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(54) **UNIVERSAL CASSETTE**

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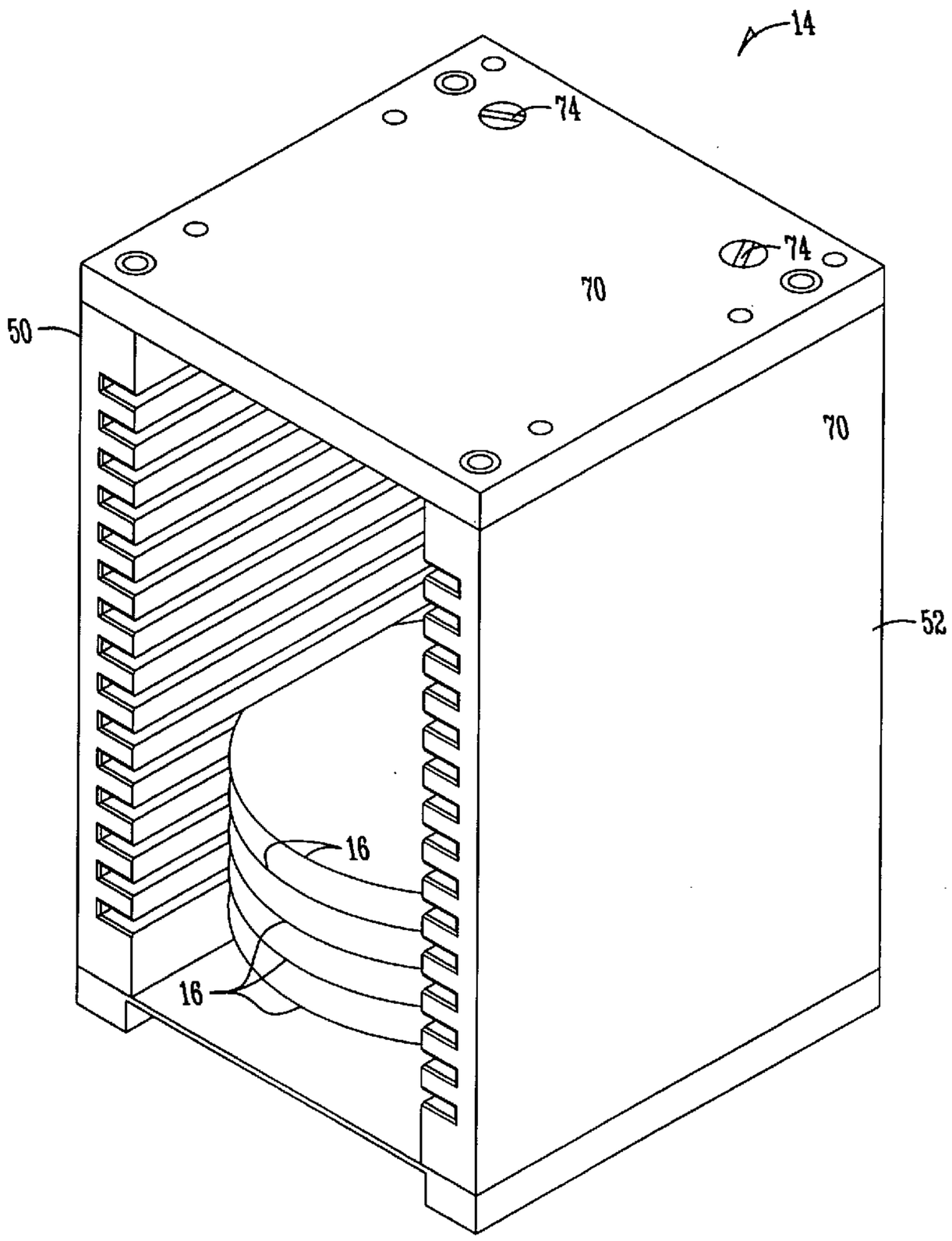
(57) **ABSTRACT**

A cassette assembly for holding circular and non-circular disks is provided. A cassette body has a top wall, a bottom wall, opposite side walls, and an open front, creating an inside and outside of the cassette body. The side walls have grooves adapted to receive and hold the disk. One or more first stops are provided inside the cassette body adjacent the grooves for stopping non-circular disks at a location in the grooves as the non-circular disks are placed in the grooves from the front. Additionally, one or more removable second stops inside the cassette body are spaced inwardly from the first stops for stopping the circular disks at the location in the groove as the circular disks are placed in the grooves from the front, so that the geometric center of the circular disk approximately aligns with the geometric center of the non-circular disk.



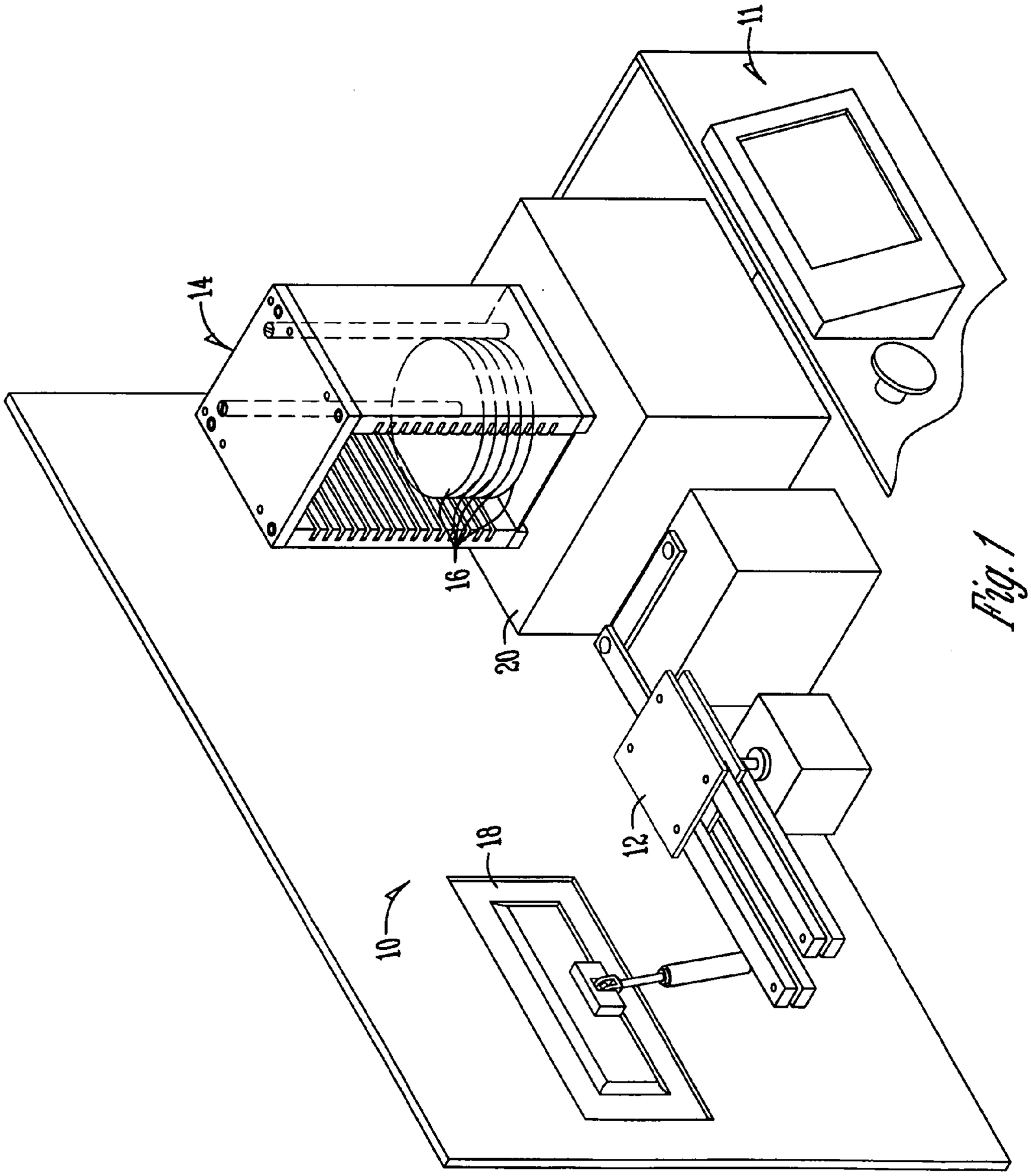


Fig. 1

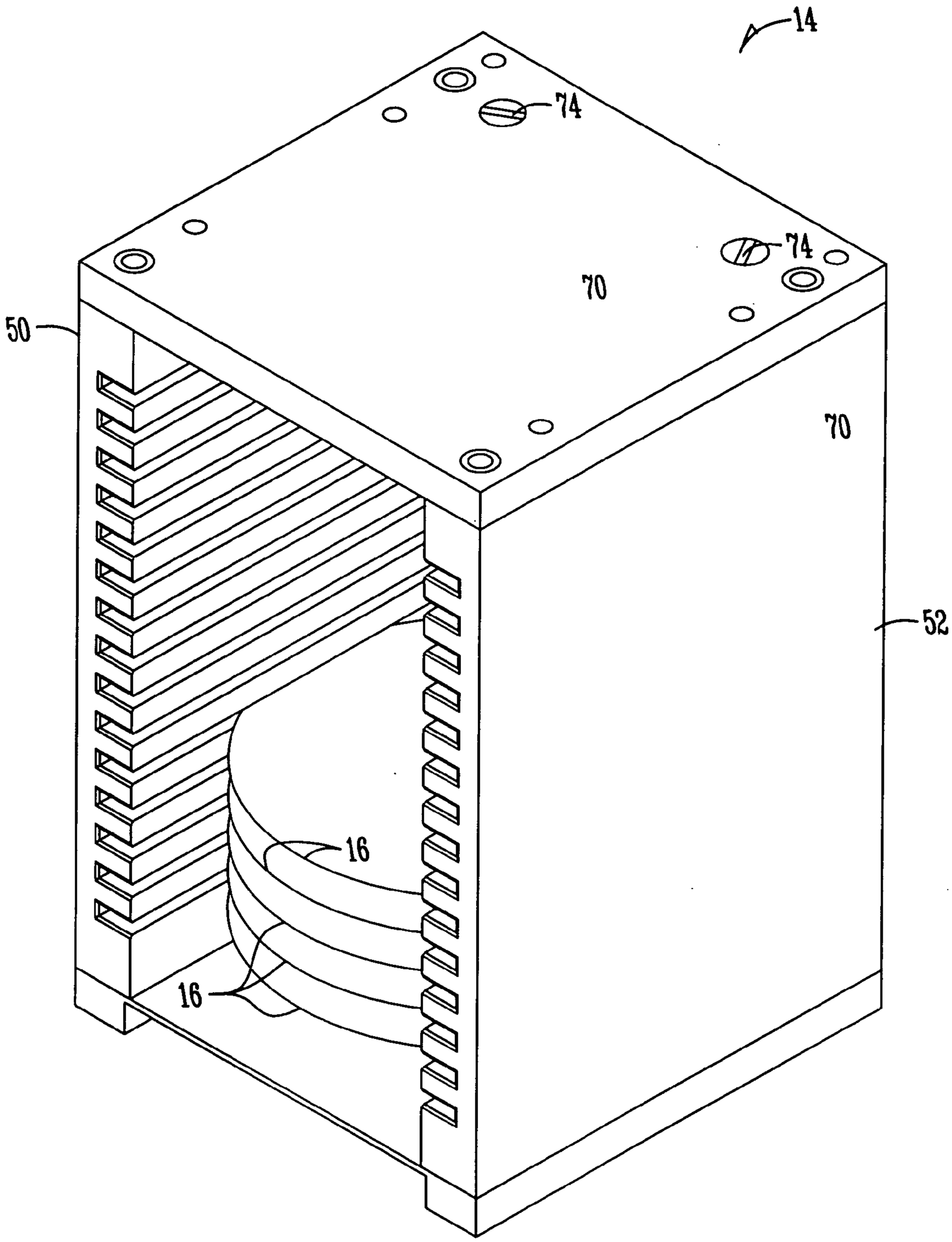


Fig.2

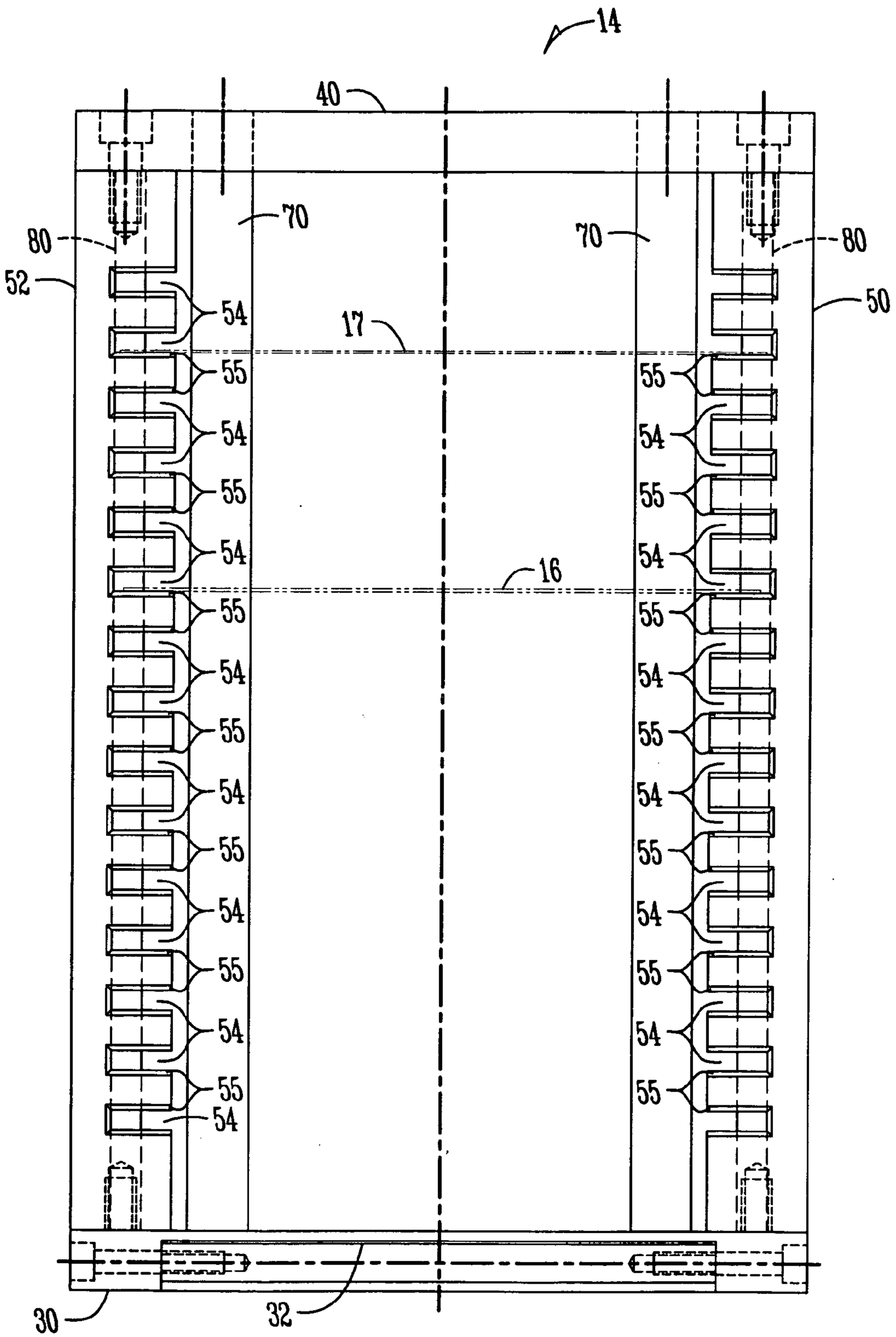


Fig. 3A

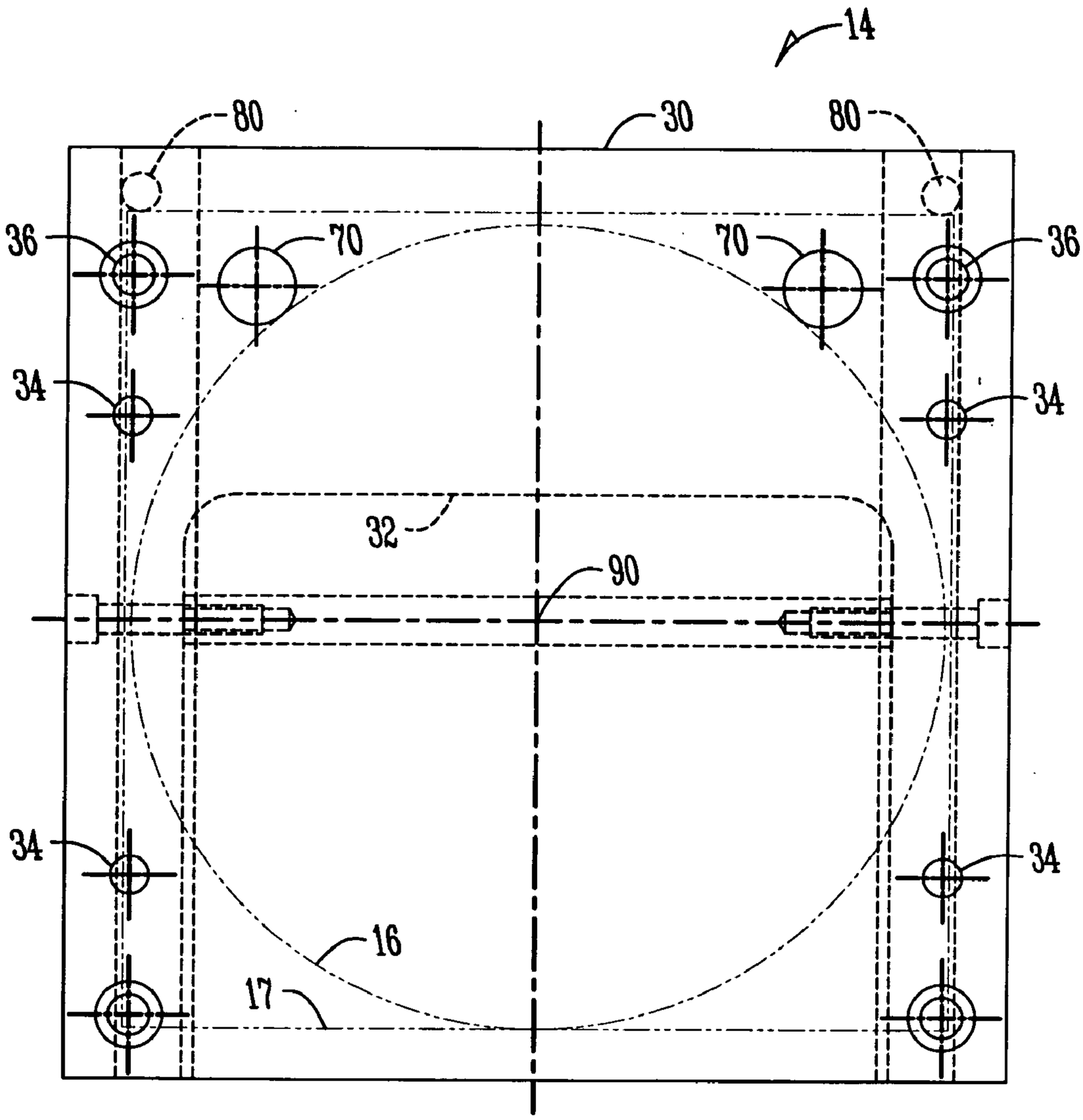


Fig. 3B

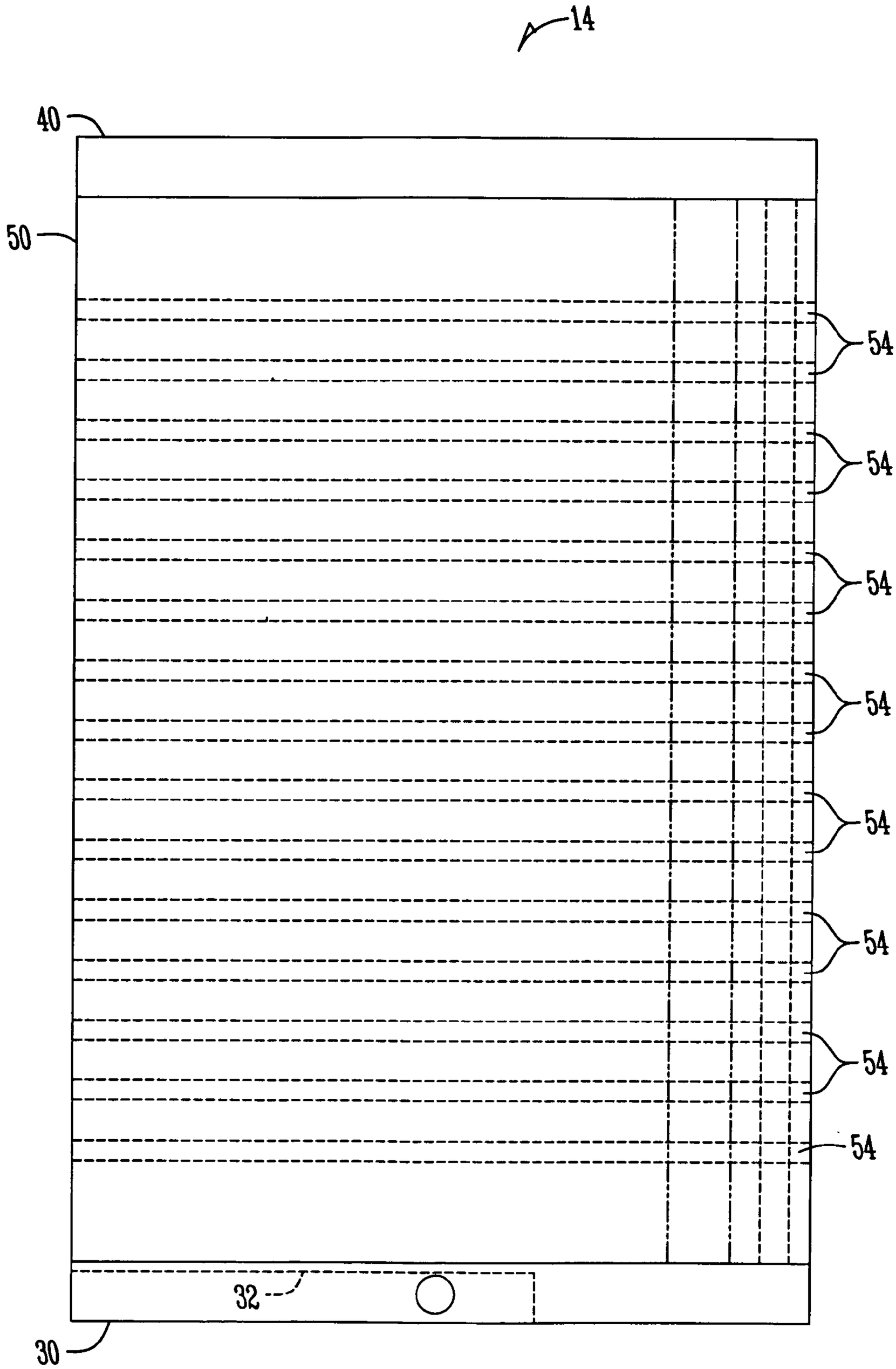


Fig. 3C

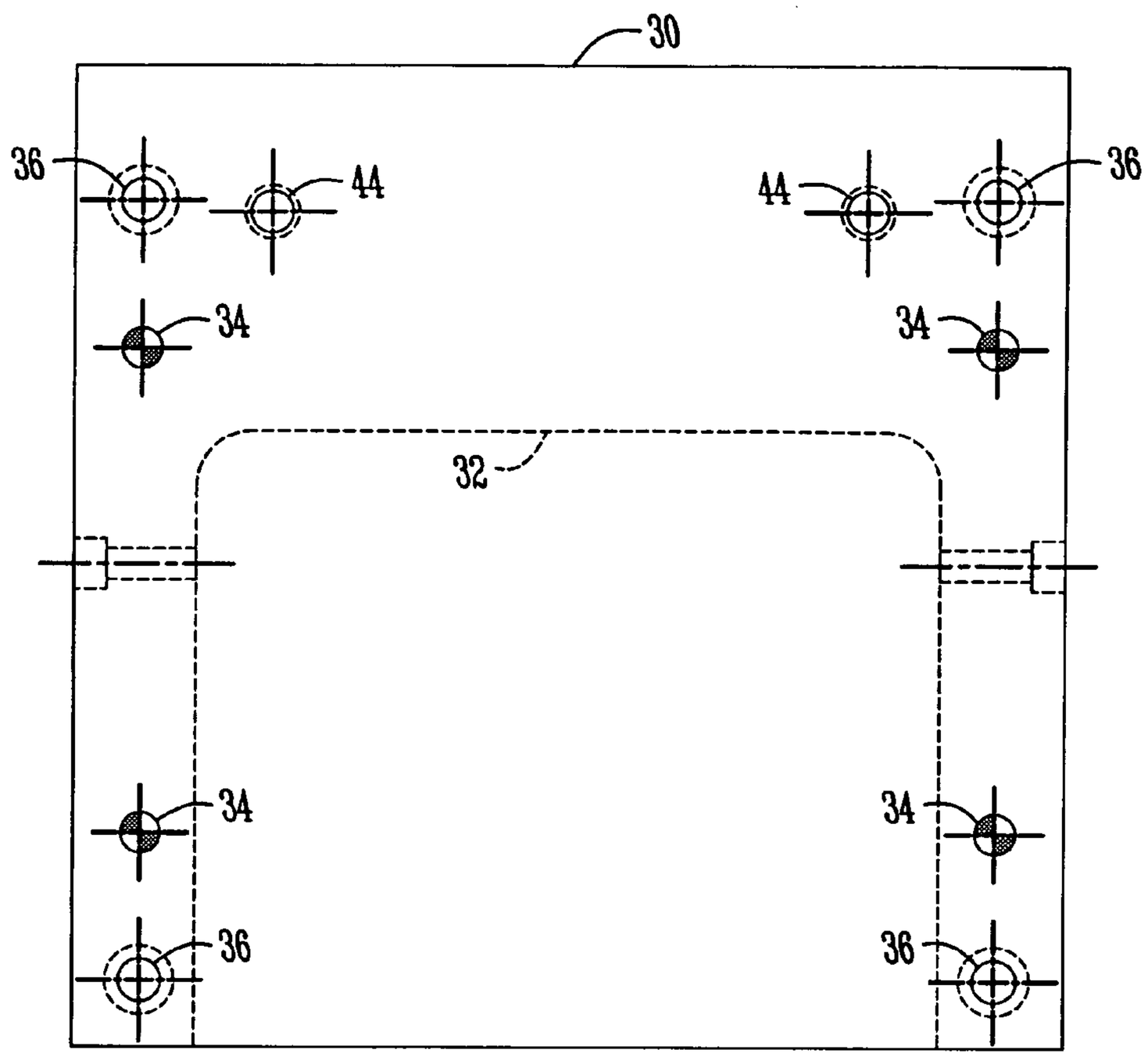


Fig. 4A

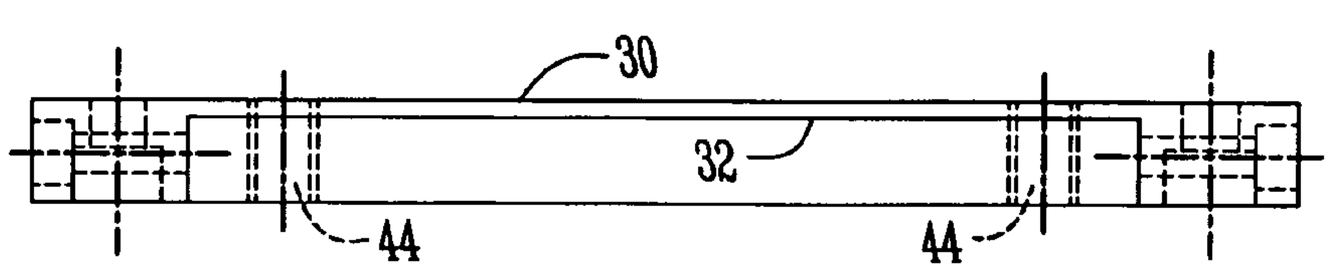


Fig. 4B

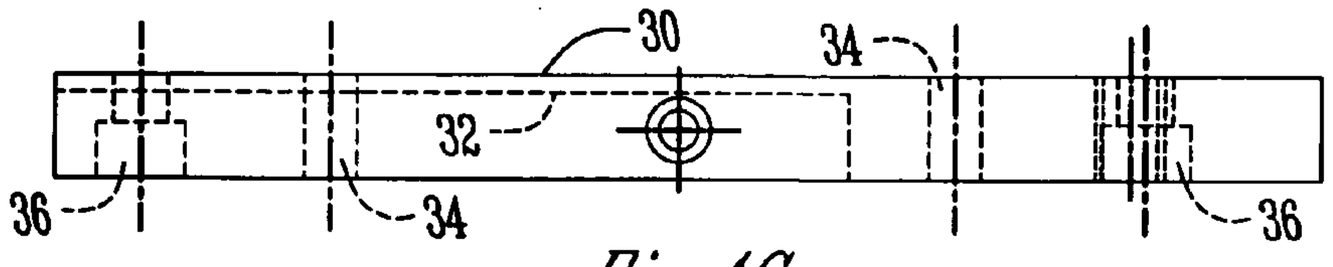


Fig. 4C

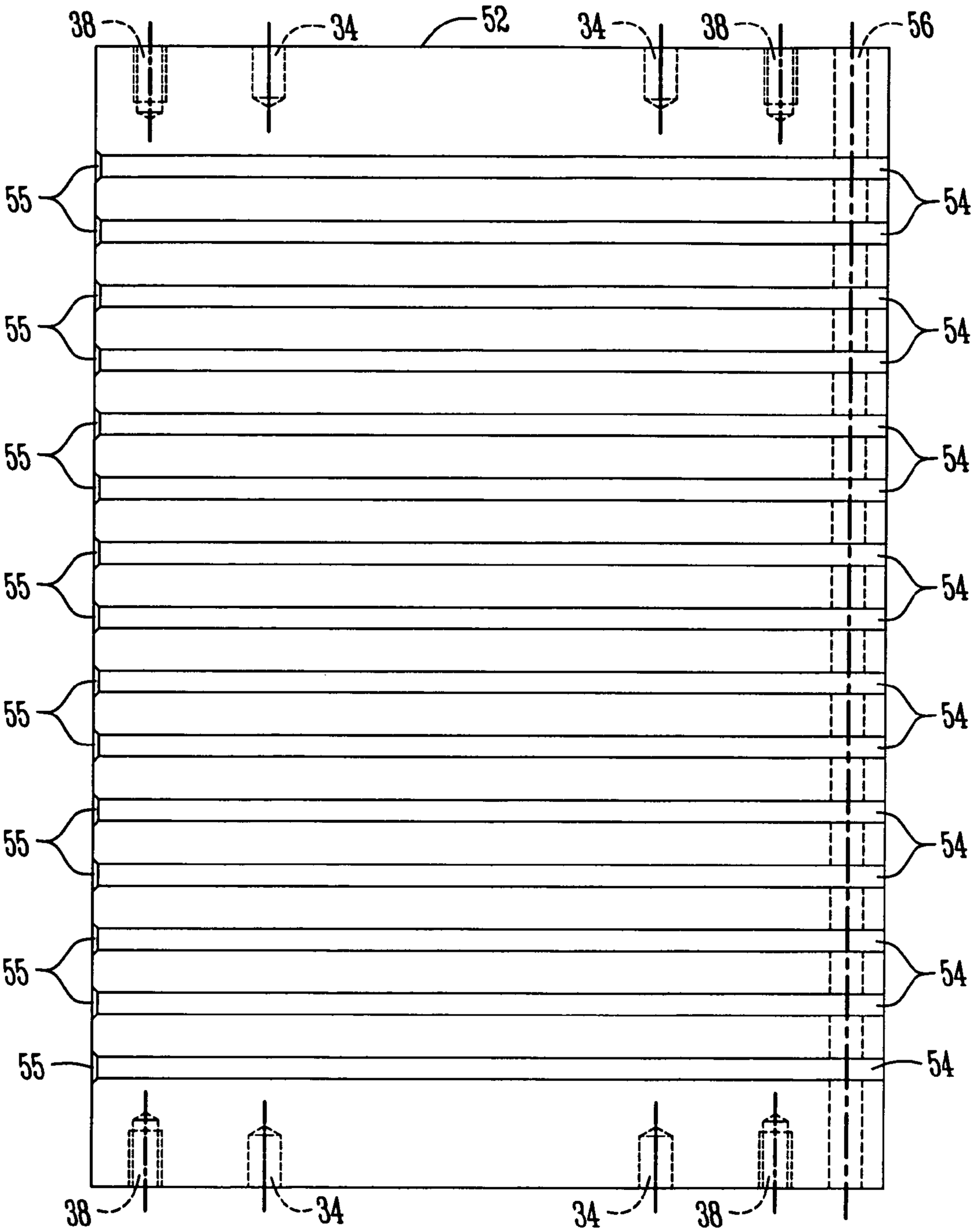


Fig. 5A

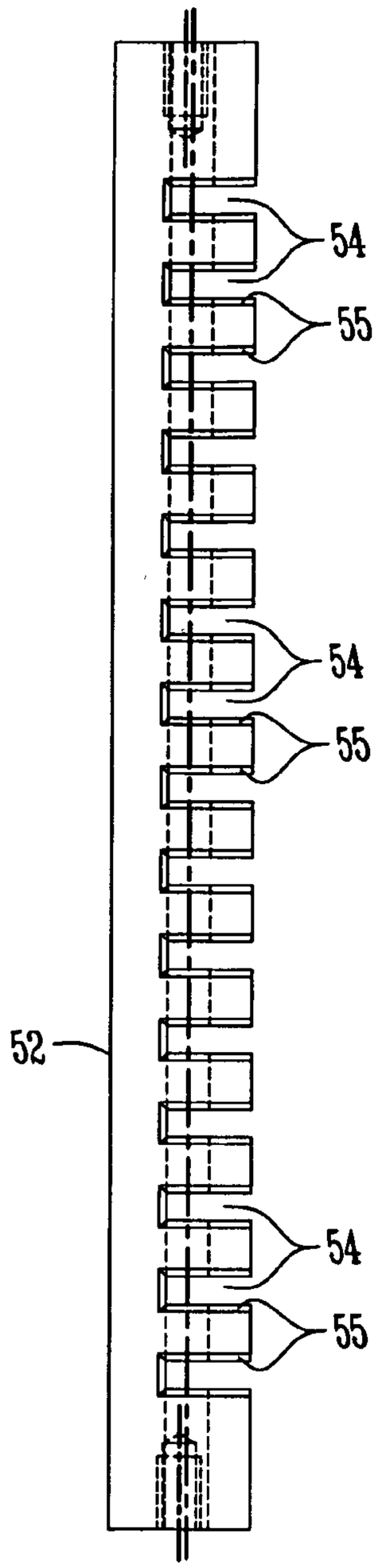


Fig. 5B

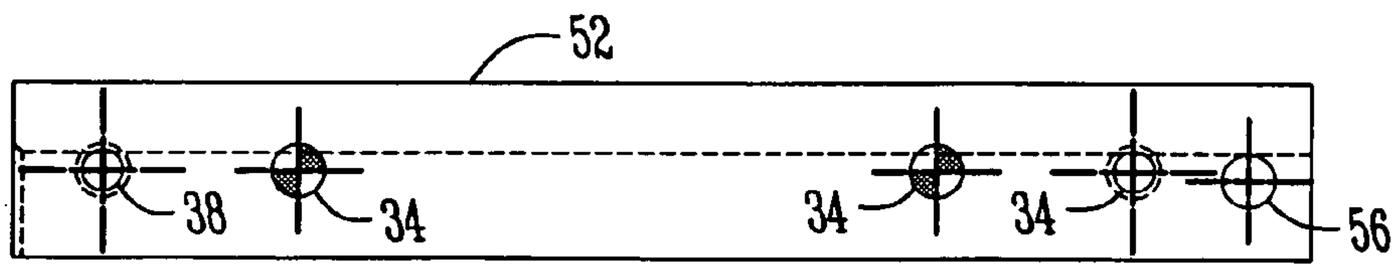


Fig. 5C

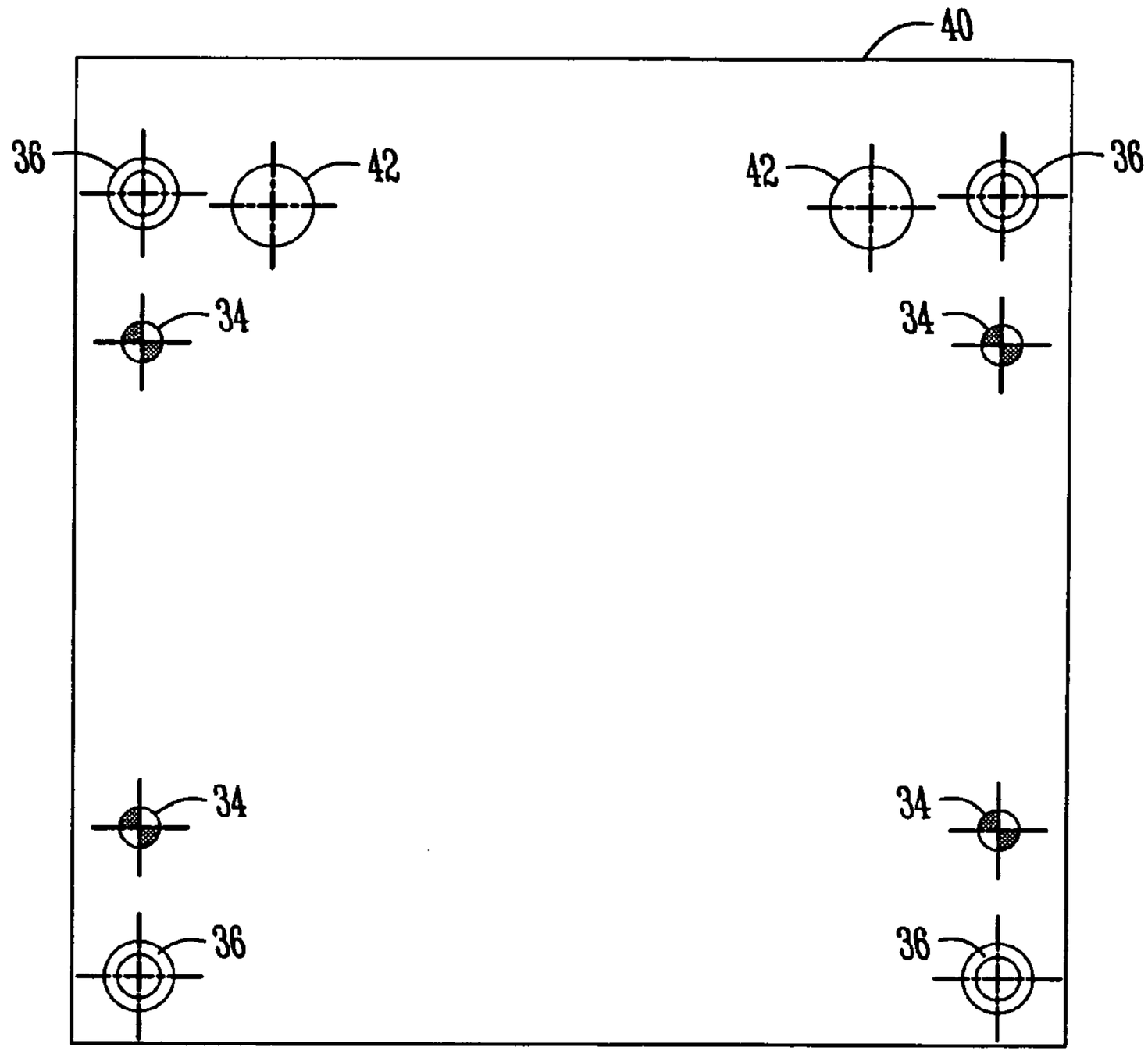


Fig. 6A

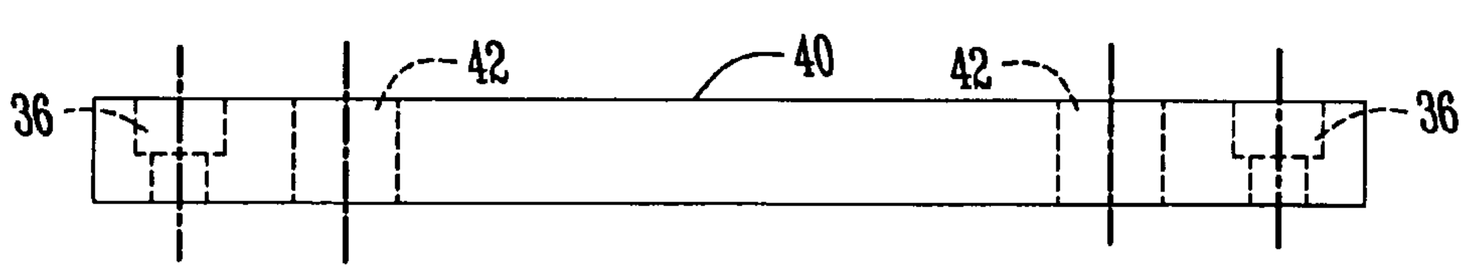


Fig. 6B

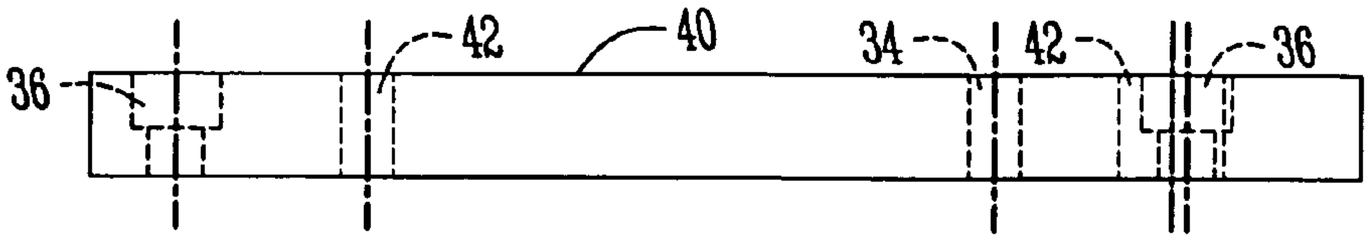


Fig. 6C

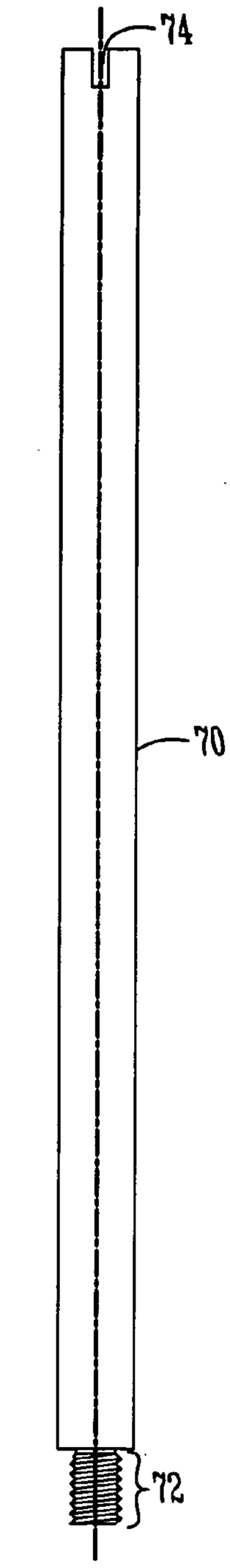


Fig. 7A

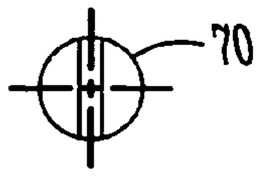


Fig. 7B

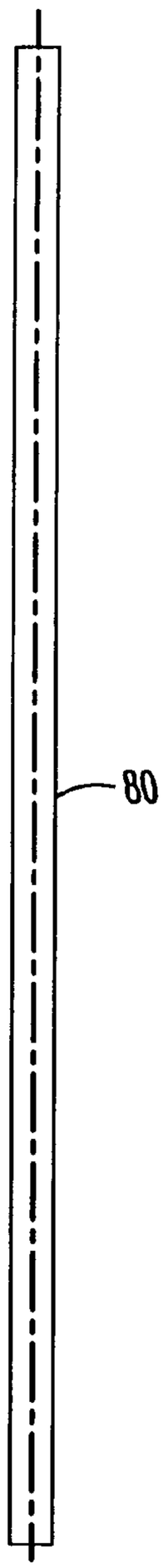


Fig. 8A

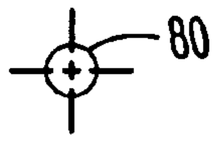


Fig. 8B

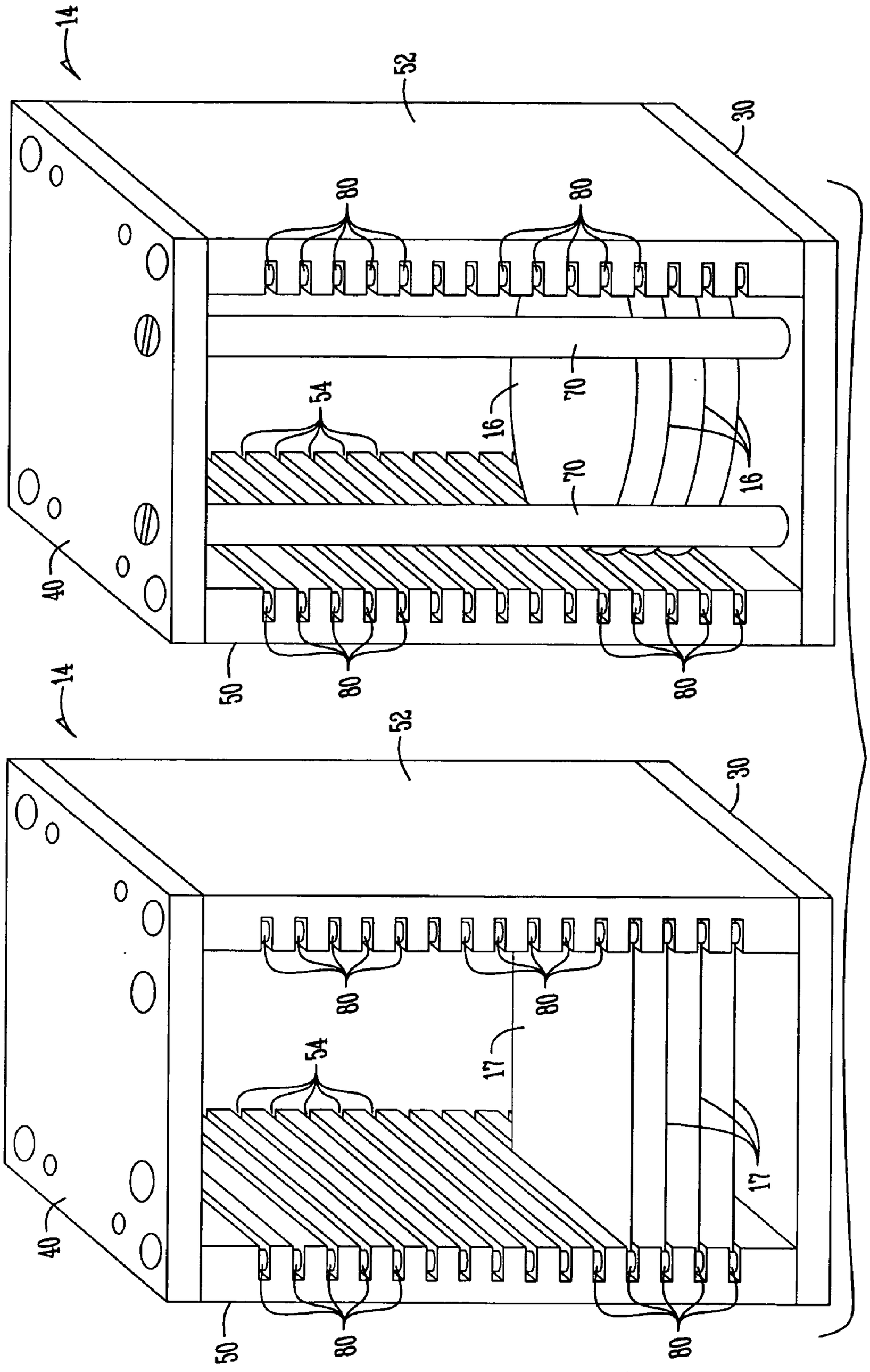

14
52
30
80
80
54
16
70
70
16
40
50
80
80
14
52
30
80
80
54
17
17
40
50
80
80

Fig. 9

UNIVERSAL CASSETTE

BACKGROUND OF THE INVENTION

[0001] This invention relates to cassettes for holding disks, wafers and/or plates during thin film manufacturing processes. Specifically, this invention relates to a universal cassette.

[0002] It is common today to use cassettes for holding and transporting semi-conductor type devices during processing in reusable cassettes. Generally, the silicon disks used with these cassettes are circular. However, advances in nontraditional materials, such as alumina, aluminum nitride, and fused silica are becoming more widespread. These nontraditional materials however, are generally square shaped during processing., Thus, it is desirable to have a cassette capable of holding and storing both the round silicon disks as well as the square nontraditional disks. Furthermore, it is desirable to have a universal cassette design which allows existing, robotic processing equipment to handle both the round and square devices without modification to the robotic or processing equipment.

[0003] In light of the foregoing, the primary feature or advantage of the present invention is to provide an improved universal cassette.

[0004] A further feature or advantage of the present invention is a cassette which can easily be converted from a configuration for holding round semi-conductor type disks to a configuration for holding square plates.

[0005] Another feature or advantage of the present invention is a cassette which is capable of holding both round disks and square plates for processing so that the geometric center of each is in the same location within the cassette.

[0006] A still further feature or advantage of the present invention is a provision of a universal cassette design which is economical to manufacturer, durable in use, and efficient in operation.

[0007] One or more of these and/or other features or advantages of the current invention will be apparent from the specification and claims that follow.

BRIEF SUMMARY OF THE INVENTION

[0008] One or more of the foregoing features or advantages may be achieved by cassette assembly for holding circular and non-circular disks having a cassette body with a top wall, a bottom wall, opposite side walls, and an open front, creating an inside and an outside of the cassette body. The side walls having horizontal grooves adapted to receive and hold the disks. One or more first stops are inside the cassette body adjacent the grooves for stopping non-circular disks at a location in the grooves, as the non-circular disks are placed in the grooves from the front, and one or more removable second stops inside the cassette body spaced inwardly from the first stops for stopping the circular disks at the location in the grooves as the circular disks are placed in the grooves from the front, so that the geometric center of the circular disk approximately aligns with the geometric center of the non-circular disks.

[0009] Another aspect of the current invention is a cassette assembly wherein grooves open toward the inside of the cassette body and extend from the front towards the rear of the cassette body.

[0010] Another aspect of the current invention is a cassette assembly having linear grooves.

[0011] Another aspect of the current invention is a cassette assembly having one or more removable stops extending from the top wall to the bottom wall. In addition, these stops may be constructed of stainless steel.

[0012] A still further aspect of the current invention is a cassette assembly using stops which may be constructed from a plastic material.

BRIEF DESCRIPTION OF THE DRAWINGS

[0013] FIG. **1** shows one embodiment of a robotic transfer station assembly in association with a process chamber and one embodiment of the current invention.

[0014] FIG. **2** shows a perspective view of one embodiment of the current invention.

[0015] FIGS. **3**A-C respectively show a front, top and side view of one embodiment of the current invention.

[0016] FIGS. **4**A-C respectively show a top, front and side view of one embodiment of the bottom plate.

[0017] FIGS. **5**A-C respectively show a front, side, and top view of one embodiment of the side plates.

[0018] FIGS. **6**A-C respectively show a top, front and side view of one embodiment of the top plate.

[0019] FIGS. **7**A-B respectively show a side and top view of one embodiment of a spacer post.

[0020] FIGS. **8**A-B respectively show a side and top view of one embodiment of a stop rod.

[0021] FIG. **9** shows a rear perspective view of two cassette assemblies, one configured for holding square plates and one configured for holding round disks.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

[0022] The invention is an improved universal cassette for holding semi conductor or other materials for thin film processing. One embodiment of the invention is shown in FIGS. **1-9**. This embodiment incorporates removable spacer posts **70** used within the universal cassette assembly **14** to hold round disks **16** when the spacer posts **70** are installed and non-round disks **17**, such as square plates, when the spacer posts **70** are removed. Additionally, the geometric centers of both the round disk **16** and square plates **17** are located within the same approximate front to rear location within the cassette assembly grooves **54**.

[0023] FIG. **1** shows a typical robotic transfer station **10** which is controlled by a computer control panel **11**. The robotic transfer station **10** generally has a lift arm **12** for extending into a cassette assembly **14** and lifting a disk **16**, **17** and placing the disk **16**, **17** into a process chamber **18**. Process chambers **18** are typically used to remove impurities, such as photo resist. A common process chamber is a Matrix System 1 Plasma Asher or stripper.

[0024] In operation, an elevator **20** raises a cassette assembly **14** to the proper height for the lift arm **12** to extend underneath the proper disk **16**, **17**. The lift arm **12** then slightly lifts the disk **16**, **17** and slides the disk **16**, **17** out of

the cassette assembly **14**. The lift arm **12** can then rotate to the proper orientation and insert the disk **16**, **17** into the process chamber **18** for processing. Once processing is completed in the process chamber **18**, the lift arm **12** can then enter the processing chamber **18**, lift the disk **16**, **17**, remove the disk **16**, **17**, and return the disk **16**, **17** to the cassette assembly **14**. This cycle is repeated for each disk **16**, **17** in the cassette assembly **14**. Any number of disks **16**, **17** can be held in the contemplated cassette assembly **14**. The processing procedure is well-known to one ordinarily skilled in the art.

[**0025**] FIGS. **1-3** and **9** show the preferred embodiment of an assembled wafer cassette assembly **14**. FIG. **1** shows a typical set-up utilizing the wafer cassette assembly **14** in process. FIG. **2** shows an isometric view of the preferred embodiment of the cassette assembly **14**. FIG. **3**A-C show front, top and side views of the wafer cassette assembly **14**. FIG. **9** shows a perspective view of two wafer cassette assemblies **14** side-by-side, one having spacer posts **70** installed and the other not having spacer posts **70** installed.

[**0026**] FIGS. **4**A-C shows a preferred embodiment of the bottom plate **30** of the wafer cassette assembly **14**. The bottom plate **30** may have a cut-out **32** on the bottom side of the bottom plate **30**. In addition, it is preferred that the bottom plate **30** have one or more locating pin points **34** which are holes that can help align the bottom plate **30** to the side plates **50**, **52** with dowel pins (not shown). This helps to create a proper alignment of the bottom plate **30** to the side plates **50**, **52**. The bottom plate **30** is also preferred to have one or more machine bolt through holes **36**. These machine bolt through holes **36** allow a machine bolt (not shown) to pass through the hole **36** and into machine bolt threaded holes **38** in the side plates **50**, **52**. The machine bolt(s) tighten into the threaded holes **38** to hold the pieces together.

[**0027**] The top plate **40**, shown in FIG. **6**, additionally has machine bolt through holes **36** and locating pin points **34** for locating and attaching the top plate **40** to the side plates **50**, **52**. The preferred material for the top plate **40**, bottom plate **30** and side plates **50**, **52** is anodized aluminum, however other materials will work.

[**0028**] The side plates, **50**, **52** shown in FIG. **5**, have a plurality of grooves **54**. The grooves **54** are preferred to have a chamfer **55**. The grooves **54** should be deep enough, wide enough and spaced apart enough to allow the desired size plates **16**, **17** to easily slide in and out of the grooves **54** when used with a cassette assembly **14**. In addition, the chambers **55** smooth the sharp edges on the corners of the groove **54** to reduce damaging the disks **16**, **17**. Furthermore, the grooves **54** should be wide enough and deep enough to also allow the cassette assembly **14** to hold alumina, aluminum nitride, and fused silica, and other types of square plates as well as round silica disks for thin film processing.

[**0029**] The side plates **50**, **52** are preferred to have a rod stop hole **56**. The rod stop hole **56** is sized to receive a rod stop **80**, as shown in FIG. **8**. The rod stop is preferred to be made of Teflon®, Delrin®, or other types of plastic type material to stop the travel of the plates **17** as they slide into the groove **54** of the cassette assembly **14**. A plastic type stop rod **80** is preferred so that it doesn't damage the disk **16** or plate **17** within the cassette assembly **14**. The rod stop **80** passes through the stop rod hole **56** in the side plates **50**, **52** and extends into the grooves **54**. Additionally, the rod stop **80** is held into the rod stop hole **56** in the side plates **50**, **52** by the bottom plate **30** and the top plate **40**.

[**0030**] The top plate **40** additionally is preferred to have one or more spacer post through holes **42** for allowing spacer posts **70** to pass through the through hole **42** and to the spacer post threaded holes **44** in the bottom plate **30**. The spacer post **70**, as seen in FIG. **7**, is preferred to be a stainless steel rod with a screw driver slot **74** on one end and threads **72** on the other end. This allows the spacer post **70** to pass through a spacer post through hole **42** in the top plate **40** and thread into and tighten in the spacer post threaded holes **44** in the bottom plate **30**. The spacer post **70** is to be placed in a location which stops the travel of round silicon disks **16** within the grooves **54** in the same location within the grooves **54** that the square plates **17** are stopped with the stop rod **80**. In other words, the geometric center **90** of both the round disk **16** and the square plate **17** should be located in the same position in the groove **54**.

[**0031**] Constructed in this manner, the wafer cassette assembly **14** can easily be transformed from holding square plates **17**, with the square plates **17** being stopped by the stop rod **80**, to being capable of holding round disks **16** in the grooves **54** such that the geometric centers **90** align. This allows for a cassette assembly **14** to be easily transformed into holding either round disks **16** or square plates **17** so that a robotic transfer station **10** can easily pick up the geometric center **90** of either the round disk **16** or the square plate **17** and properly locate it into and out of a process chamber **18** and back into the cassette assembly **14**. This allows any substrate to be used without reprogramming or realignment of the robotic transfer station **10**. To convert a cassette assembly **14** from using round disk **16** to square plate **17**, one simply has to remove the spacer post **70**. On the other hand, to convert a cassette assembly **14** which is using square plates **17** to be able to use round disk **16**, one simply has to install spacer post **70**.

[**0032**] Traditionally, when substrate media was changed, individualized or customized cassette assemblies had to be constructed and used. This invention allows for a single design of cassette assembly **14** to be used for any type of substrate material for use in thin film processing. In addition, the preferred embodiment is configured to hold substrates ranging in size from about 0.015" to about 0.060" nominal thickness. However, the invention can be built to hold any size substrate.

[**0033**] The words circular and non circular disk and plate are used in this application interchangeably. Generally, a disk was referred to a round material and a plate was referred to a square shaped material. However, any shape of devices can be used with the current invention. Furthermore, circular and round disks or plates are used for exemplary purposes only. Any shape or sets of shapes of disks may be used with this invention.

[**0034**] In the drawings and specification there has been set forth preferred embodiment of the invention, and all those specific terms are employed, these are used in a generic and descriptive sense only and not for purposes of limitation. Changes in the form and the portions of parts as well as in the substitution of equivalence are contemplated as circumstance may suggest or render expedient without departing from the spirit or scope of the invention as further defined in

the following claims. For example, the present invention contemplates variations in structure of the top plate, bottom plate and side plates. Additionally, it is contemplated that other types or shapes of substrate materials can be used within the present invention. These and other variations are within the spirit and scope of the invention.

What is claimed is:

1. A cassette assembly for holding circular and non-circular disks comprising:

a cassette body having a top wall, a bottom wall, opposite side walls, and an open front, creating an inside and an outside of the cassette body, the side walls having horizontal grooves adapted to receive and hold the disks;

one or more first stops inside the cassette body adjacent the grooves for stopping non-circular disks at a location in the grooves as the non-circular disks are placed in the grooves from the front; and

one or more removable second stops inside the cassette body spaced inwardly from the first stops, for stopping the circular disks at the location in the grooves as the circular disks are placed in the grooves from the front, so that the geometric center of the circular disk approximately aligns with the geometric center of the non-circular disks.

2. The cassette assembly of claim 1 wherein the grooves open toward the inside of the cassette body and extend from the front towards a rear of the cassette assembly.

3. The cassette assembly of claim 1 wherein the grooves are linear.

4. The cassette assembly of claim 1 wherein the one or more removable second stops extend from the top wall to the bottom wall.

5. The cassette assembly of claim 1 wherein the one or more first stops are plastic.

6. The cassette assembly of claim 1 wherein the one or more removable second stops are stainless steel.

7. The cassette assembly of claim 1 wherein the grooves are chamfered.

8. A cassette assembly for holding circular and non-circular disks comprising:

a top plate:

a bottom plate;

two opposite side plates extending between the top and bottom plates and relatively parallel to one another, the side plates having parallel grooves from a front edge of the side plates extending towards a rear edge of the side plates, the grooves opening towards an inside of the cassette assembly and adapted to slideably receive the disks;

one or more removable spacer posts connected inside the cassette assembly relatively perpendicular to the grooves.

9. The cassette assembly of claim 8 further comprising one or more stops in the grooves, near the rear edge of the side plates.

10. The cassette assembly of claim 9 wherein the stops in the grooves are nearer the rear edge of the side plates than the removable spacer posts are.

11. The cassette assembly of claim 8 wherein the grooves are chamfered.

12. The cassette assembly of claim 8 further comprising one or more locating pins for locating the top and/or bottom plate to the side plates.

13. A cassette assembly for holding circular and non-circular disks comprising:

a top wall;

a bottom wall;

a pair of spaced apart side walls connected by the top and bottom wall, the side walls having multiple grooves adapted to slideably receive the disks between the side walls, the grooves extending from a front of the walls toward a rear of the walls;

one or more removable stops extending from the top wall to the bottom wall for stopping travel of the circular disks at a location within the grooves; and

one or more stops adjacent the grooves for stopping the non-circular disks in the same relative location within the groove when the removable stops are removed.

* * * * *