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(71) Applicant : **PORTALS ENGINEERING LIMITED**
Laverstoke Mill
Whitchurch Hants. RG28 7NR (GB)

(72) Inventor : **Guthrie, Duncan Richard**
72, Beechwood Avenue, Melborn
Nr. Royston, Hertfordshire SG8 6BW (GB)

(74) Representative : **Bayliss, Geoffrey Cyril et al**
BOULT, WADE & TENNANT 27 Furnival Street
London EC4A 1PQ (GB)

(54) **Improvements in or relating to article wrapping apparatus.**

(57) The disclosure relates to an article wrapping apparatus including a perimeter frame (19) to support a sheet of film (18) or wrapping material in engagement with a face of the frame, the frame defining an opening (21) through which the article to be wrapped may pass to engage the sheet or film around the article, the frame having means to hold the sheet to said face of the frame comprising vacuum port means (24, 25) extending around the frame to hold, by suction, the sheet or film against the face of the frame for the article wrapping operation.

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FIG. 3.

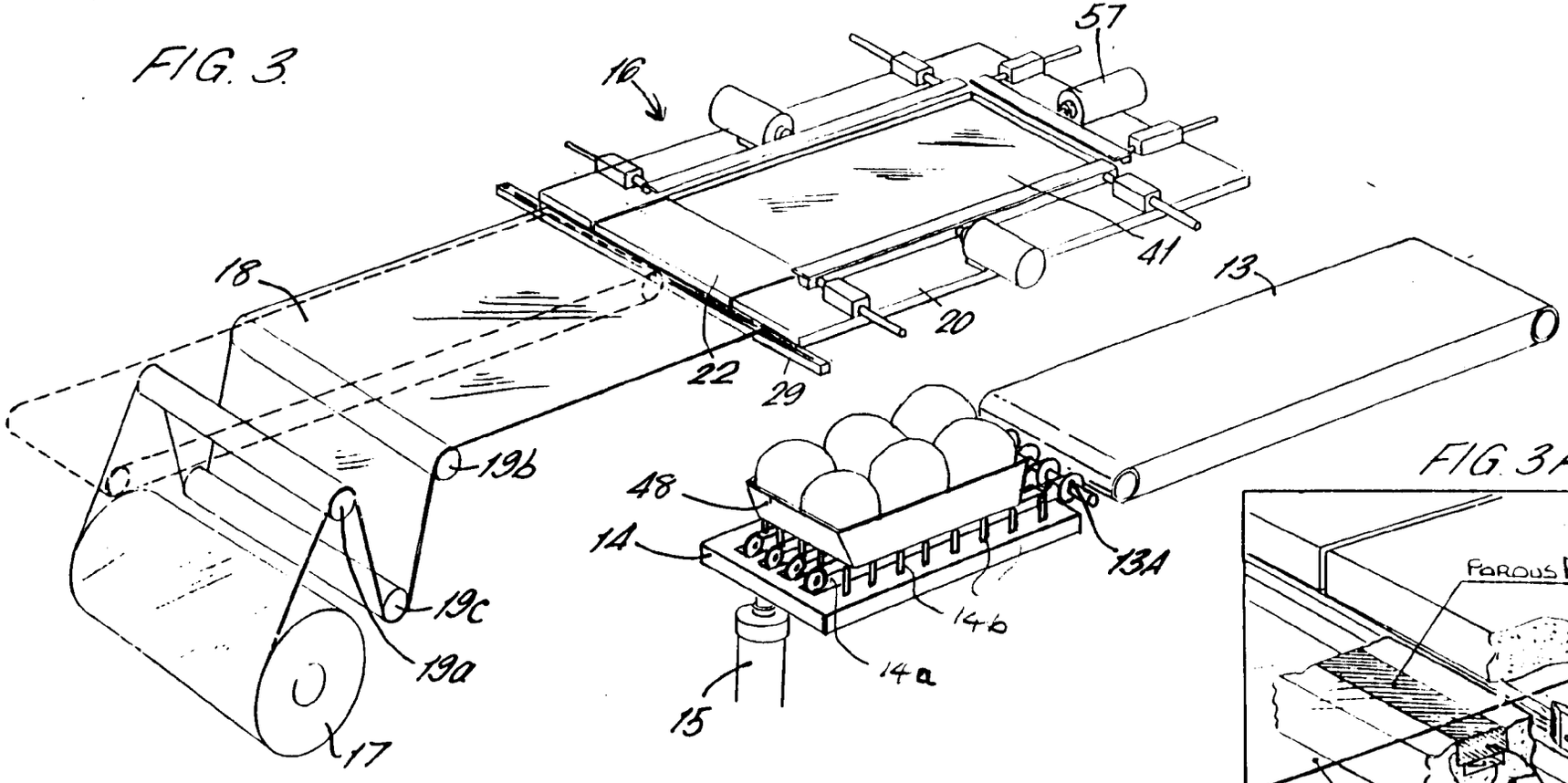
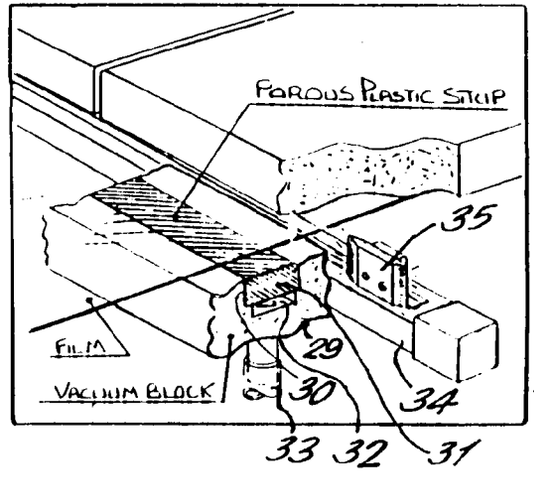

57
16
41
18
20
13
22
29
19b
48
14
13A
14b
19c
19a
14a
15
17

FIG. 3A.


POROUS PLASTIC STRIP
35
FILM
29
VACUUM BLOCK
30
34
33
32
31

This invention relates to article wrapping apparatus and is particularly although not exclusively applicable to "stretch" wrapping of articles which may include containers of loose articles such as shallow trays containing perishable food items and the like.

This invention provides an article wrapping apparatus including a perimeter frame to support a sheet of film or wrapping material in engagement with a face of the frame, the frame defining an opening through which the article to be wrapped may pass to engage the sheet or film around the article, the frame having means to hold the sheet to said face of the frame comprising vacuum port means extending around the frame to hold, by suction, the sheet or film against the face of the frame for the article wrapping operation.

Preferably means are provided for regulating the vacuum drawn at the port means on the frame to vary the tension induced in the sheet or film to suit the article to be wrapped.

In one arrangement according to the invention the frame may have an encircling vacuum chamber and said face of the frame may include a porous element in communication with the vacuum chamber to draw vacuum at the face of the frame for holding the sheet or film against the face by suction.

More specifically the porous element may comprise a porous strip mounted in said face of the frame in communication with the vacuum passage in the frame.

In any of the above arrangements a supply of sheet or film may be provided at a dispensing station, means may be provided for supplying articles to be wrapped to a wrapping station and means may be provided for moving the frame between the dispensing and wrapping stations to collect a length of film by adhesion to the suction part of the frame and then, in the wrapping station, to hold the film for wrapping around the article.

In one arrangement according to the invention the frame may comprise a generally U-shaped member facing towards the sheet or film dispensing station and means may be provided for reciprocating the frame between the sheet or film dispensing and the article wrapping stations, the sheet or film being adhered to the frame at the dispensing station and being drawn to the article wrapping position with the frame for a wrapping operation.

Further means may be provided for adjusting the travel of the U-shaped member of the frame according to the length of film required to be drawn from said supply.

In accordance with a further feature of the invention a separate floating member may be slidably mounted between the limbs of the U-shaped member to complete the perimeter frame the floating member being engageable with the base of the U-shaped member when the latter moves towards the sheet dispensing station and being restrained by a fixed stop when the U-shaped member moves towards the wrapping station so that the size of the aperture in the frame can be varied by varying the travel of the U-shaped member to the article wrapping station to suit the size of article to be wrapped.

The ports in the U shaped frame member and separate frame member may have separate valve controlled connections to the source of vacuum to enable the ports therein to be connected or disconnected to the vacuum source individually.

In addition a stationary ported block may be mounted between the film dispensing and article wrapping stations having an upwardly facing elongate port over which film is drawn by the frame and means are provided for connecting selectively vacuum and air pressure to the port to restrain or facilitate respectively film passing over the member.

In accordance with a further feature a cutter means may be provided between the film dispensing and article wrapping stations to sever a length of film drawn from said supply by the frame for an article wrapping operation.

In any of the above arrangements means may be provided for raising an article to be wrapped through said opening in the frame to be enclosed by said film held on the frame and means may be provided to tuck the film under the article to be adhered under the article.

In the latter arrangement means may be provided for conveying the wrapped article from the frame including heat sealing means to seal the film portions tucked under the article together.

The following is a description of some specific embodiments of the invention, reference being made to the accompanying drawings, in which:

Figure 1 is a diagrammatic view of a stretch wrapping machine in accordance with the invention;

Figure 1A is a section on the line 1A-1A on Figure 1;

Figure 1B is a similar view to Figure 1A showing a modified arrangement;

Figures 2 to 7 illustrate the essential components of the stretch wrapping machine at various stages in a stretch wrapping operation;

Figures 8 to 20 illustrate a further similar machine in greater detail;

Figure 21 shows part of a pneumatic circuit for the apparatus; and

Figure 22 shows a modified film cutter.

Referring firstly to Figure 1 of the drawings the stretch wrapping apparatus illustrated comprises a base frame 10 having uprights 11 on which a cabinet 12 is mounted. A feed conveyor 13 for delivering articles to be wrapped extends horizontally to a location below the wrapping station which is described below. The feed conveyor delivers articles one by one to a separate holding conveyor 13A at the end of the feed

conveyor. As illustrated in Figure 3, holding conveyor 13A may comprise a plurality of short horizontally spaced parallel endless bands which are driven by a power source (not shown) to align or centralise an article to be wrapped. Articles are raised from the holding conveyor to the wrapping station above by a lifting platform 14 which is raised and lowered by a vertically acting pneumatic ram 15 (see Figures 3 to 7). The lifting platform has elongate slots 14a corresponding to the bands of conveyor 13A so that the platform can be raised and lowered through conveyor 13A. The platform is raised from the bottom of its travel through the conveyor 13A collecting an article on the conveyor as it rises through it to lift the article into the wrapping station. When the article has been removed from the platform in the wrapping station, the platform returns to its lower position through the holding conveyor ready for the next article to be fed onto the holding conveyor.

The platform 14 is formed with rows of upstanding flexible fingers 14b which may be formed integrally with the platform from a plastics material such as polyurethane to support an article on the platform whilst permitting access under the article as described later.

Plastic sheet or film for wrapping articles of the wrapping station is supplied from a roll of film 17 mounted adjacent one end of the cabinet. Film 18 is drawn from the roll around two spaced guide rollers 19a and 19b which are mounted generally level with the wrapping station 16 and which have a dancer roller 19c disposed between them.

At the wrapping station there is a perimeter frame 19 under which film from the roll 17 is held to receive an article to be wrapped from the lift platform 14. The perimeter frame comprises a flat U-shaped plate 20 having a central opening 21 to receive the article raised by the platform 14. The frame is completed by a separate "floating" plate 22 extending between the limbs of the U-shaped plate.

The plate 20 has an underside 23 (see Figure 1A) formed with a channel 24 extending around the plate adjacent the opening 21 in which a porous strip 25 is mounted so as to be flush with the underside of the plate. The channel 24 communicates directly with the chamber 26 extending through the plate above the channel and the chamber 26 is connected by a coupling 27 mounted in one or more faces of the plate via a flexible hose and a variable control valve to a vacuum pump to create a partial vacuum in the chamber 26 and therefore a suction effect at the under surface of the porous strip 25 to adhere the sheet or film to the strip. The control valve provided is adjustable to enable the degree of suction to be adjusted to vary the tension in the film applied to an article to be wrapped as described below.

The U-shaped plate 20 is reciprocated by a linear actuator 20a (see Figures 8, 18 & 20) in the direction of the arrow "x" (see Figure 1) between the article wrapping station 16 and a film dispensing station 28 adjacent to the roller 19b. Between the film dispensing and article wrapping stations there is a stationary elongate film holding block 29 extending transverse to and directly below the path of travel of plate 20. The block is shown in detail in Figure 3A. The upper surface of the block is formed with a rectangular channel 30 extending lengthwise of the block and a porous strip 31 is mounted in the mouth of the channel. The channel below strip 31 is connected by a conduit 33 and control valve 100 (see Figure 21) selectively either to the aforesaid vacuum pump or to a source of air pressure to create suction or air flow at the surface of the strip 31 to adhere film extending over the strip or to facilitate movement of the film over the block as described later. A linear actuator 34 extends along the side of the block adjacent the wrapping station from which a "flying cutter" blade 35 projects upwardly to sever the sheet of film held by the plate 20 from the supply of film when the plate reaches the wrapping station.

The U-shaped plate 20 is completed by a "floating" plate 22 extending between the limbs of plate 20 and which has, like plate 20, a channel with a porous strip in the underside and an enclosed chamber above the strip. The chamber is connected by a conduit (not shown) and adjustable control valve with the chamber of plate 20 to the source of vacuum referred to earlier. The plate 22 is mounted for sliding movement on the frame of the apparatus between the limbs of the U-shaped plate 20. When the U-shaped plate moves towards the film dispensing station the plate 22 will eventually engage the base of the U-of plate 20 and plate 22 then moves with plate 20. A fixed stop limits movement of plate 22 in the return direction to a position just beyond block 29 from the film dispensing station.

Figure 1B shows a modified arrangement in which a film support plate 5 is positioned just below the perimeter frame 19 having an opening sufficiently large to allow the maximum container size through. The plate supports the free edges of the film to prevent them from dropping away from the vacuum chambers.

The cycle of operation of the wrapping machine and the remaining features of the machine will now be described with reference to Figures 2 to 7 of the accompanying drawings.

In the position shown in Figure 2, the U-shaped plate 20 has advanced to the film dispensing station 28 and film 40 drawn off the roll 17 has been adhered to the porous plastic strip where vacuum is drawn on the underside of the plate. At this stage the floating plate 22 is located towards the bottom of the U in the plate and air under pressure is being supplied to the block 29 to issue from the porous strip in the upper surface of the bar and thereby to facilitate the passage of the film over the block 29.

The U-shaped plate 20 is then returned to the article wrapping station 16 shown in Figure 3 drawing with it a fresh portion of film 41 for the next wrapping operation. As the plate 20 moves back to the article wrapping station, the floating plate 22 moves with it until it encounters the aforesaid stop which constrains the plate 22 just beyond block 29 from the film dispensing station. The extent of movement of plate 20 by its linear actuator is adjusted to provide a required aperture size between plate 20 and floating plate 22 to suit the size of article to be wrapped. The valve control for the conduit 33 connected to the block 29 is then changed over to disconnect the air pressure supply and apply vacuum to the bar and the valve control for floating plate 22 is also opened to apply vacuum at the upper surface of the block and underside of the plate 22 in addition to the vacuum already applied at the underside of the plate 20. The film 41 is then adhered to the block 29 and to the frame 20/22 so that the film is held firmly on all sides. The linear actuator operated flying blade cutter 35 is then triggered to sever the length of film held in the frame 19 from the film supply.

A container 48 with fruit or other articles to be wrapped is delivered to the lift platform 14 by the conveyor 13. An associated transfer conveyor 13A has an number of parallel powered bands which extend between the fingers of the lift platform (with the latter at the bottom of its travel) to centralise, under the guidance of control means (not shown) a container on the lift platform. The lift platform has elongate slots to register with the bands of the transfer conveyor so that as the platform is raised, the transfer bands pass through the slots. The platform lifts the container into the opening 21 in the plate 20 as shown in Figures 4 and 5 so that the film is stretched over the top of the article on the platform. Elongate edge folders 50 extend along the limbs of the upper side of the plate 20 being mounted for movement towards and away from the centre of the opening 21 in the plate on spindles 51 which are mounted in blocks 52 on the upper surface of the plate. Double acting pneumatic rams 53 are also mounted on the upper surface of the blocks connected to the respective edge folders 50 to move the edge folders towards and away from the centre of the opening. The base of the U-shaped plate 20 has a similar edge folder 54 mounted on spindles 55 supported in blocks 56 on the plate and again moved towards and away from the centre of the opening in the plate by means of a double acting pneumatic ram 57 (see Figure 4).

When the lift platform 14 has raised the container 48 to be wrapped through the opening 21 in the plate (see Figure 4), the rams 53 are energised to move the edge folders 50 inwardly under the container deflecting the fingers 14b supporting the container to draw the film 41 stretched over the container underneath the container as shown in Figure 5. Ram 57 is then energised to move edge folder 54 inwardly over the opening and underneath the container 48 to tuck the film at that end of the container underneath the container as shown in Figure 6.

Referring to Figure 7, a further edge folder 58 is mounted at a fixed location across the wrapping station above the U-shaped plate and is arranged so that as the plate moves back to the film dispensing station 28 to commence the next cycle of operation, the fixed edged folder 58 engages under the adjacent end of the container to draw the film under the container. A ramp 59 extends upwardly from the edge folder 58 to a further conveyor 60. As the plate continues to move towards the film dispensing station, the wrapped container is driven up the ramp on to the conveyor 60. The upper surface of the conveyor is heated to heat seal the film on the underside of the pack to seal the pack. Meanwhile the U-shaped plate continues to move forwardly to the film dispensing station to pick up a new length of film for the next wrapping operation and the conveyor 13 delivers the next container to the lift ready to be wrapped.

The front edges of tuckers 54 and 58 may be provided with small rollers to guide the film under the container and reduce drag as illustrated in Figure 19A.

The various pneumatic rams and valves referred to above are connected in a pneumatic circuit part of which is illustrated in Figure 21. The pneumatic circuit is operated by an associated control system which may include a programmed microprocessor for sequencing the various functions to operate automatically without the need for manual intervention to wrap a succession of articles or containers delivered by the conveyor to the apparatus and deliver the wrapped article.

To cater for different sized articles to be wrapped the "U-shaped" frame 20 is driven by a linear actuator 21a, capable of moving from a fixed reference point at the film pickup position 28 to any pre-set position indicated generally by label 16. The length of film drawn may vary between a minimum and a maximum determined by the machine dimensions and is adjusted within these limits to suit the article to be wrapped. The plate 22 moves generally under the influence of the base of the "U-shaped" frame 20 until a permanent stop is encountered relative to the fixed film holding block 29. The resultant action of 20 and 22 is to produce a smaller or larger aperture suitable for the article to be wrapped.

Figures 8 to 20 illustrate a further similar machine in somewhat greater detail and like parts have been given the same reference numerals.

In particular Figures 10 and 11 show the low pressure air supply to film tensioning tubes utilised in place of rollers 19a, 19b and 19c. These tubes are porous, so that as air bleeds from the surface of the tubes an "air bearing" is formed between tubes and film drawn over the tubes enabling the film to slide over the tubes with very little friction.

Figure 12 shows a modified form of the film holding plate 29. The major difference from the previous form of plate is the provision of a larger area of the porous material including both a central rectangle of porous material and an elongate strip extending along one edge of the plate.

Figures 13 and 14 show the arrangement of the lift platform 14. The polyurethane fingers 14b are able to collapse, as shown, when side folders 50 move towards each other. In a further construction metal fingers are pivotally mounted on the platform and are spring loaded upright but can be deflected laterally to allow wrapping of the article on the platform as described earlier.

Figures 15, 16 and 17 show a pack pusher 61 mounted on frame 20. Its function is to push the pack over tucker 58 as the frame 20 returns to the film pickup position 28.

The film grip area 62 is connected via a valve and the pipework shown to a source of vacuum operating at 20 inches of mercury.
This area is repeated on the other side of the frame 20. As previously described a porous material is used to support the film.

The operation of the film grip area is as follows:-

With the frame 20 in the film pickup position 28, the vacuum supplied to film holding block 29 is switched via a valve to a source of compressed air. Simultaneously the film grip areas 62 are connected to the source of vacuum thereby holding the film firmly to the underside of plate 20. This enables the movement of plate 20 to draw film, once the required film length has been drawn the film grip areas are again disconnected from the vacuum source.

Figures 18 to 20 show in more detail the operation of the final tucker 58. Note the wiper blade connected to the radius arms. This is returned by the springs shown acting on the radius arms.

Figure 22 shows another form of cutter 70 for the film to be used instead of the flying blade 35. The cutter is mounted on a carrier having a motor or actuator drive for transversing the cutter across the path of the film to sever the film as described earlier.

Claims

1. An article wrapping apparatus including a perimeter frame to support a sheet of film or wrapping material in engagement with a face of the frame, the frame defining an opening through which the article to be wrapped may pass to engage the sheet or film around the article, the frame having means to hold the sheet to said face of the frame comprising vacuum port means extending around the frame to hold, by suction, the sheet or film against the face of the frame for the article wrapping operation.

2. An article wrapping apparatus as claimed in Claim 1, wherein means are provided for regulating the vacuum drawn at the port means on the frame to vary the tension induced in the sheet or film to suit the article to be wrapped.

3. An article wrapping apparatus as claimed in Claim 1 or Claim 2, wherein the frame has an internal encircling vacuum chamber and said face of the frame includes a porous element in communication with the vacuum chamber to draw vacuum at the face of the frame for holding the sheet or film against the face by suction.

4. An article wrapping apparatus as claimed in Claim 3, wherein the porous element comprises a strip of porous material mounted in said face of the frame in communication with the vacuum passage in the frame.

5. An article wrapping apparatus as claimed in any of Claims 1 to 4, wherein a supply of sheet or film is provided at a dispensing station, means are provided for supplying articles to be wrapped to a wrapping station and means are provided for moving the frame between the dispensing and wrapping stations to collect a length of film by adhesion to the suction part of the frame and then, in the wrapping station, to hold the film for wrapping around the article.

6. An article wrapping apparatus as claimed in claim 5, wherein the frame comprises a generally U-shaped member facing towards the sheet or film dispensing station and means are provided for reciprocating the frame between the sheet or film dispensing and the article wrapping stations, the sheet or film being adhered to the frame at the dispensing station and being drawn to the article wrapping position with the frame for a wrapping operation.

7. An article wrapping apparatus as claimed in Claim 6, wherein means are provided for adjusting the travel of the U-shaped member of the frame from the sheet dispensing station to the film wrapping station according to the length of film required to be drawn from said supply.

8. An article wrapping apparatus as claimed in Claim 7, wherein a separate floating member is slidably mounted between the limbs of the U-shaped member to complete the perimeter frame the floating member being engageable with the base of the U-shaped member when the latter moves towards the sheet dispensing station and being restrained by a fixed stop when the U-shaped member moves towards the wrapping station so

that the size of the aperture in the frame can be varied by varying the travel of the U-shaped member to the article wrapping station to suit the size of article to be wrapped.

9. An article wrapping apparatus as claimed in Claim 8, wherein the ports in the U shaped and floating frame members have separate valve controlled connections to the source of vacuum to enable the ports therein to be connected or disconnected to the vacuum source individually.

10. An article wrapping apparatus as claimed in any of Claims 4 to 9, wherein a stationary ported block is mounted between the film dispensing and article wrapping stations having an upwardly facing elongate port over which film is drawn by the frame and means are provided for connecting selectively vacuum and air pressure to the port to restrain or facilitate film passing over the member.

11. An article wrapping apparatus as claimed in any of Claims 4 to 10, wherein cutter means are provided between the film collection and article wrapping station to sever length of film drawn from said supply by the frame from the supply for an article wrapping operation.

12. An article wrapping apparatus as claimed in any of the preceding claims, wherein means are provided for lifting an article to be wrapped through said opening in the frame to be enclosed by said film held on the frame and means are provided on the frame to tuck the film under the article to be adhered under the article.

13. An article wrapping apparatus as claimed in any of the preceding claims, wherein means are provided for conveying the wrapped article from the frame including heat sealing means to seal the film portions tucked under the article together.

14. An article wrapping apparatus as claimed in Claim 12, wherein conveyor means are provided for delivering articles to be wrapped to said article lift means.

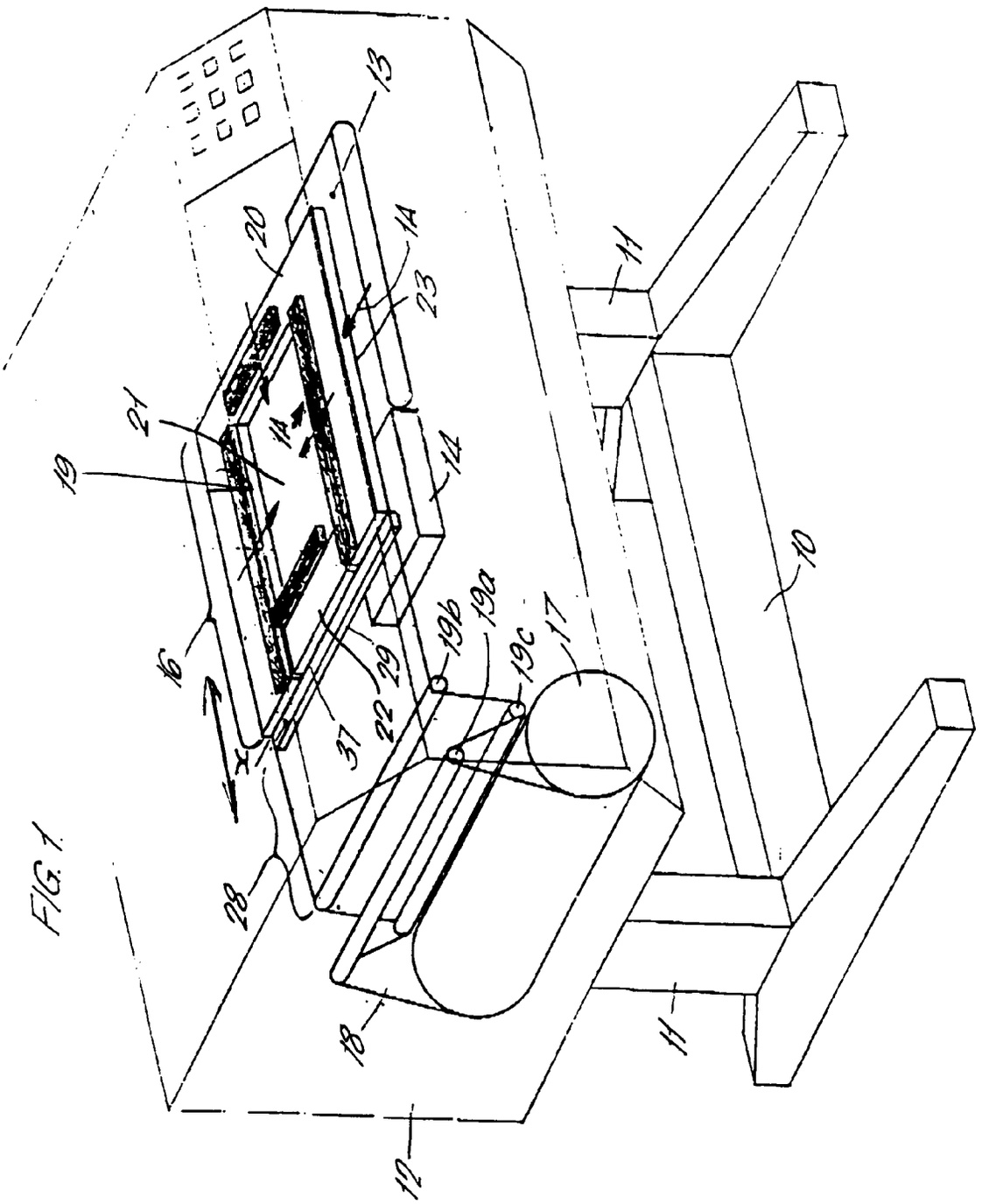
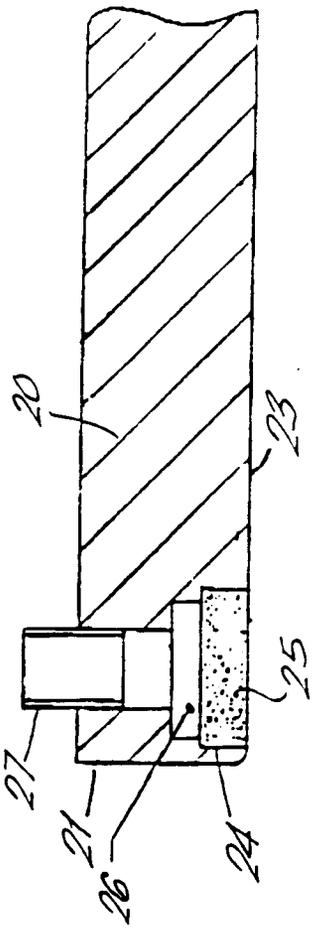


FIG. 1.

FIG. 1A.



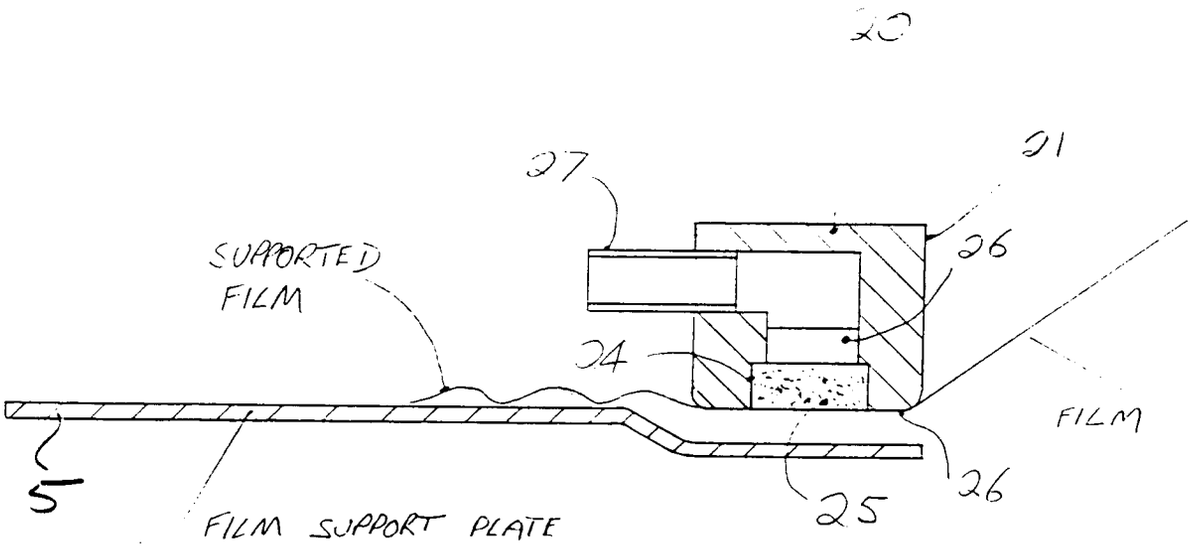


FIG 1B

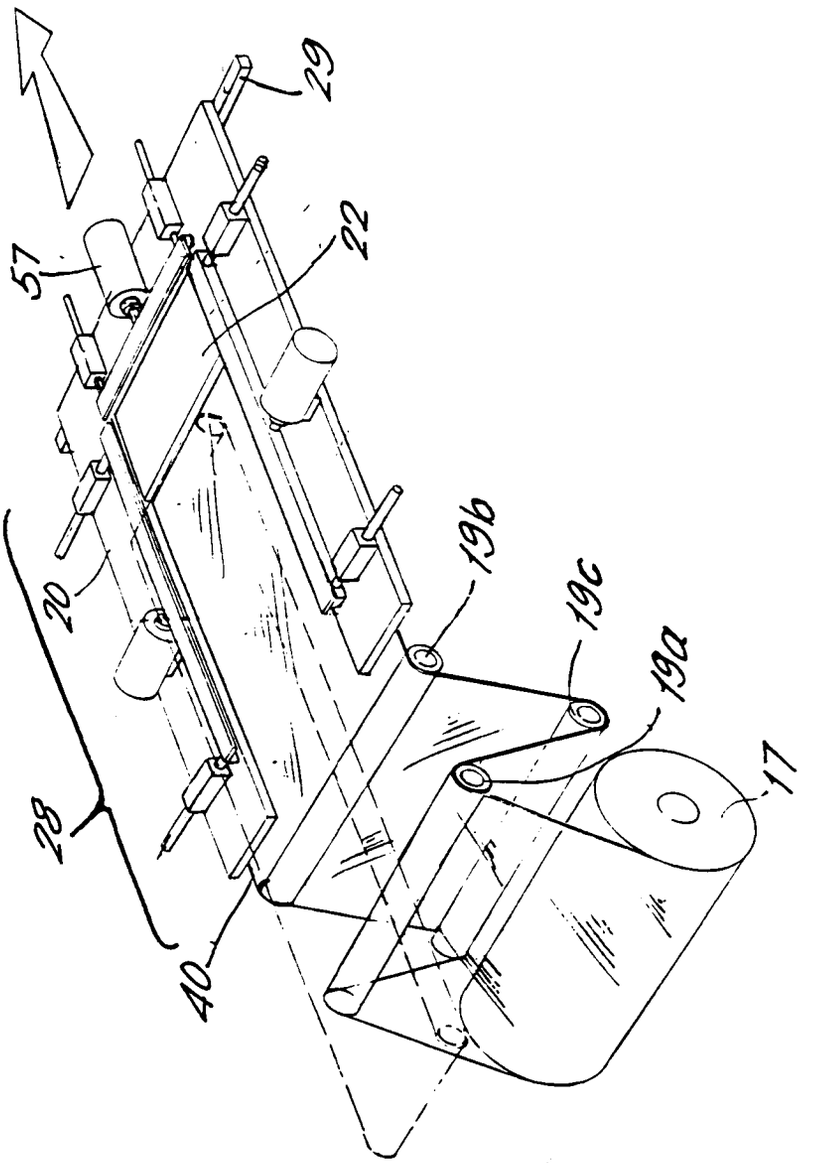


FIG. 2.

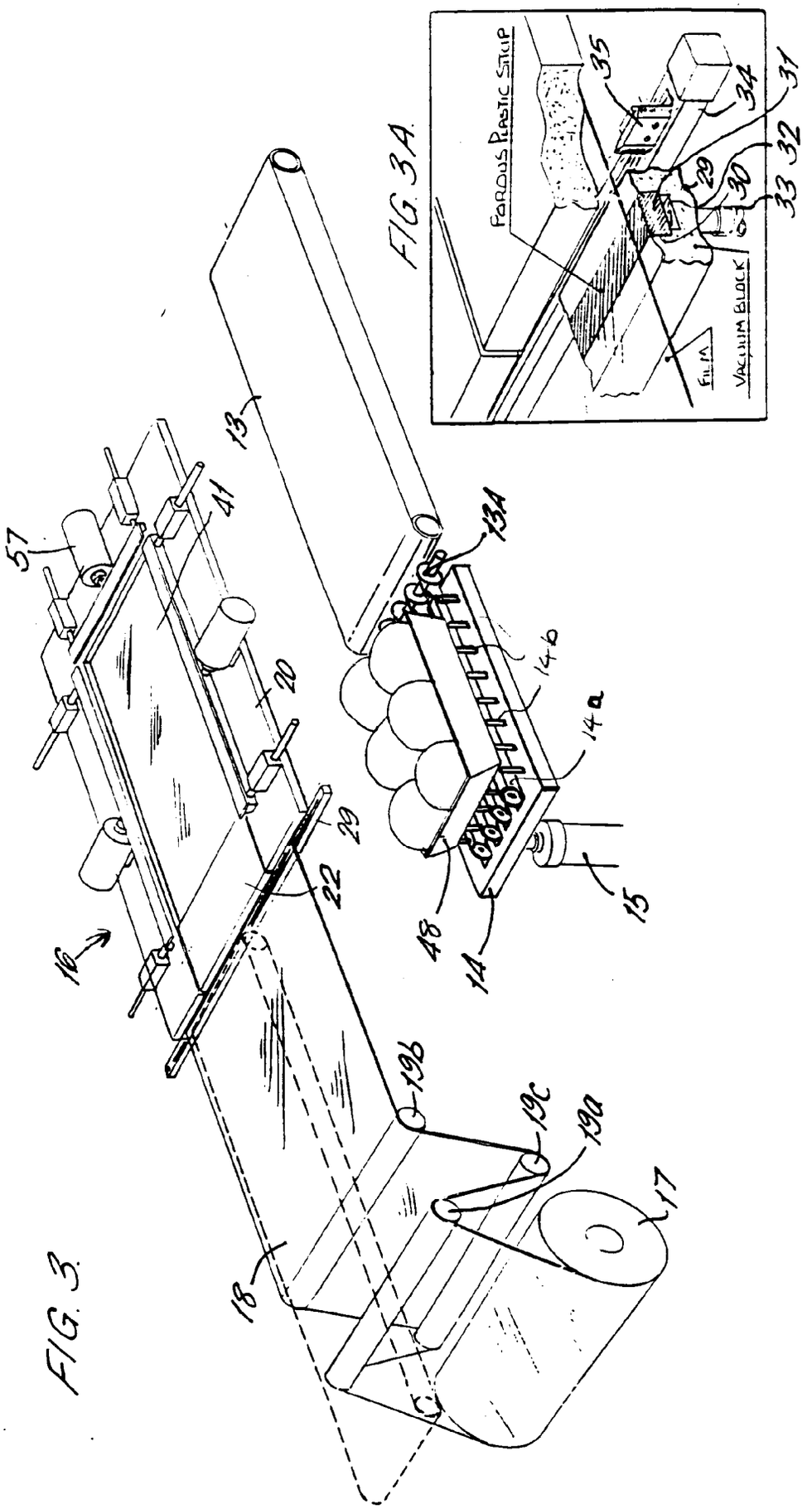


FIG. 3
FIG. 3A
POROUS PLASTIC STRIP
VACUUM BLOCK
FILM
57
11
13
13A
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22
29
16
14
14a
14b
15
18
19a
19b
19c
17
48
29
30
31
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33
34
35

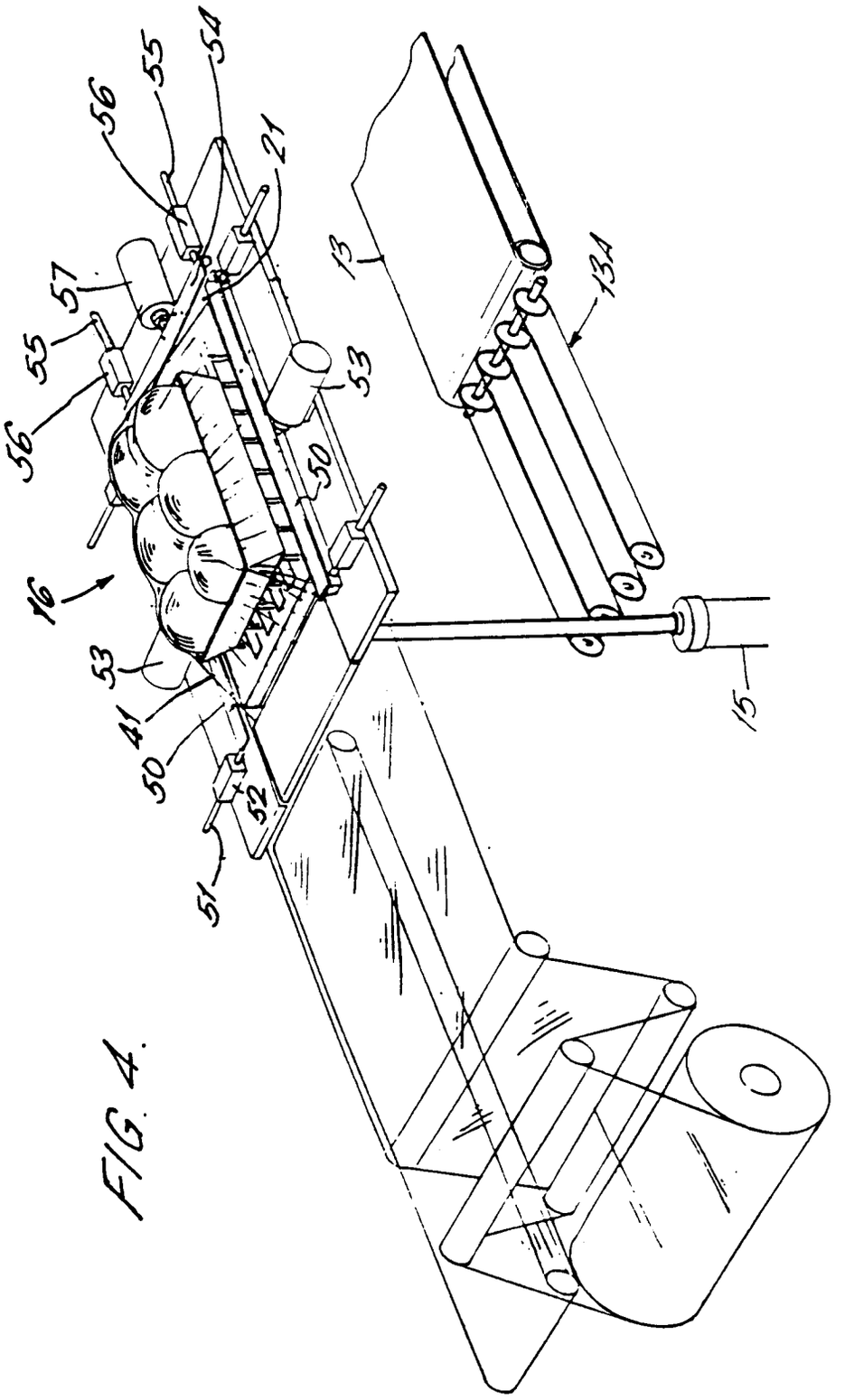


FIG. 4.

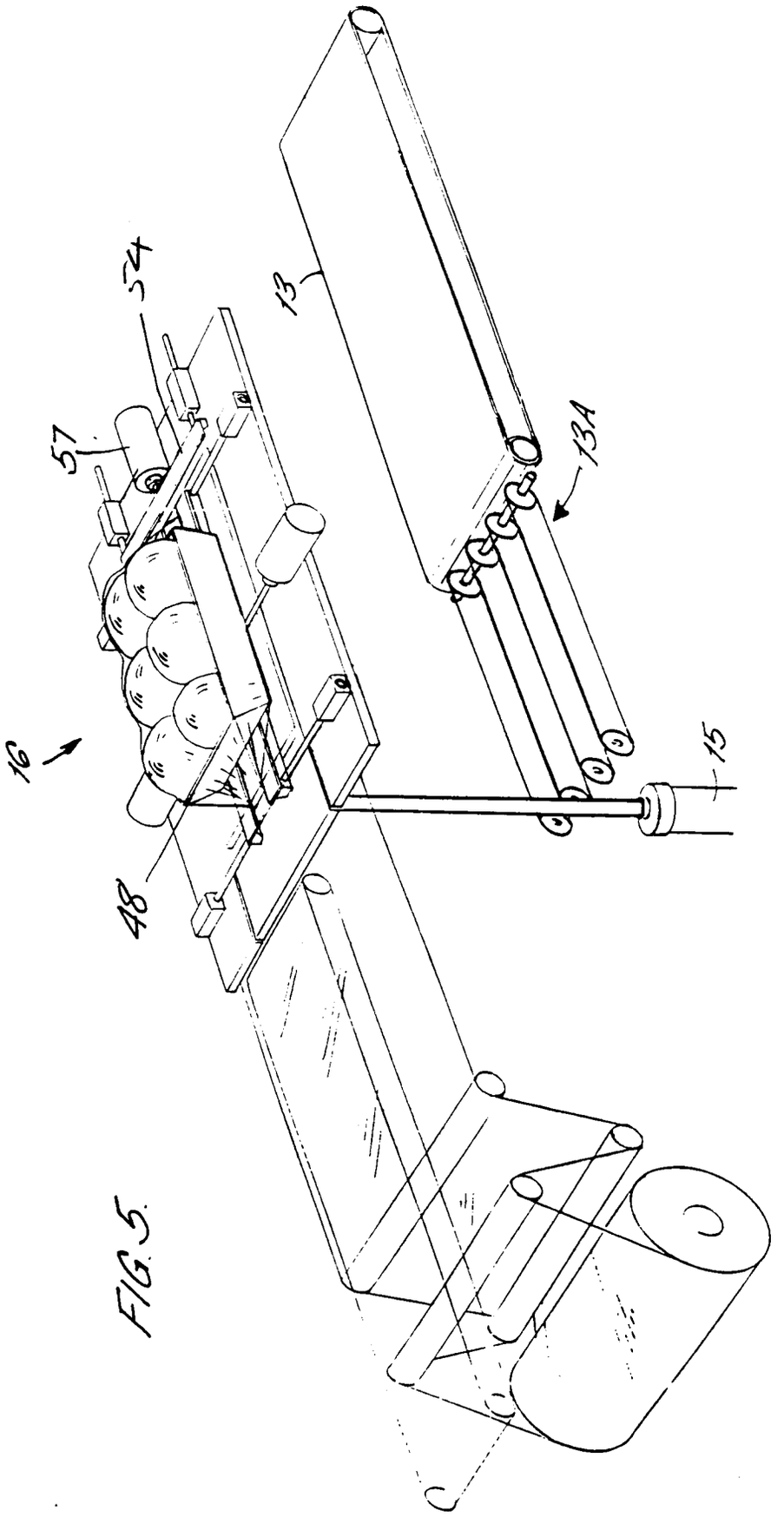


FIG. 5.

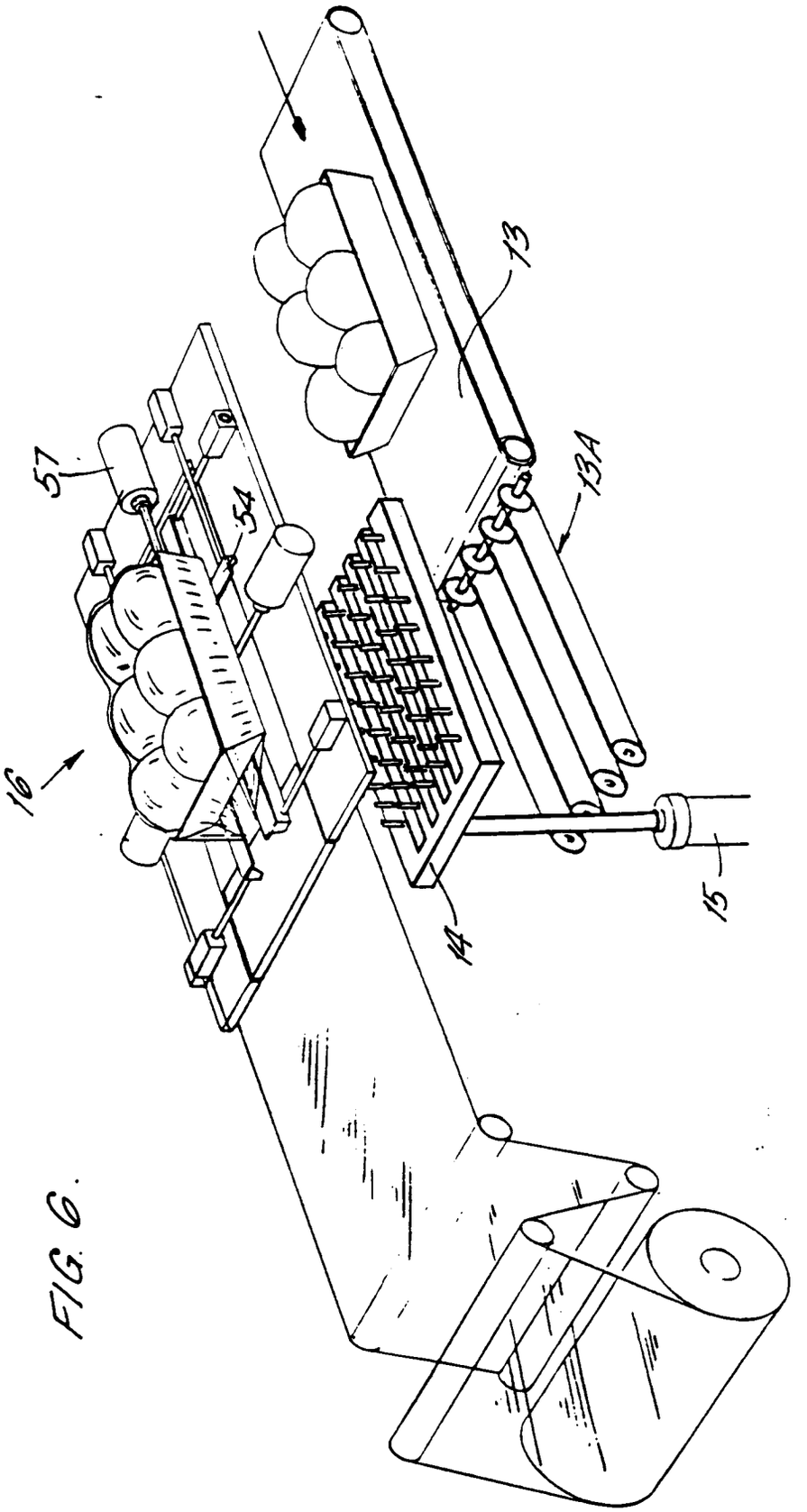


FIG. 6.

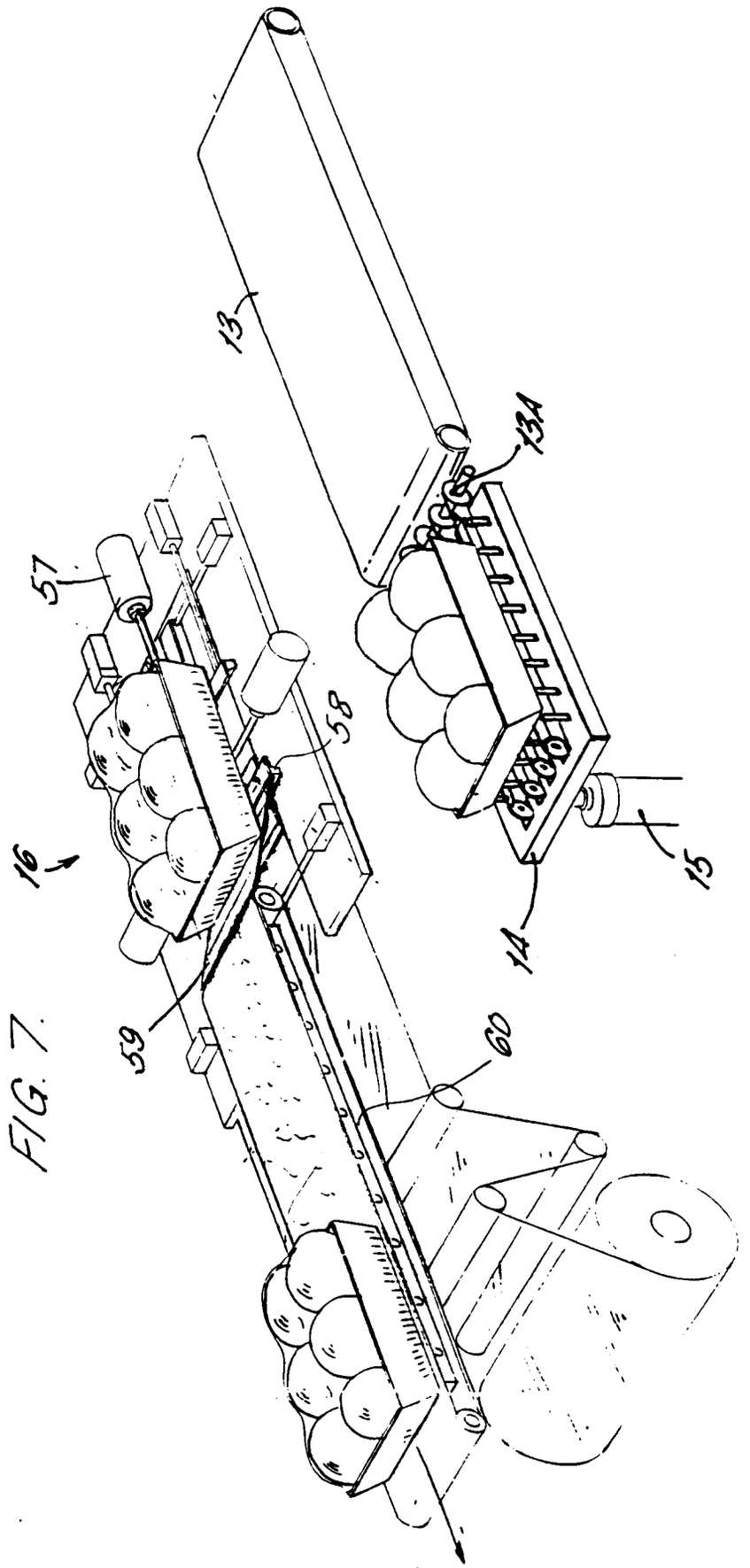


FIG. 7.

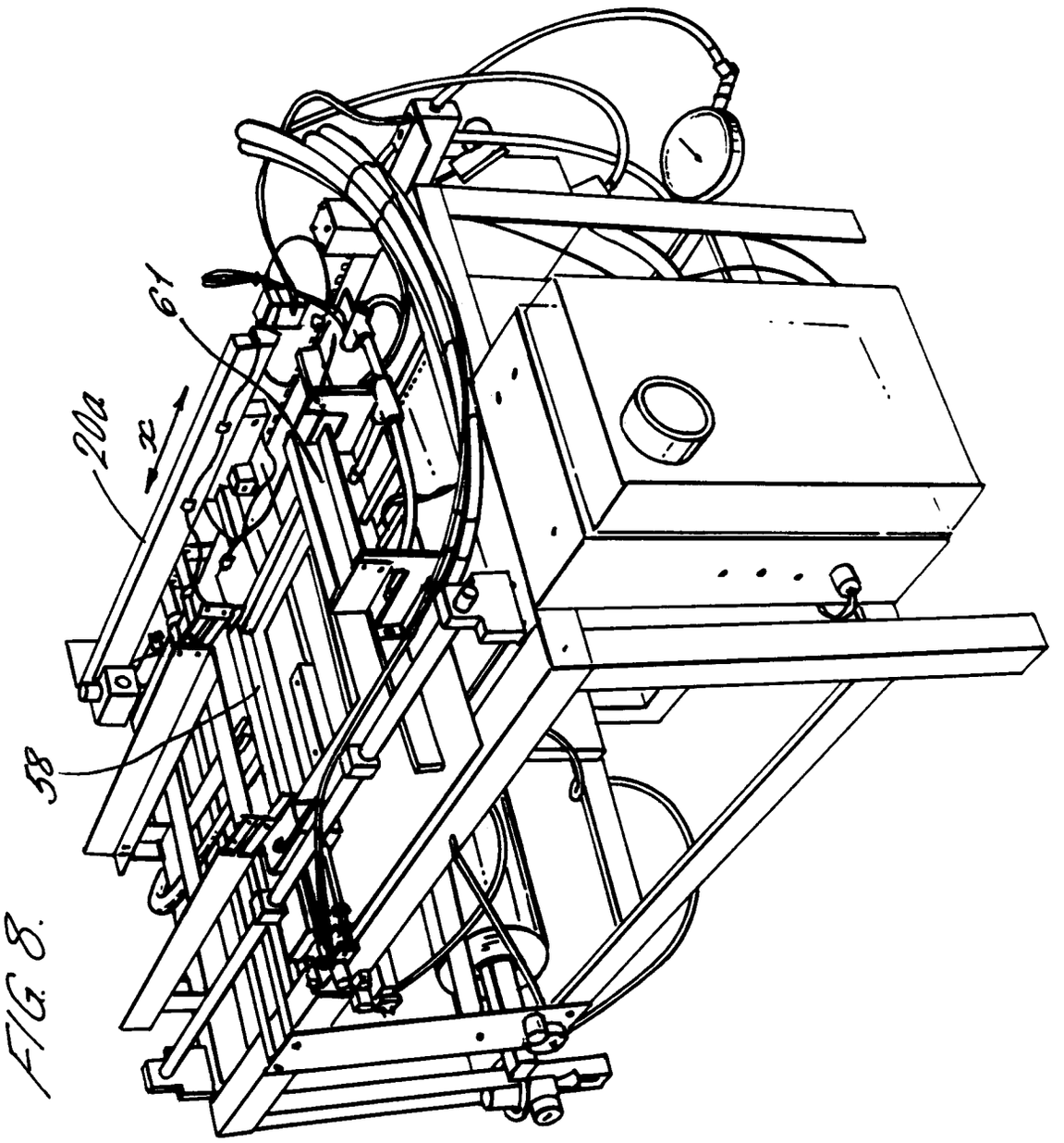
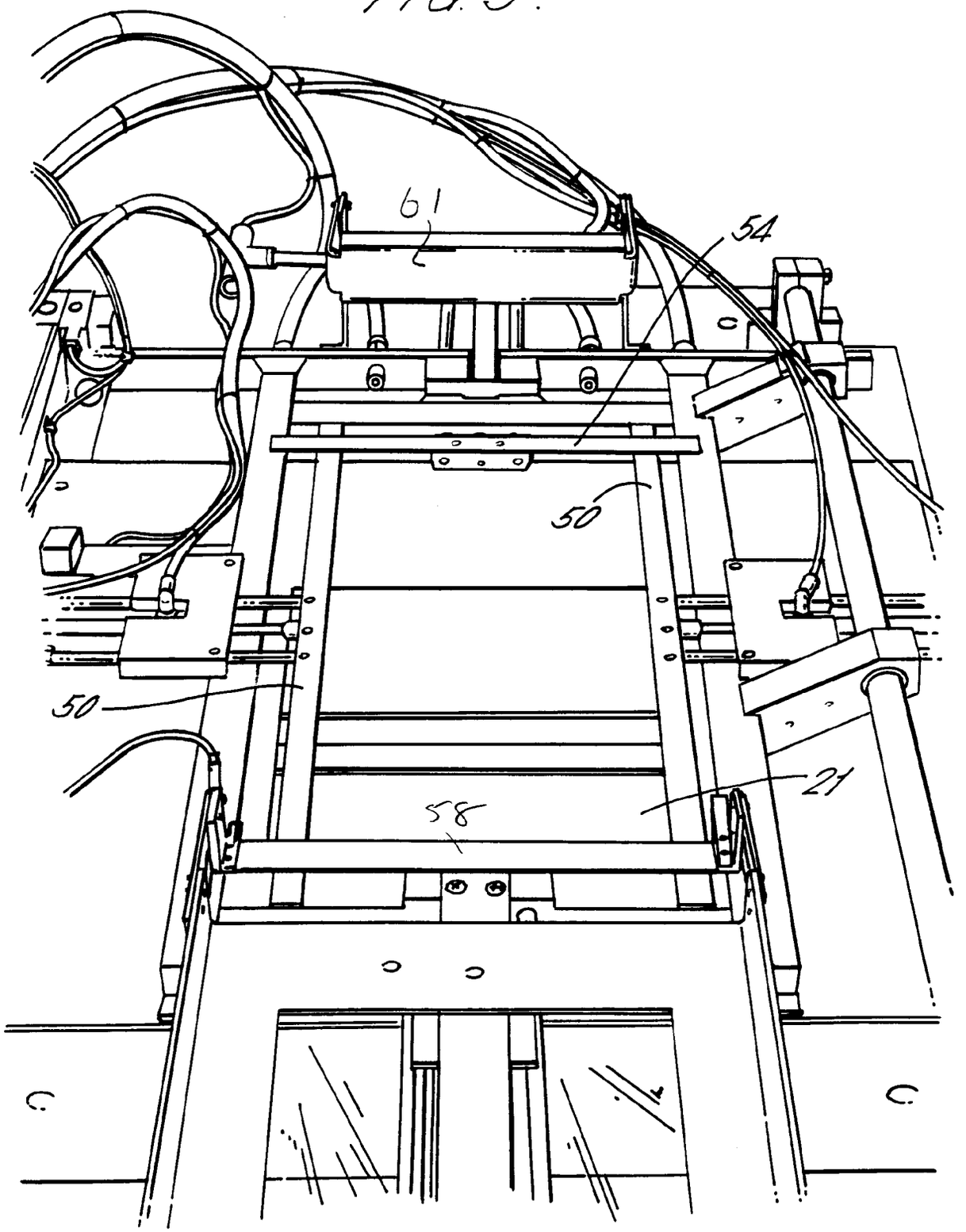


FIG. 8.

FIG. 9.



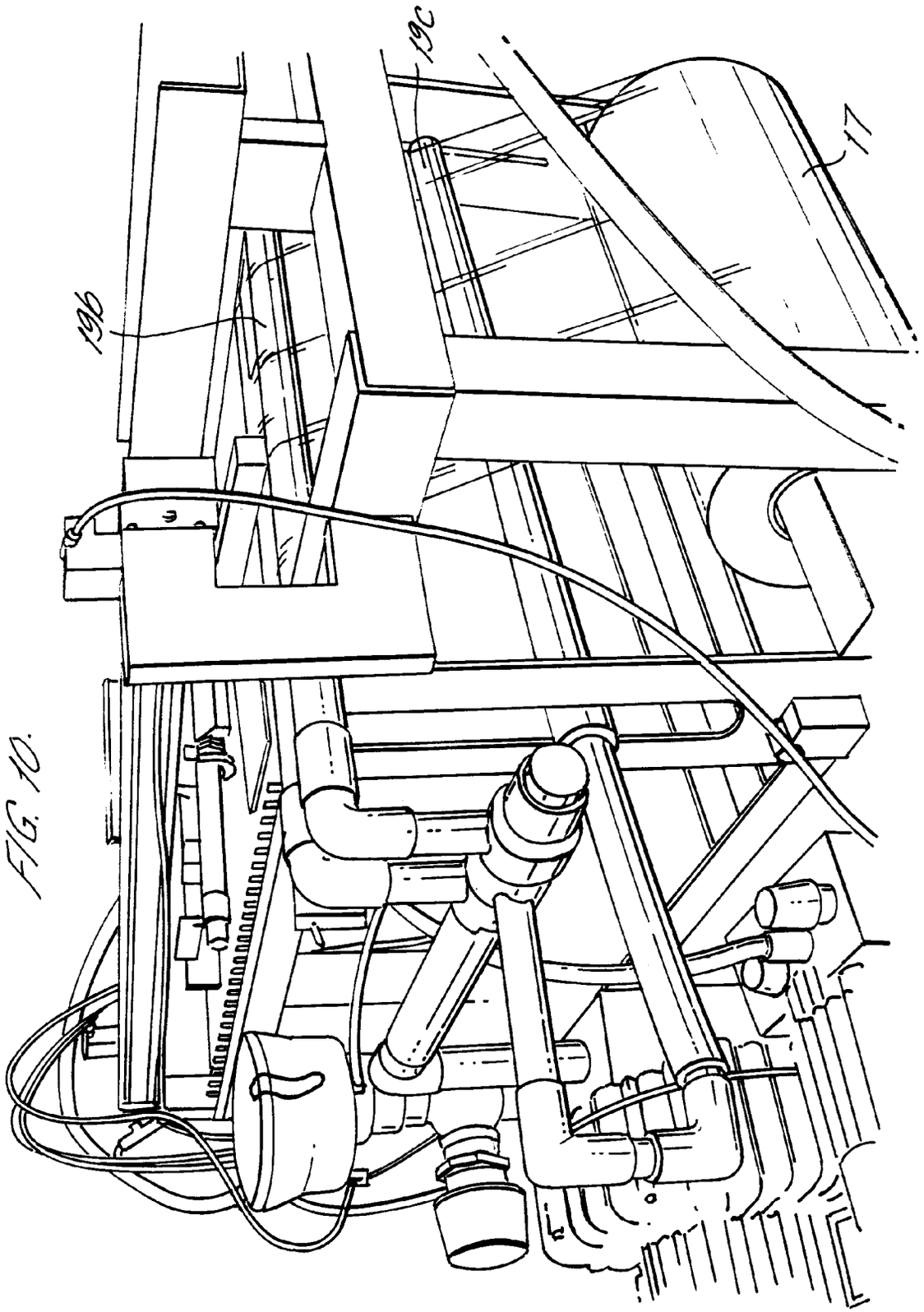
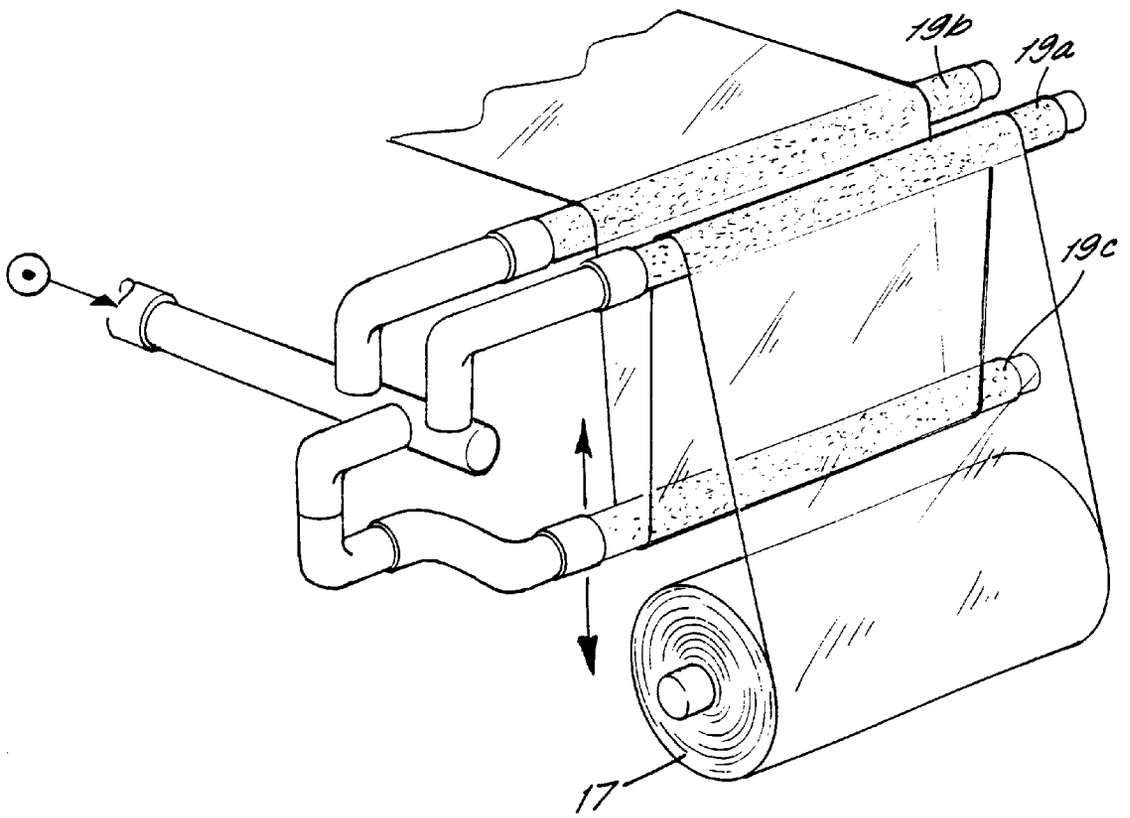


FIG. 10.

FIG. 11.



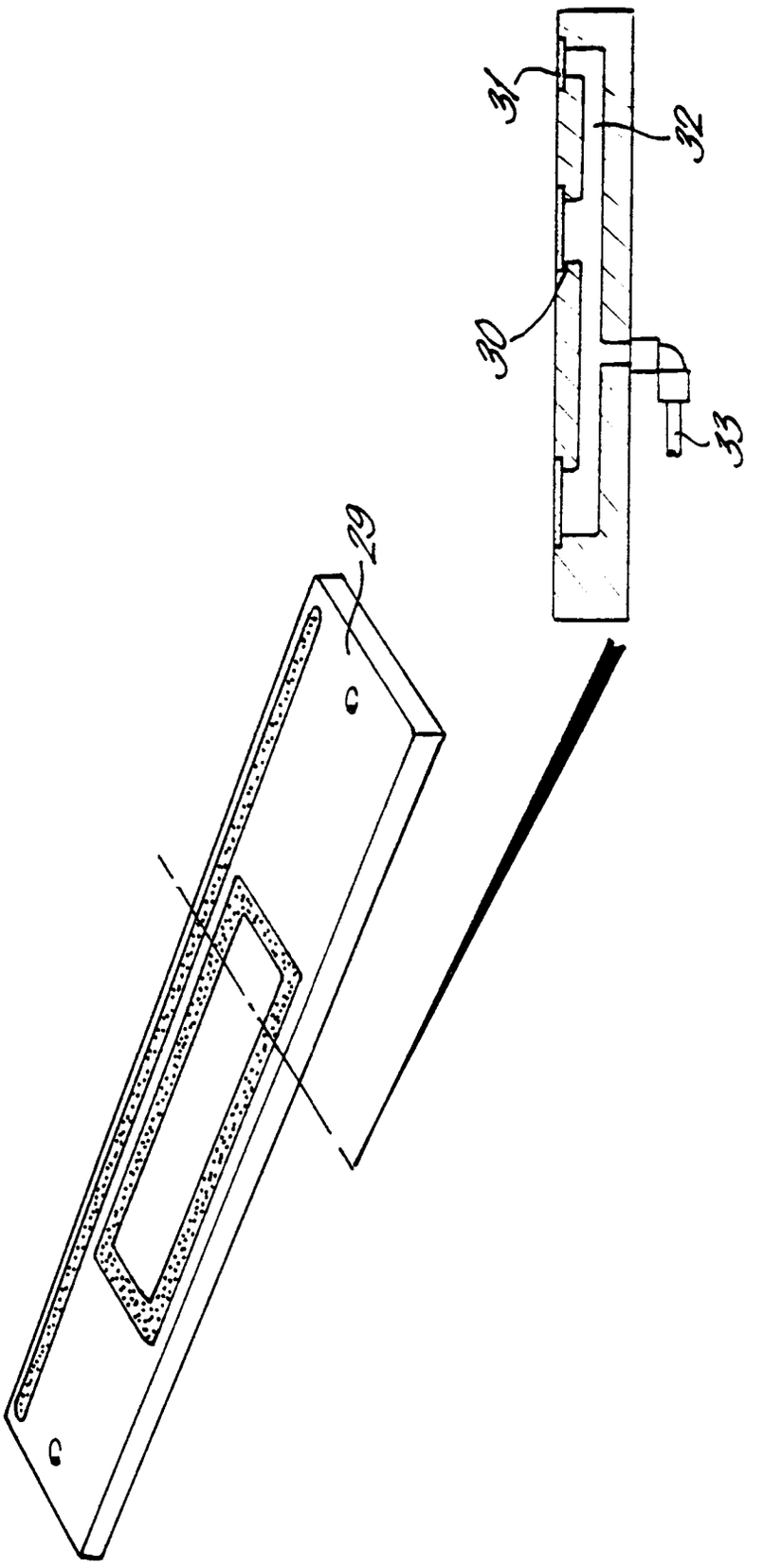
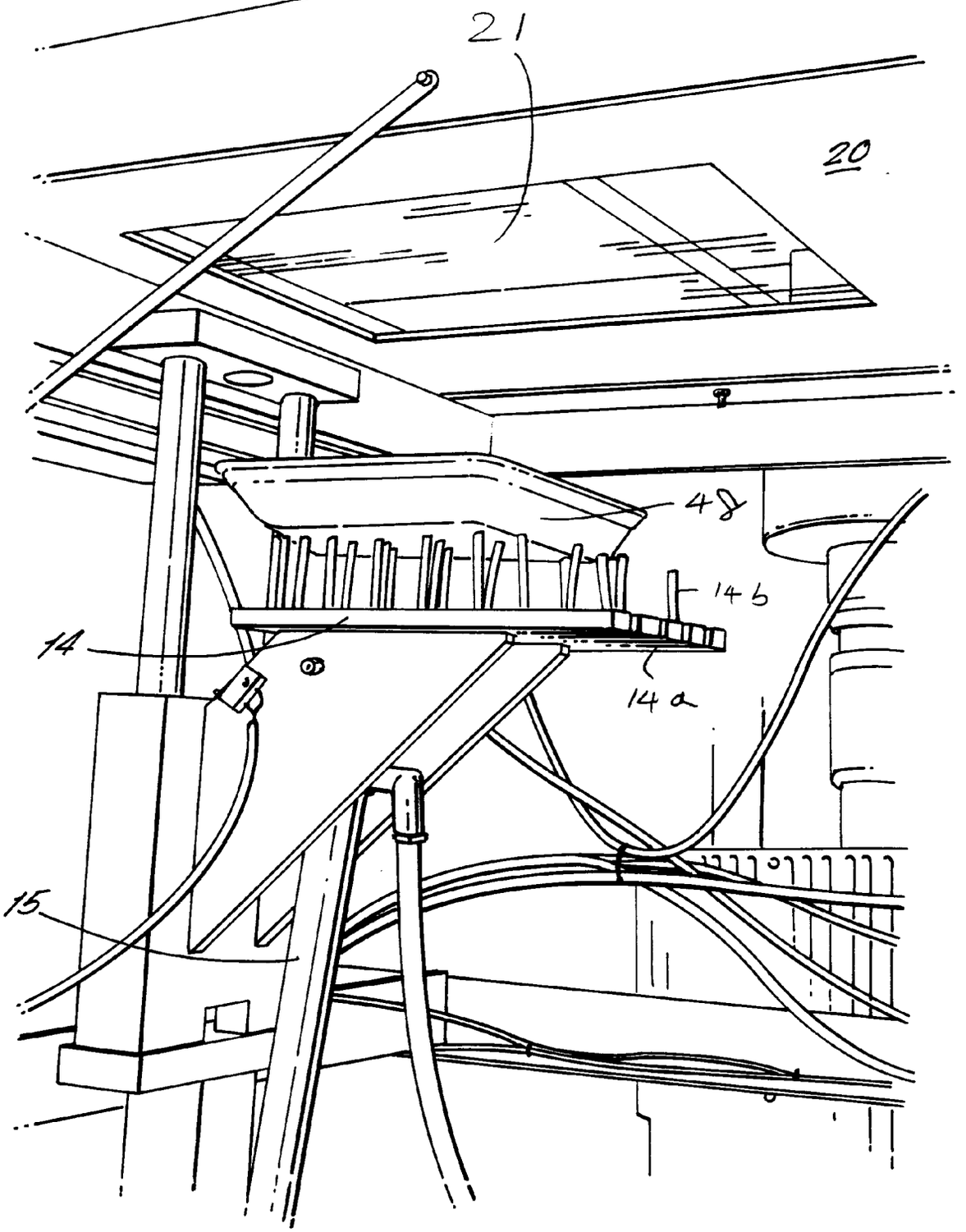


FIG. 12.

FIG. 13



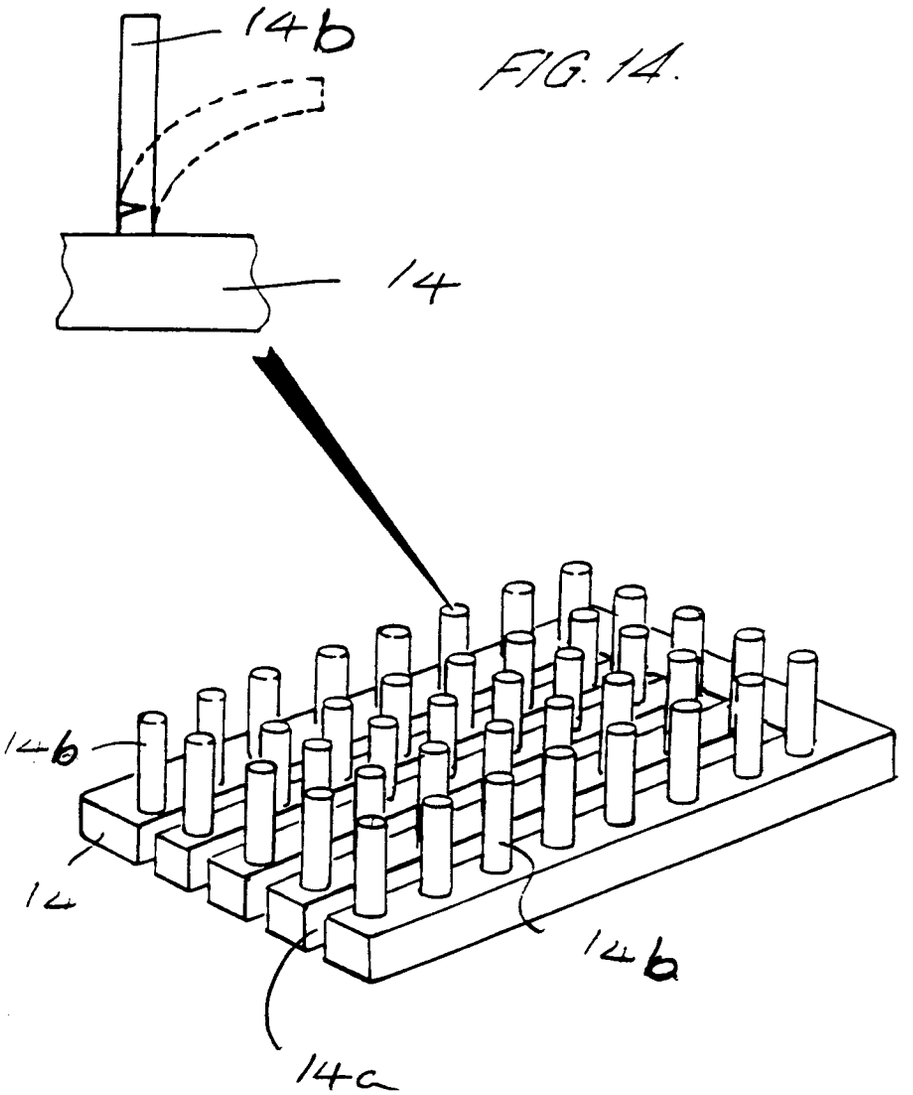


FIG. 14.

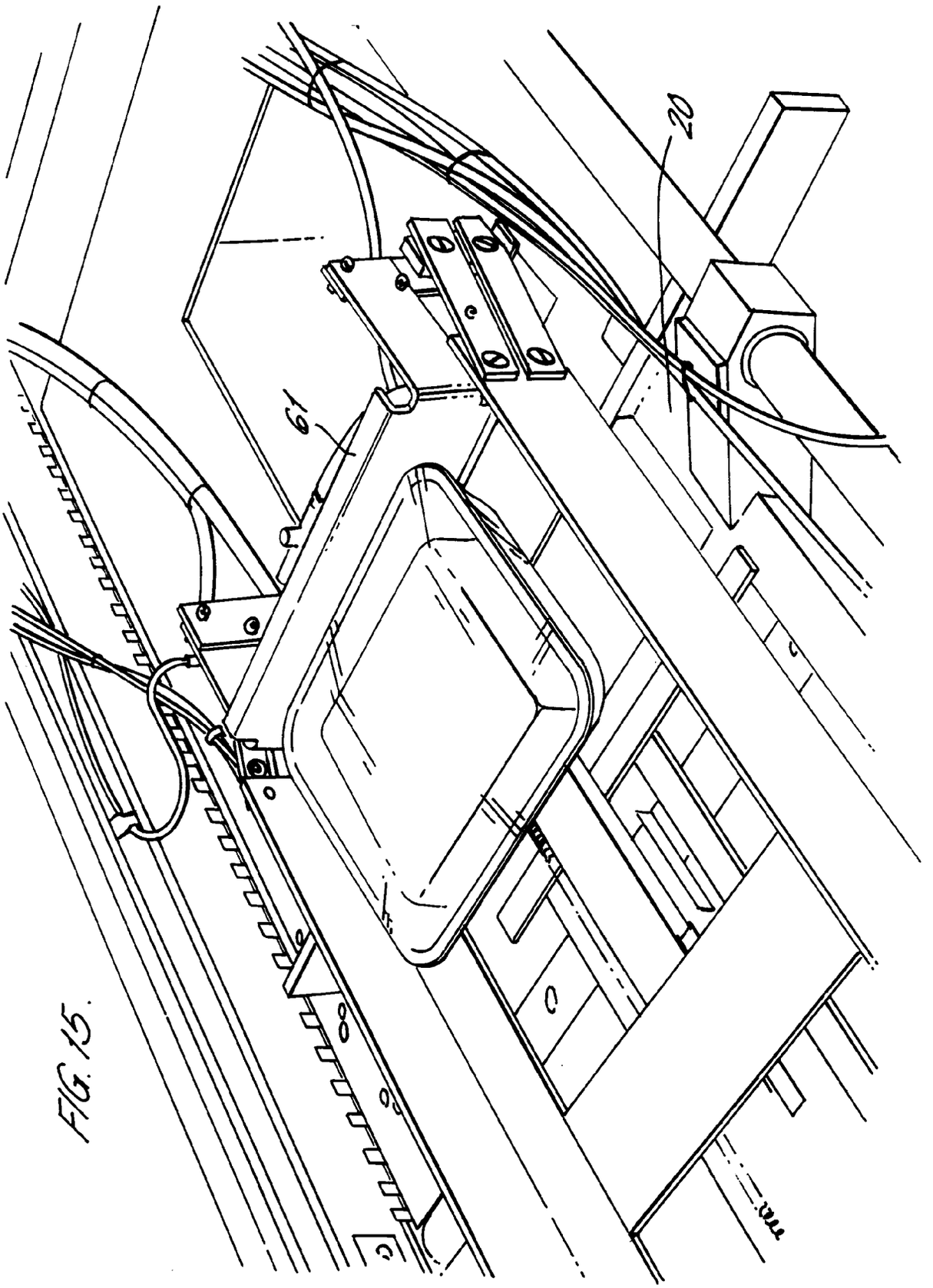


FIG. 15.

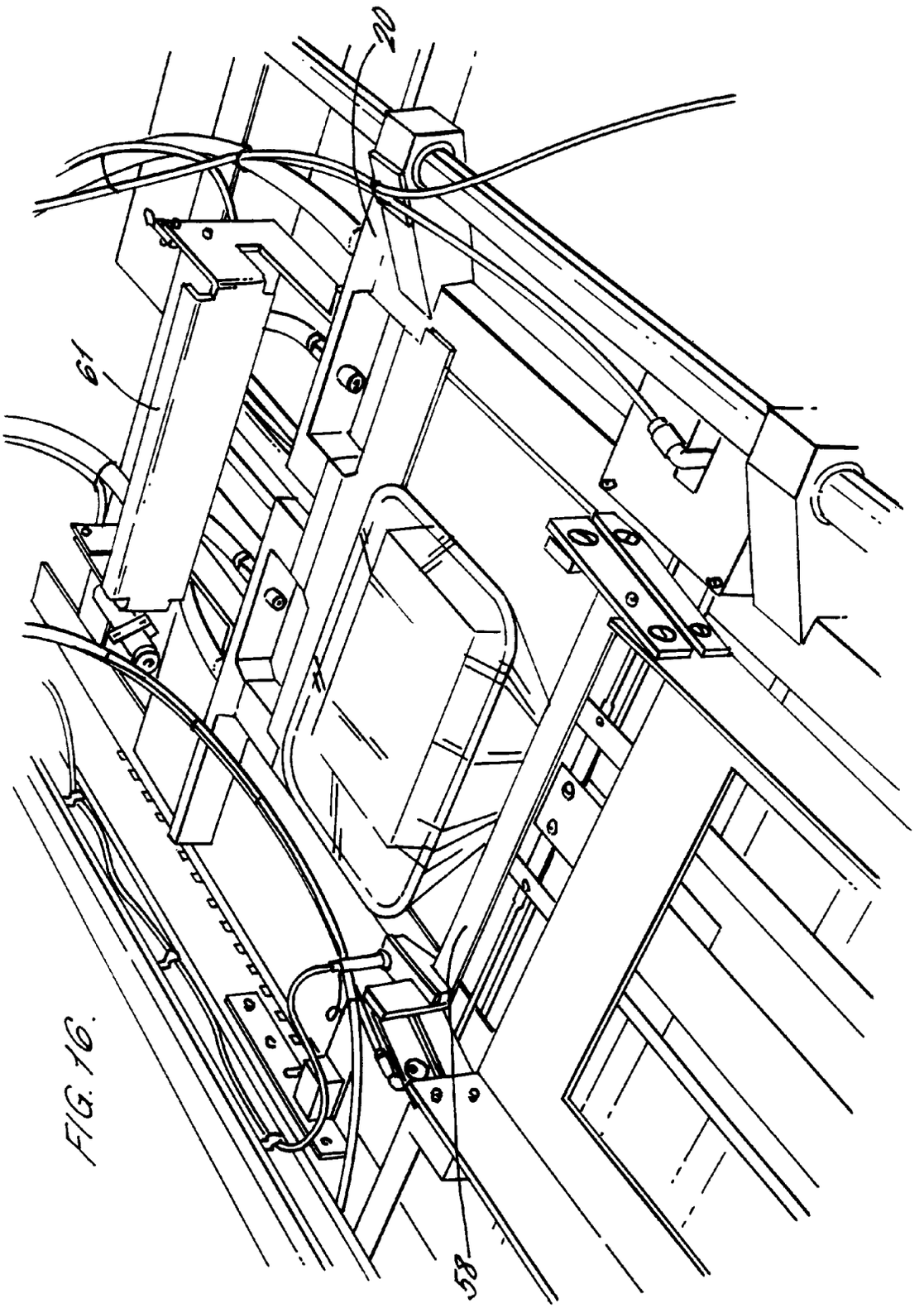
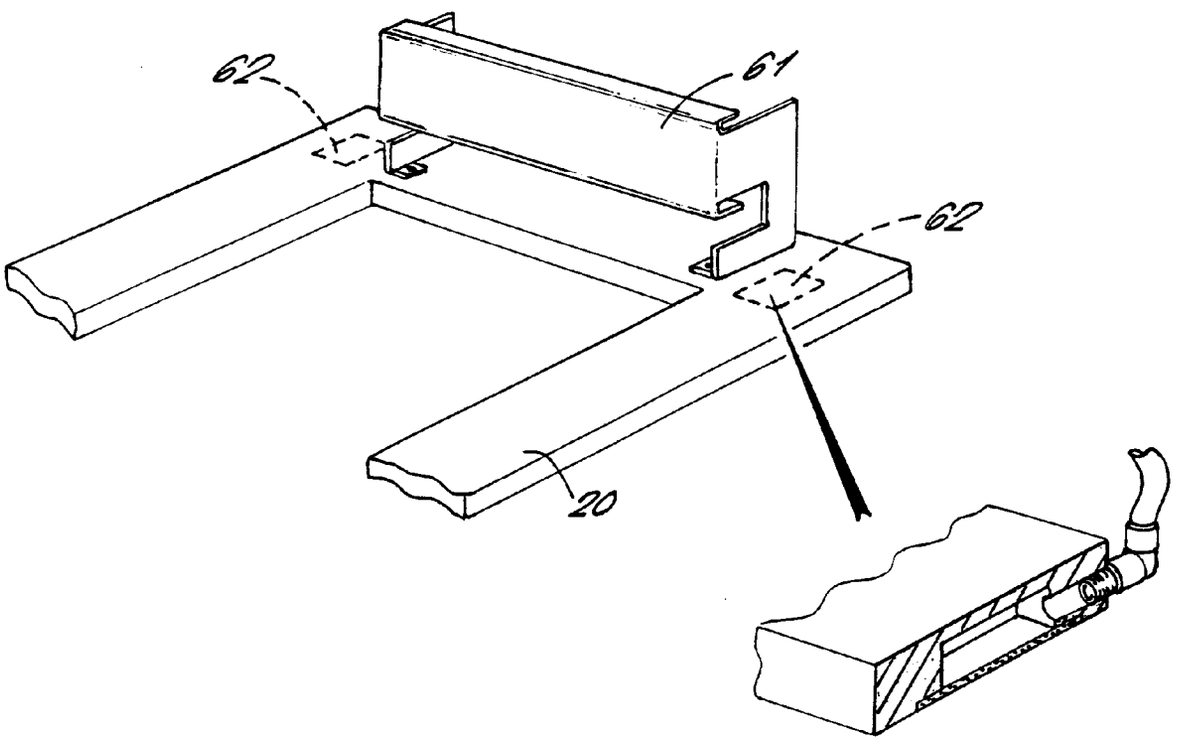


FIG. 16.

FIG. 17.



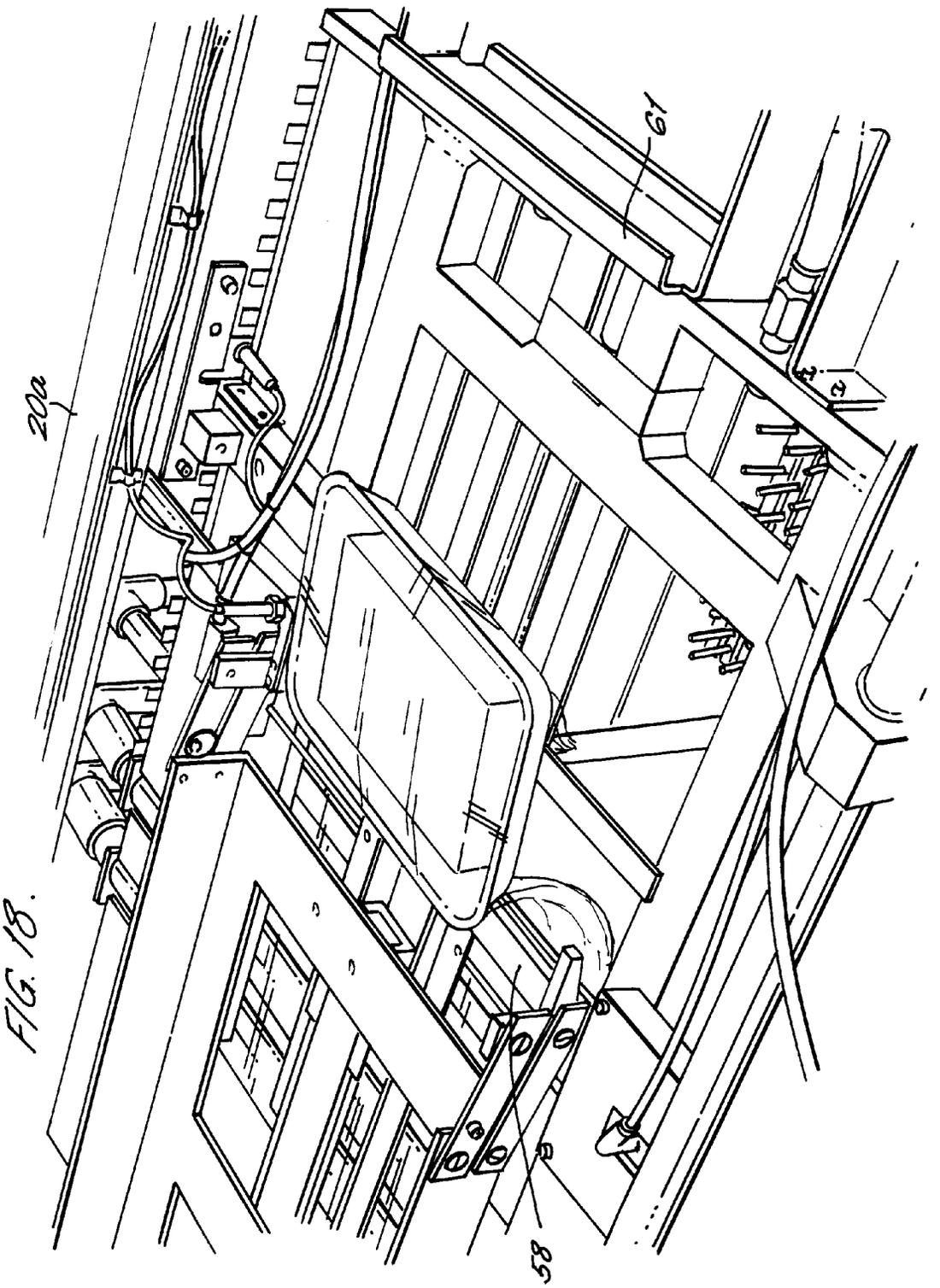


FIG. 18.

FIG. 19.

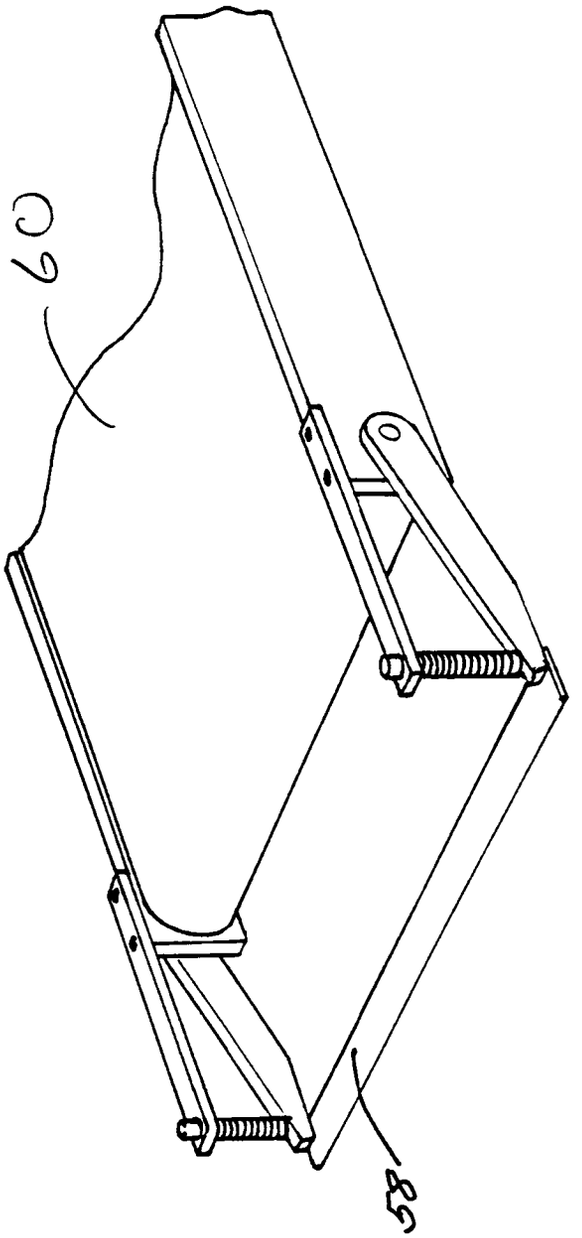
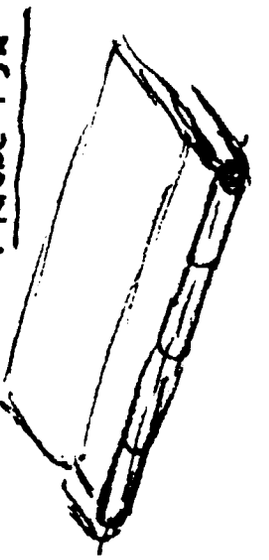


Figure 19a



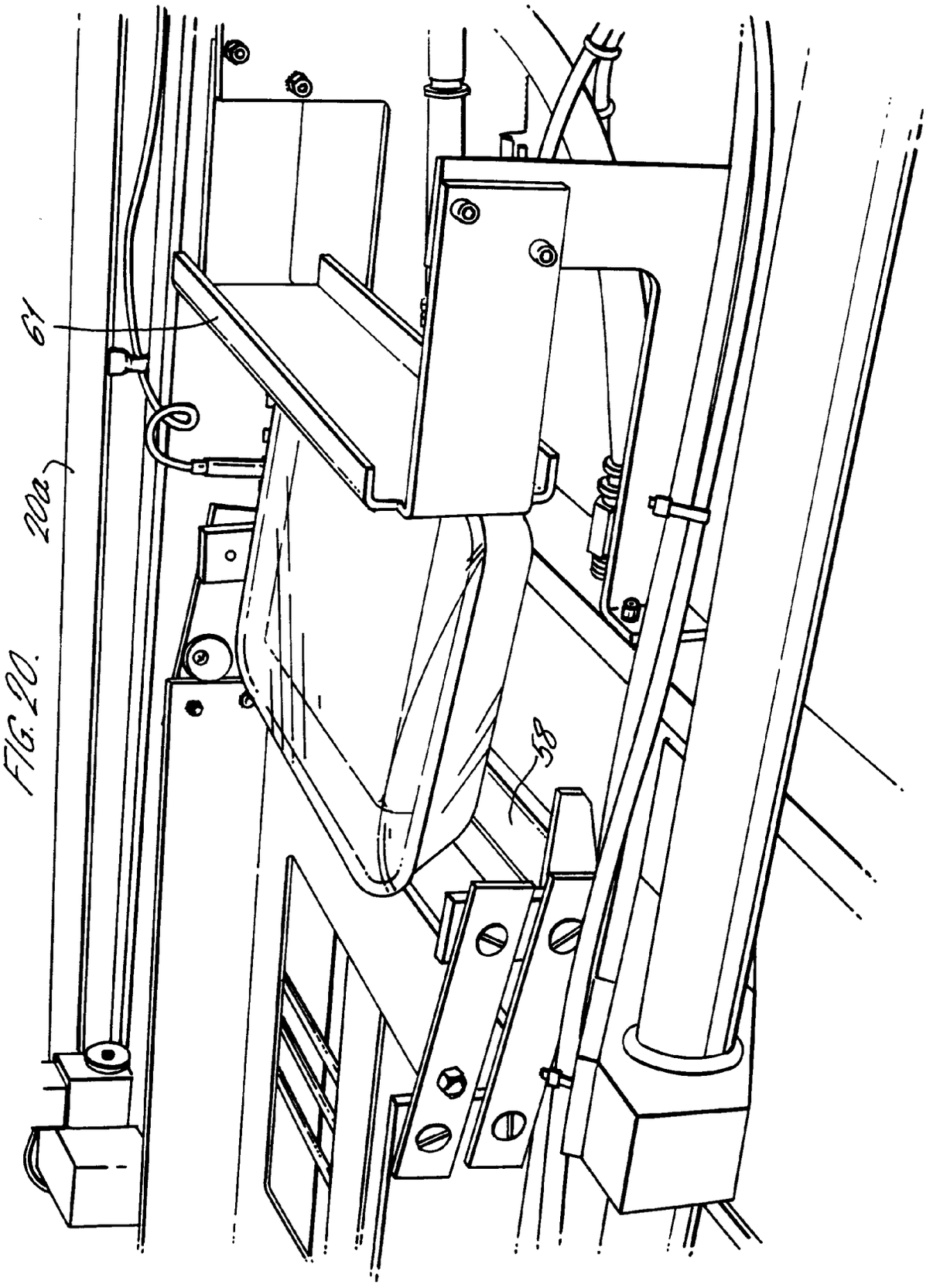
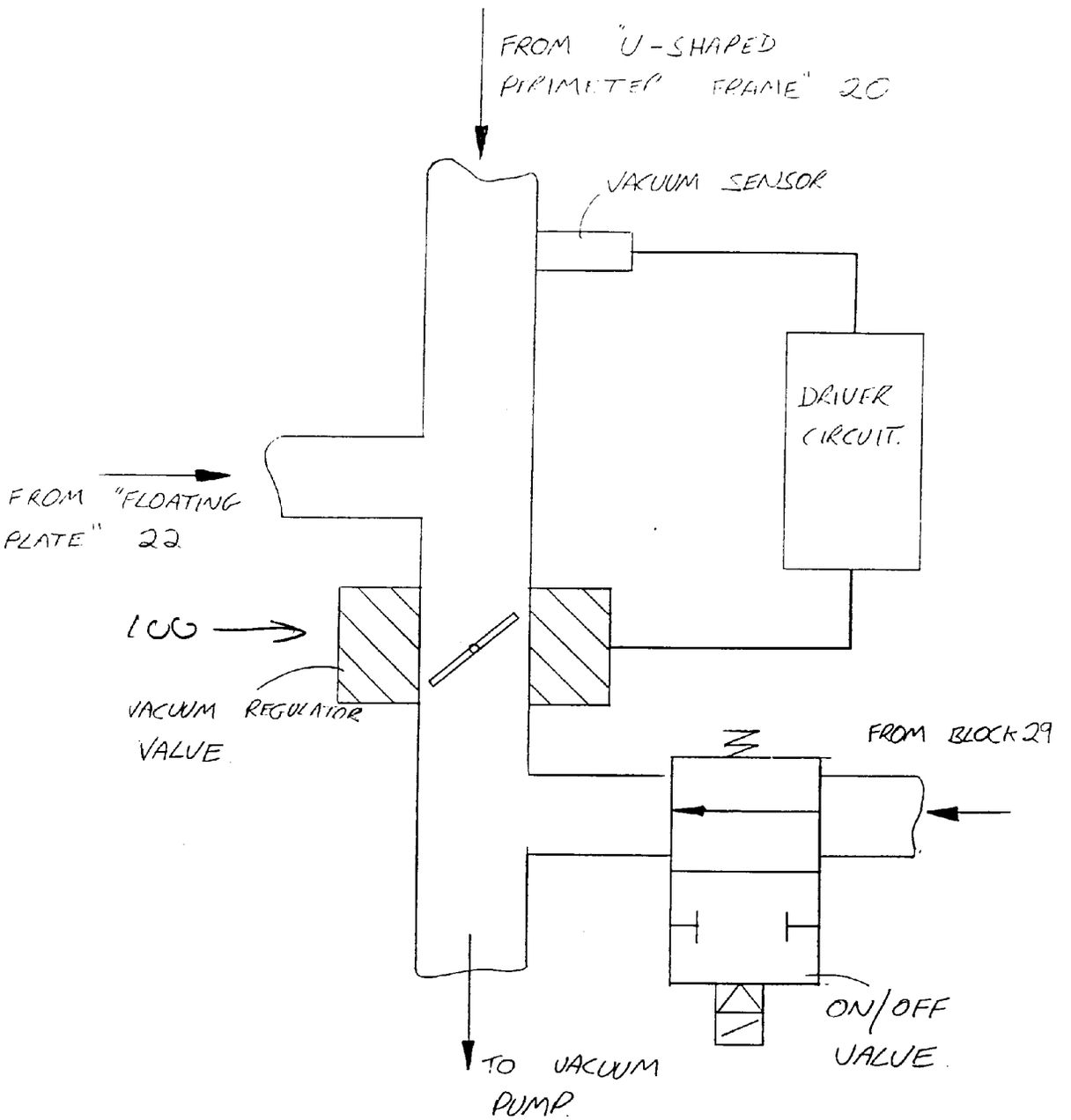


FIG. 20.

FIG21 - VACUUM SYSTEM



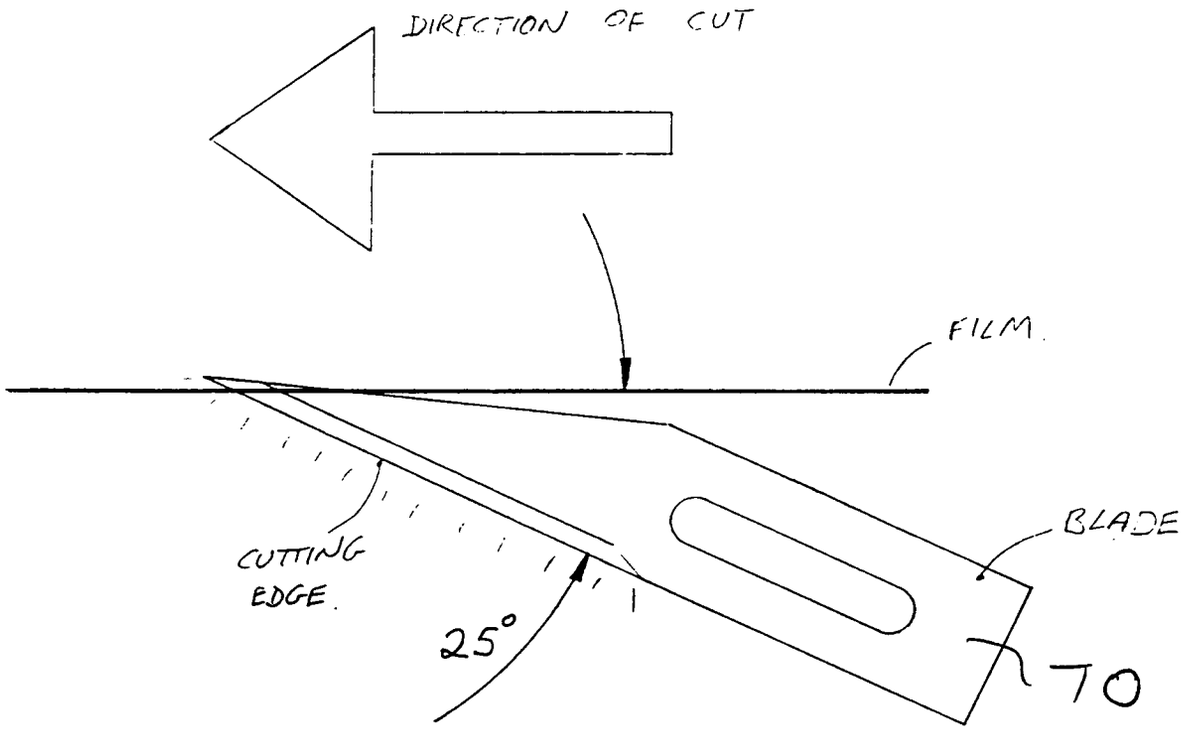


FIG 22

European Patent Office

EUROPEAN SEARCH REPORT

Application Number

EP 91 30 6763

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.5)
A	US-A-3 355 166 (PLUMB , W.W.) * the whole document *	1	B65B11/54 B65B41/06
A	EP-A-0 057 144 (EVRARD , J.E.M.) * page 14, line 10 - page 17, line 28; figures 1-4 *	1	
A	US-A-3 662 513 (FABBRI , E.) * the whole document *	1	
A	FR-A-1 435 635 (SCHMERMUND , A.) * the whole document *	1	
			TECHNICAL FIELDS SEARCHED (Int. Cl.5)
			B65B

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	15 OCTOBER 1991	NGO SI XUYEN G.

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