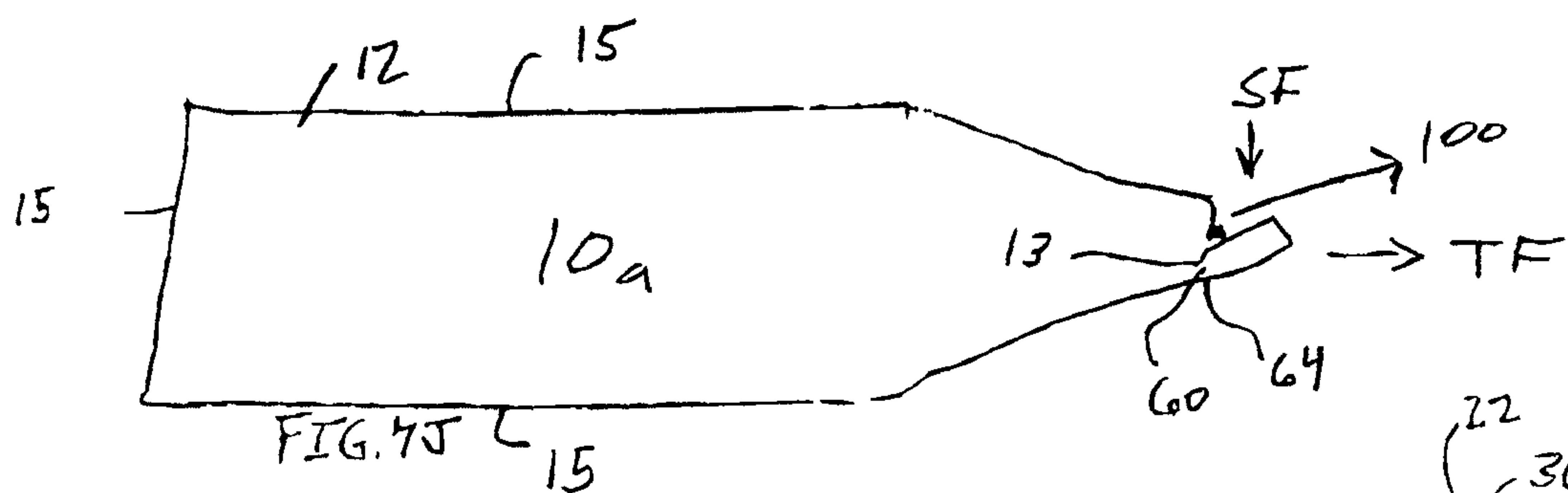


FIG. 7J

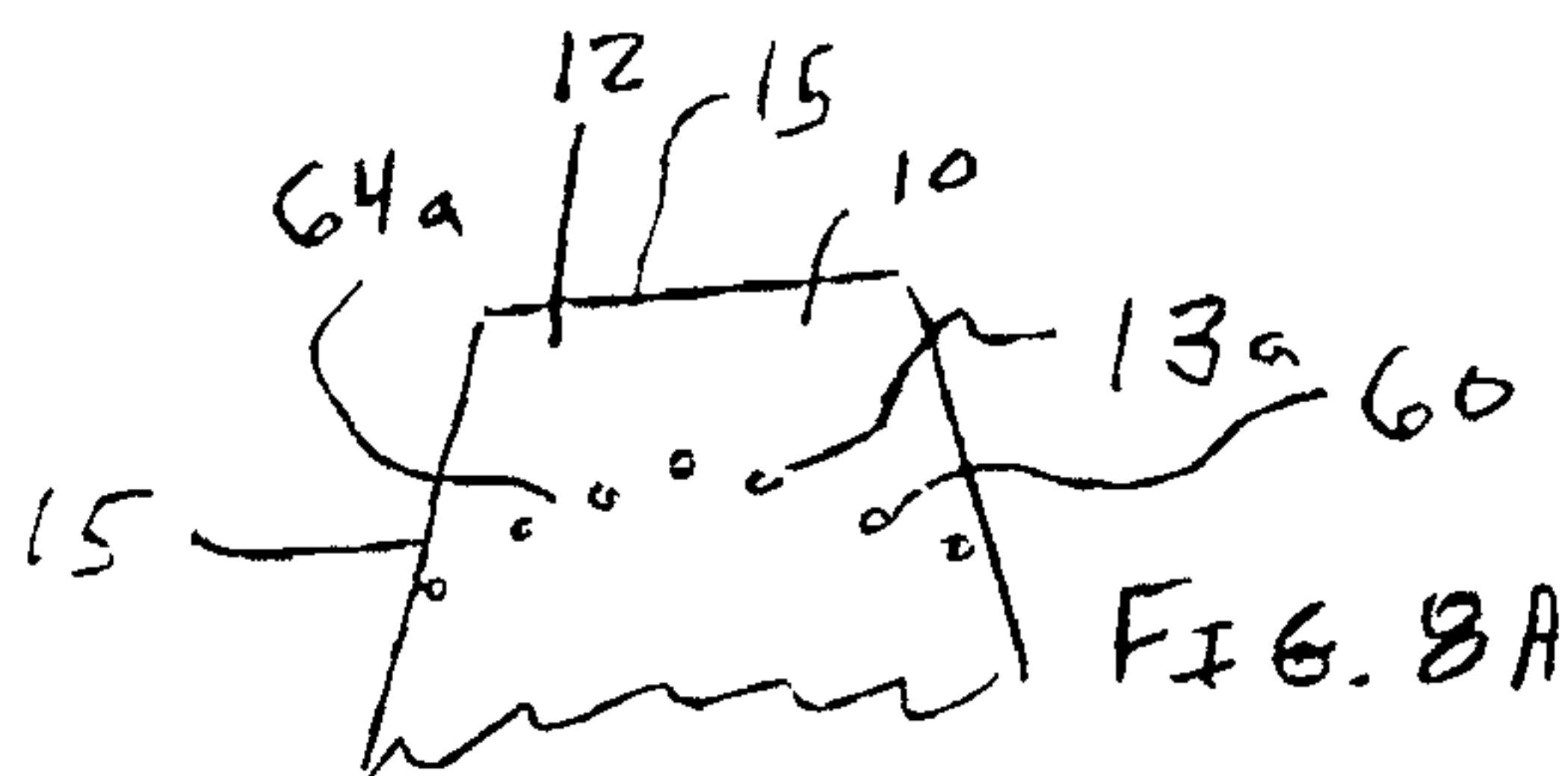


FIG. 8A

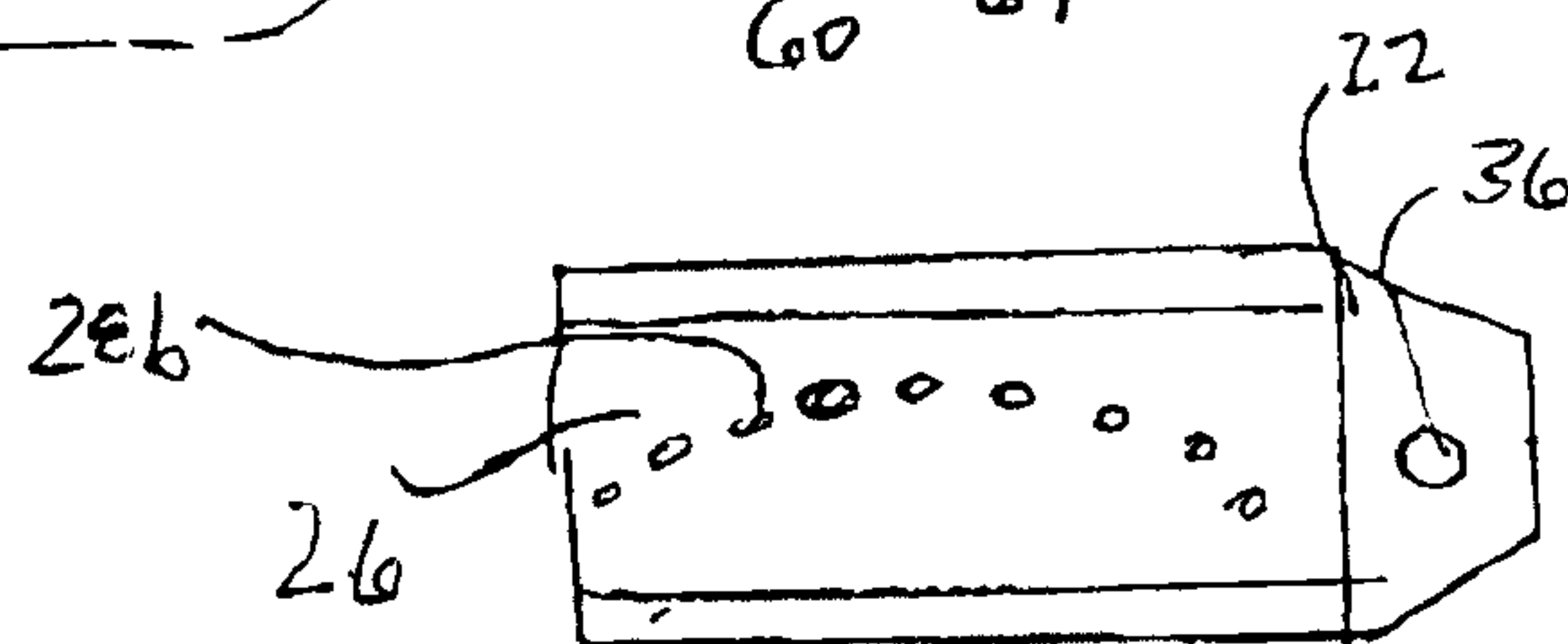


FIG. 8B

