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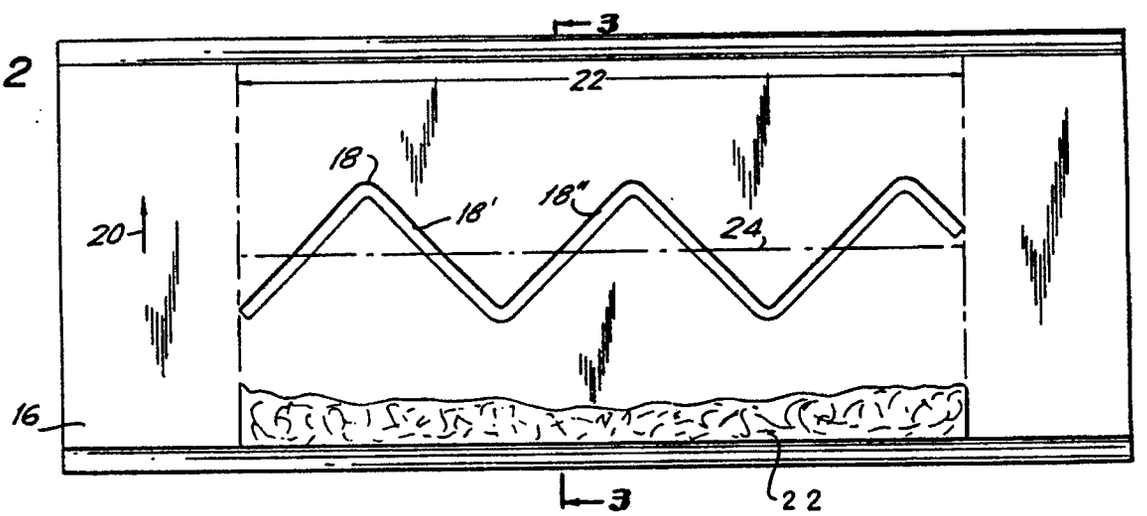
## (54) Suction box cover.

(57) An improved suction box (10) for a papermaking or boardmaking machine includes a cover (16) having an elongated slot (18) over which a press or forming fabric (22) passes. The slot (18) has a generally zig-zag pattern to eliminate noise and to reduce wear and tear on the fabric (22).

FIG. 2

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# SUCTION BOX COVER

This invention pertains to an improved cover for a suction box for use, for example, in machines such as papermaking and boardmaking machines and the like, wherein water is removed from a moving fabric or web by suction.

Various types of paper may be made at high speed and economically on so-called papermaking machines. In this machine, a slurry of wood pulp and other materials is dispensed onto an endless forming fabric. The forming fabric with the slurry moves across several suction boxes used to remove water from the slurry to form a continuous paper sheet. Since this sheet still has a high water content, it is then transferred to a press section where it is contacted with at least one continuous press fabric and fed through press nips for the further removal of water by mechanical means. The press fabric is then passed over another suction box where water is removed from the press fabric. Usually, the press fabric is made of materials which may be woven and manufactured to form a continuous fabric, or which may have two opposite ends joined by a seam.

Other types of machines exist, for example, those producing multi-ply boards for industrial uses such as gypsum wall board, and paper wrapping tubes. Here the sheet is formed in layers of plies directly onto a fabric. The stock is introduced via cylinders in vats filled with stock or using multiple small forming wires. As the fabric passes over each rotating cylinder, it picks up a layer of stock. The fabric then carries this layered sheet through several presses in the conventional sense. Therefore, in this case, the fabric has both forming and pressing functions. Suction boxes are utilized to dewater the fabric here also. While these types of boardmaking machines are slower, and the fabrics used as the "making fabric" are relatively light in weight, the principles of dewatering and pressing and the requirements of the fabric are still basically the same as those for papermaking machines.

The suction boxes are normally provided with a cover having a straight slot extending transversely across the width of the press fabric. The slot size ranges from 3/8″ to 3″ (1 to 7.5 cm) in linear length. (The suction box is described herein as part of the press section of a papermaking machine; however it should be understood that it may also be used in the paper forming section). This type of suction box has been found to be unsatisfactory for a number of reasons. For example, if a press fabric with a seam is used, as the seam goes over the slot, the fabric makes a loud, unpleasant popping sound which is not only irritating, but also increases the overall noise level produced by the machine. The seam also rubs against the slot edges causing the seam flap, formed of batt material, to wear out before the rest of the fabric. Thus the useful life of the press fabric is reduced drastically. The fabric may also fail due to the flexing of the fabric caused by the edges of the slot.

Another type of suction box cover is also used in which slots are made in a so-called herringbone pattern. These slots are usually defined by at least four contact edges. This type of cover has also been unsatisfactory because studies have shown that if the number of edges traversed by a fabric is increased, the wear and tear of the fabric also increases. This wear and tear is even more pronounced with fabrics having seams because the seam flap wears away faster as explained above. Another disadvantage is that the open area (length X width) of the herringbone box cover usually is greater than a single straight slot. This reduces both the specific air flow (volume/area) and vacuum level, thus reducing the system's capability to properly dewater the press fabric. To overcome this problem a larger vacuum source may be necessary, requiring both capital expenditure and increased operating costs.

In view of the above-mentioned disadvantages of the existing suction box covers, it is an objective of the present invention to provide an improved suction box cover which has slot edges presented at an angle with respect to the direction of movement (i.e. the machine direction) of the press or forming fabric, thereby extending the useful life of the fabric seam flap and the entire structure.

The present invention is also concerned with the problem of providing an improved box cover at which the flexing of the fabric at the slot is reduced or eliminated.

Furthermore, the invention is concerned with the problems of reducing or eliminating the sound produced during use compared with the sound produced by prior art box covers, and providing a suction box cover in which the number of edges traversed by the press fabric is reduced. Other advantages of the invention shall become apparent from the following description of the invention.

The invention provides a suction box for extracting water from a fabric continuously moving in a papermaking machine, comprising a body for connection to a vacuum source, and a cover secured to said body and having an elongated slot in communication with said body, said slot extending in a direction substantially transversal to the direction of movement of the fabric, characterised in that the said slot comprises a plurality of slot segments forming a zig-zag pattern. The cover is secured to the body and is

constructed and arranged to support a papermaking fabric, for example, a press fabric moving continuously across it. Preferably, each slot segment is substantially straight. Advantageously, each slot segment is inclined at the same angle to the direction of movement of the fabric, the angle preferably being about 45°. It is preferred that the effective area of the slot is substantially equal to the area of a transversal slot of the prior art and further, that the slot extends substantially across the width of the fabric (i.e. in the cross-machine direction). The slot segments are joined end to end to form a continuous zig-zag pattern across the width of the fabric.

The invention also provides a suction box for extracting water from a fabric moving in a papermaking or boardmaking machine, the suction box having a cover provided with a plurality of slot segments that each extend in a direction inclined at an acute angle to the direction of movement of the fabric, characterised in that the arrangement of the slot segments is such that as the fabric, in use, passes over the cover, at least most of the width of the fabric passes over two slot segment edges. Preferably, the slot segments together extend in a direction substantially transverse to the direction of movement of the fabric and the slot segments may be joined so as to form a single slot. It is preferred that the open area defined by the slot segment edges is about 1 square inch of area per inch (2.5 $cm^2/cm$) of machine width in the direction perpendicular to the direction of movement of the fabric.

The invention also provides a cover for a suction box as described above and a papermaking or boardmaking machine including such a suction box.

Furthermore, the invention provides a process for extracting water from a fabric moving in a papermaking or boardmaking machine, using a suction box as described above. In such a process, the overall wear of the fabric is reduced and, if a seam flap is present, the noise produced therefrom and resultant wear is also substantially reduced. Preferably, the open area per inch of width is as specified above so that traditional vacuum levels may be used to dewater the fabric properly.

By way of example, a suction box constructed in accordance with the invention, and a prior art suction box, will be described with reference to the accompanying drawings in which:

Figure 1 shows an isometric view of a suction box with a cover constructed in accordance with the invention;

Figure 2 shows a plan view of the cover of Figure 1;

Figure 3 shows a side sectional view of the cover of Figures 1 and 2 and a press felt traversing the same; and

Figure 4 shows a plan view of a prior art suction box with a standard herringbone cover.

Referring now to the Figures, a suction box 10 constructed in accordance with this invention includes a main body 12 which is connected to a vacuum source that provides suction (not shown) by a connecting pipe 14. The box is provided with a cover 16 which is secured to the main body in a known manner. For example in Figure 1, the cover 16 is secured to the main body in a dovetail joint, however other types of connections are equally suitable.

The cover is provided with a single slot 18. The slot 18 is composed of a plurality of substantially straight slot segments, such as 18′ and 18″, each segment being disposed at an angle of about 45 degrees with respect to the machine direction indicated by arrow 20. The segments are joined end to end, with each two adjacent segments being perpendicular to each other to form a continuous zig-zag pattern as shown in Figure 2. Each segment may be for example about 5 inches (12.5 cm) long.

The operation of the suction box with the improved cover shall now be described. The suction box is disposed in a paper machine, such as for example its press section, along the continuous path of a press fabric 22. The press fabric 22 traverses the cover in a continuous movement indicated by the arrow 20. The vacuum in suction box 10 extracts water from the fabric through slot 18. As shown in Figure 2, a fabric 22 traversing the box cover, overlaps only a small number of relatively narrow slot sections of the slot. For example, the section of fabric traversing an imaginary line 24 overlaps sections of five slot segments. Between these segments the fabric is fully supported by the box cover so that the fabric does not travel over any edges transversal to its movement. Thus, the wear on the fabric and its seam flap (if any) resulting from both friction between the fabric and the box cover and the deflection of the fabric with a single transverse slot, is reduced when compared to prior art box covers. The box illustrated in the Figures 1-3 may also be disposed in the forming section, for removing water directly from a paper web through a forming fabric. Comparing the prior art suction box of Figure 4 to Figure 2, along a line A-B, any fabric area along line A-B must pass over four edges or slot edges as it moves over the conventional herringbone box cover. In Figure 2 of the invention, any fabric area moving along such a line would only pass over two slot edges, substantially reducing wear.

To demonstrate the validity of this concept, the following series of experiments were performed. A pilot press section using various seamed press fabric designs, was used to study the effect of cover design on

the seam flap and over-all wear of the press fabric surface. All the covers were made of the same material. The box open area was kept constant at 1 square inch of area per inch (2.5 $cm^2/cm$) of width. This was done to keep air flow and vacuum conditions for all box covers equal, with the exception of the standard herringbone cover which has 1.73 square inches of open slot area per inch (4.4 $cm^2/cm$) of machine width. All other operating conditions were kept constant. Visual observations were made of the flap area after various running times. The results are summarized in Table 1.

TABLE 1

| BOX COVER TYPE | FLAP CONDITION AFTER 24 HOURS | POPPING NOISE |
|---|---|---|
| Standard Herringbone (Fig. 4) | Good | Not detectable |
| Straight Slot | Very Poor | Extremely loud |
| Zig-Zag (Figs. 1-3) | Excellent | Not detectable |

Preferably, the cover is moulded from a high impact plastic material with a low coefficient of friction such as polyethylene, although other materials such as silicone nitride and ceramics can be used.

Obviously, numerous modifications such as slot opening and slot angle may be made to this invention without departing from its scope as defined in the appended claims.

## Claims

1. A suction box for extracting water from a fabric continuously moving in a papermaking machine, comprising:
a body for connection to a vacuum source; and
a cover secured to said body and having an elongated slot in communication with said body, said slot extending in a direction substantially transversal to the direction of movement of the fabric, characterised in that the said slot comprises a plurality of slot segments forming a zig-zag pattern.

2. A suction box as claimed in claim 1, wherein each slot segment is substantially straight.

3. A suction box as claimed in claim 1 or claim 2, wherein each slot segment is inclined at the same angle to the direction of movement of the fabric, the angle preferably being about 45°.

4. A suction box for extracting water from a fabric moving in a papermaking or boardmaking machine, the suction box having a cover provided with a plurality of slot segments that each extend in a direction inclined at an acute angle to the direction of movement of the fabric, characterised in that the arrangement of the slot segments is such that as the fabric, in use, passes over the cover, at least most of the width of the fabric passes over two slot segment edges.

5. A suction box as claimed in claim 4, wherein the slot segments together extend in a direction substantially transverse to the direction of movement of the fabric.

6. A suction box as claimed in claim 4 or claim 5, wherein the open area defined by the slot segment edges is about 1 square inch of area per inch (2.5 $cm^2/cm$) of machine width in the direction perpendicular to the direction of movement of the fabric.

7. A suction box as claimed in any one of claims 4 to 6, wherein the slot segments are joined so as to form a single slot.

8. A suction box as claimed in any one of claims 4 to 7, wherein the slot segments are as specified in claim 2 or claim 3.

9. A suction box as claimed in any one of the preceding claims, wherein the cover is made of a plastic material.

10. A suction box as claimed in any one of the preceding claims, wherein the cover is made of silicone nitride.

11. A suction box as claimed in any one of the preceding claims, wherein the cover is made from the family of ceramic materials.

12. A papermaking or boardmaking machine including a suction box as specified in any one of the preceding claims.

13. A process for extracting water from a fabric moving in a papermaking or boardmaking machine, using a suction box as specified in any one of claims 1 to 11.

14. A cover for a suction box as specified in any one of claims 1 to 11.

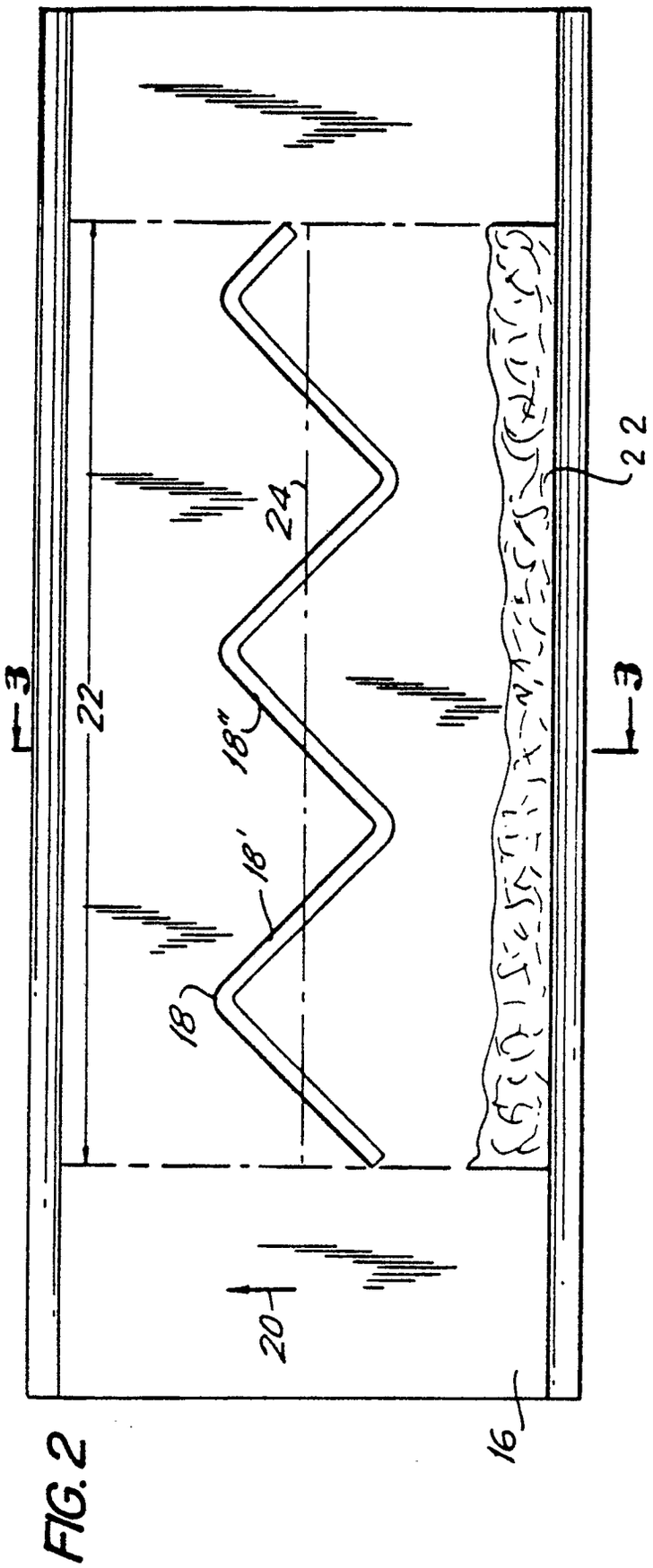


FIG. 2

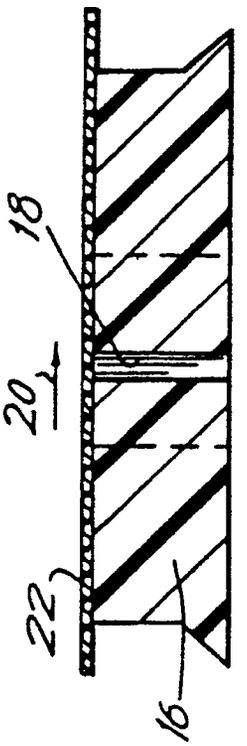


FIG. 3

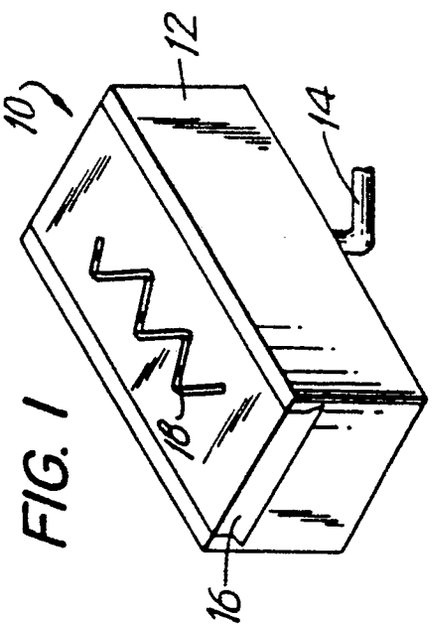


FIG. 1

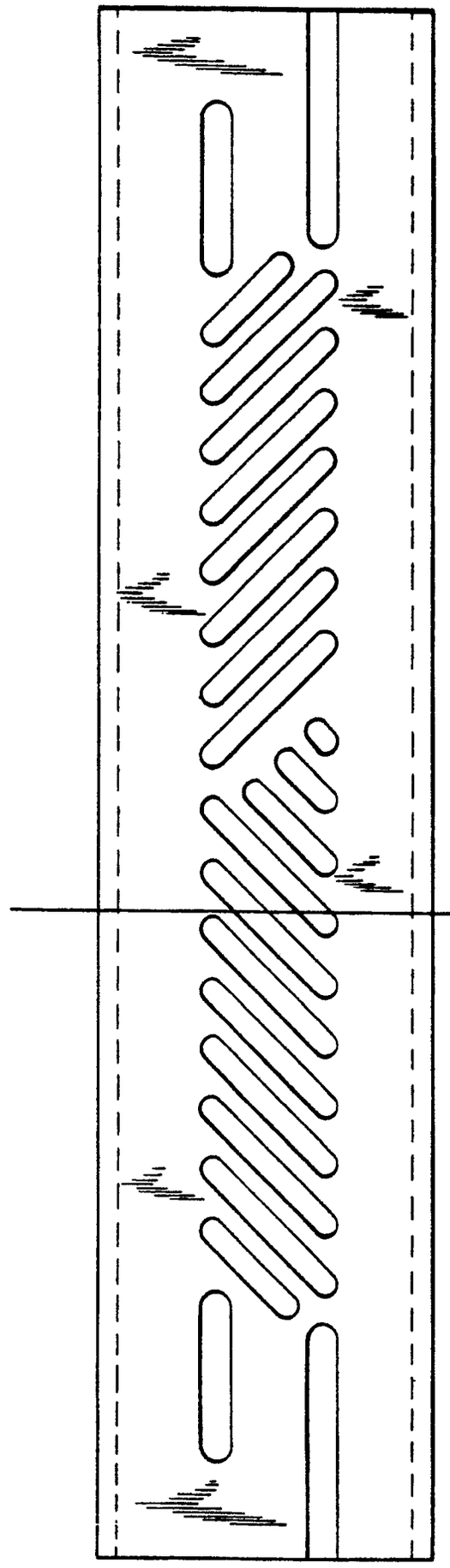


FIG. 4
PRIOR ART