March 15, 1960 A. W. WESTERN ET AL 2,928,464

ADJUSTABLE SLICE FOR FLOW BOX

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Fig. 1.

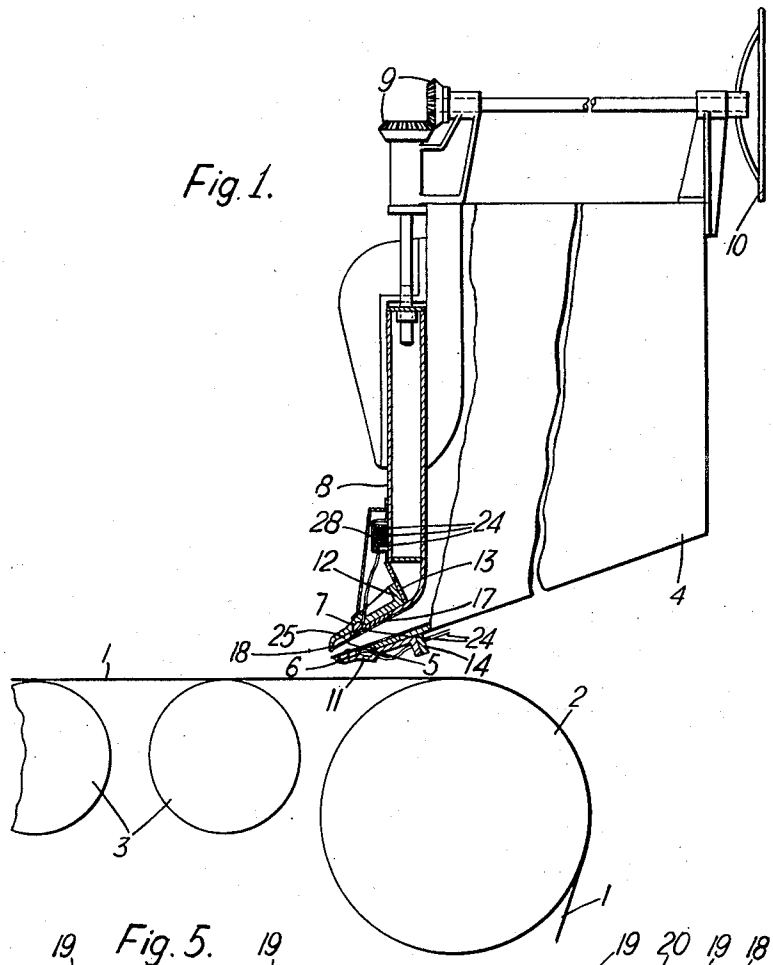
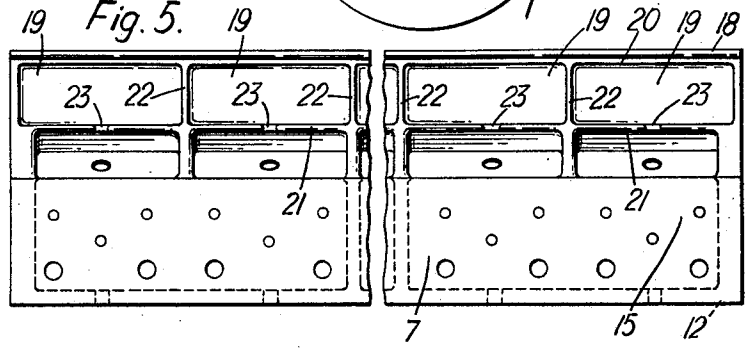


Fig. 5.



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Fig. 2.

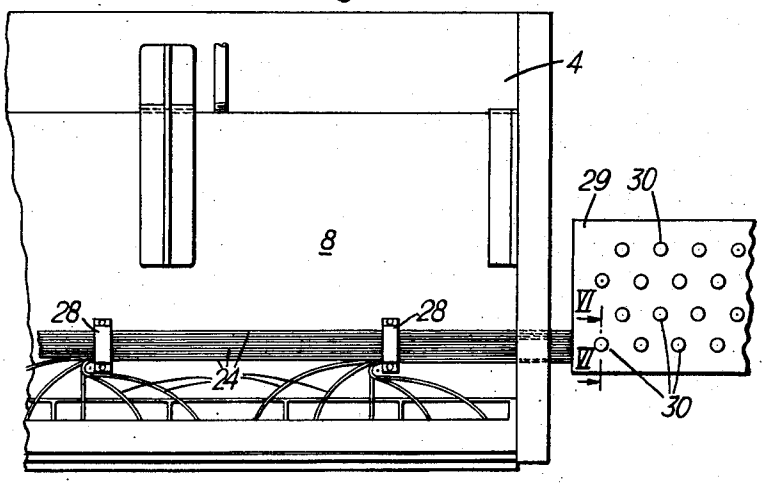
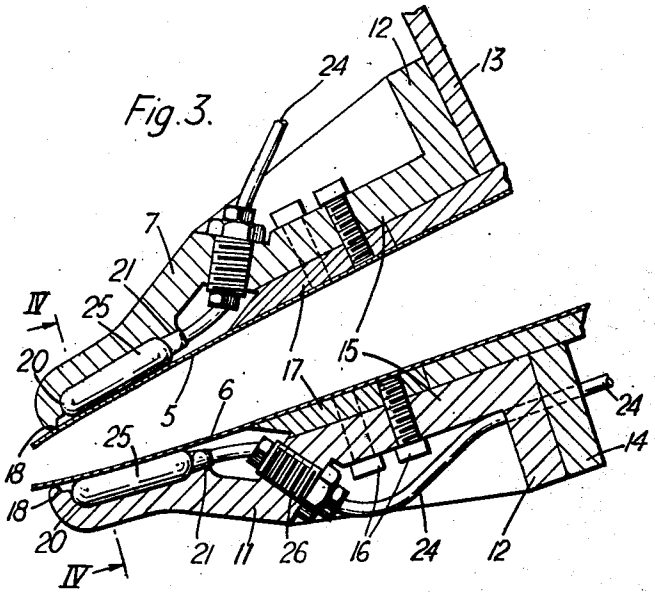


Fig. 3.



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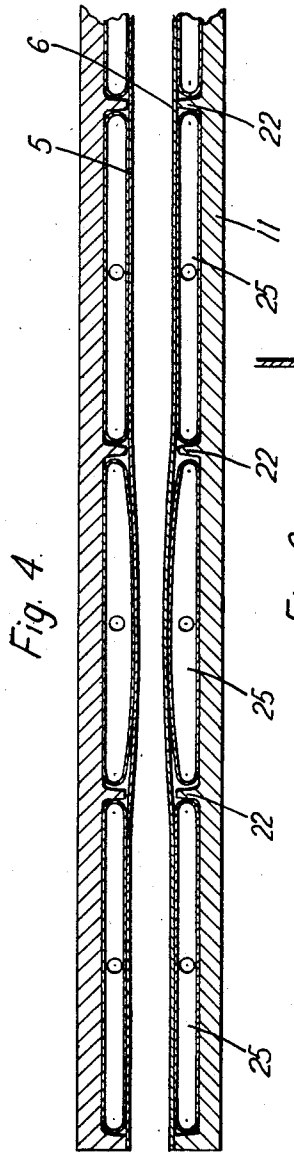


Fig. 4.

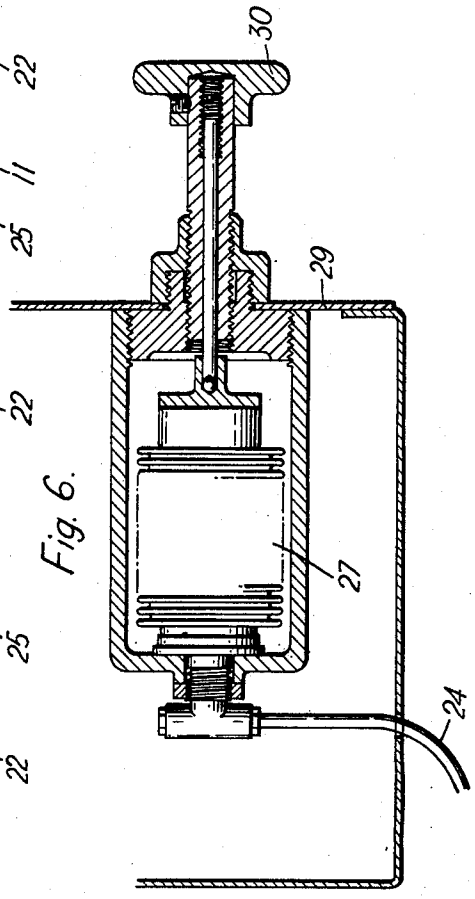


Fig. 6.

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United States Patent Office 2,928,464
Patented Mar. 15, 1960

2,928,464

ADJUSTABLE SLICE FOR FLOW BOX

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Application December 24, 1957, Serial No. 704,967

Claims priority, application Great Britain January 1, 1957

10 Claims. (Cl. 162—347)

This invention is concerned with improvements in or relating to the manufacture of paper, board or like fibrous products and more particularly with machines and parts thereof for the manufacture of paper, board or like fibrous products.

It is usual in paper or board machines to have mechanical means whereby the top slice lip of the flow box can be deformed across its width in order to vary the size of the aperture at different parts of its length so as to control the quantity or density of the stuff flowing out of the flow box onto the wire. Such control is required not only to counteract the sag which occurs across the width of the top slice lip in a large machine, but also to take account of eddies and non-uniform flow within the flow box. It is furthermore often desired to vary the flow of stuff onto the wire across its width to take into account the non uniform shrinkage of the web on drying.

Deformation of the top slice lip is effected in known machines by mechanical means which include a plurality of rods connected to the top lip and provided with threaded adjusting means by which selected rods can be raised or lowered to change the profile of the top lip. There are various disadvantages to this means of varying the profile of the top slice lip. The space required to mount and manipulate the threaded adjusting means, which are usually handwheels, places a limit on how close together the rods can be located and therefore on the amount of control which is exercisable. The connection of a rod to the lip means that tension or pressure is exerted substantially at a point with a consequent tendency to produce abrupt changes in the profile of the lip. A superstructure has to be provided on the front of the flow box to carry the adjusting means, and in large machines a runway is required to enable a machine man to have access to the handwheels to make any necessary adjustments. Variations in the profile of the top lip could only be effected remotely from the machine by means of a very complex and cumbersome linkage which would be quite impracticable. Furthermore with any threaded mechanism subjected to the working conditions of a paper or board machine backlash in the transmission again reduces the degree of control.

In addition where a paper or board machine is used having a top wire in addition to the normal wire, it may be desirable that the slice shall feed the stuff as nearly as possible into the nip between the two wires. Mechanical control of the above mentioned kind is impossible if that is to be achieved since the closer to the nip the slice is disposed, the less space is there for the top lip adjusting mechanism.

It is one object of this invention to provide improved means for varying the profile of the slice of a flow box in a paper or board machine, which overcomes the above mentioned disadvantages and enables the slice to be easily controlled if desired remotely from the machine

without the need for cumbersome mechanical transmissions.

According to the invention we provide a slice for the flow box of a paper or board machine in which the top and/or bottom lip is provided with one or a plurality of flexible, fluid impervious bags, capsules, or equivalent closed chamber devices extending across its length and bearing directly or indirectly upon it, said bag(s) or capsule(s) being adapted to be filled with fluid and means for varying the fluid pressure in said bag or capsule or any of them in order to vary the profile of the lip.

Whilst we may employ a single bag or capsule extending wholly or partially across the lip, we prefer to provide a plurality of small bags or capsules disposed close to one another across the slice lip since by varying the fluid pressure in the individual bags across the slice lip a finer control on its profile can be exercised than is the case with a single bag.

The bags or capsules may be of rubber, polyethylene, polyvinyl chloride or any other suitable substance which is flexible so as to transmit fluid pressure and impervious to the fluid to be used. In general we prefer to use a liquid in the bags or capsules such as oil or water, although with appropriate means for pressure control a gas could be used.

The bags or capsules may be of any desired shape. In general we have found it convenient to have them of generally rectangular shape and of the same size across the slice lip. If, however, it is desired to be able to exercise greater pressures and thus larger deformations at any part of the slice lip, we may have bags or capsules of appropriate shapes and sizes, since it will be understood that by increasing the area of contact of the bag with the slice lip at any part thereof greater pressure will be exerted on that part of the lip for a given increase in the fluid pressure and hence a greater deformation will be effected. If desired individual bags or capsules may be made of varying widths over their length so that varying applications of pressure may be obtained. Similarly the wall thicknesses of the bags or capsules may be varied if desired.

In order to localise or concentrate the application of pressure within the bags to the slice lip, we prefer to provide the bags or capsules with side walls which are thicker than their pressure applying surfaces or alternatively to provide pockets or seatings within the slice lip structure, which pockets or seatings receive the bags snugly and ensure that variations in pressure applied to the fluid in the bags are transmitted to the slice lip.

Whilst we prefer to have said bags or capsules on one side of the slice lip whose profile is to be varied, we may if desired, provide them on both sides thereof in which case, we prefer to arrange them so that the bags on each side of the slice lip are staggered with respect to each other.

Each bag or capsule or other closed chamber device is connected to means such as a bellows or pump whereby the fluid pressure in it can be varied as required, we may however, provide a further bellows or pump so connected to the closed fluid systems of the individual bags as to enable a common pressure variation to be imposed upon them all.

The lip of the slice to be deformed is formed of any suitable resilient material, for instance stainless steel of a suitable degree of flexibility or spring steel suitably coated to resist corrosion and is so mounted in a support that it will be constrained to bear against the support thus giving a precise starting position from which it can be deformed as required. This may be achieved by gripping the slice lip between two rigid supporting plates, one of which is provided with a rib or the like which bears on the slice lip and thus as a result of the latter's inherent

resilience, maintains it bearing firmly against the rib. The inner side of this supporting plate is preferably provided with pockets to receive the bags, which are thus disposed with their pressure applying surfaces between the supporting plate and the slice lip so that pressure variations applied to the fluid will be directly transmitted to the lip to cause its deformation.

In order that the invention may be well understood, one preferred embodiment only thereof by way of example will be described in further detail with reference to the accompanying drawings in which:

Figure 1 is a diagrammatic side view of the wet end of a paper making machine showing the wire and a flow box having top and bottom slice lips according to the invention,

Figure 2 is a front view of a part only of the flow box of Figure 1 with the cover plate removed and showing the arrangement of pipes from the capsules to the control panel,

Figure 3 is an enlarged side sectional view of the top and bottom slice lips of Figure 1,

Figure 4 is a section on the line IV—IV of Figure 3.

Figure 5 is an underneath plan view of the supporting plate of the top slice lip of Figure 1, and

Figure 6 is a sectional view on the line VI—VI of Fig. 2 and shows one of the pressure applying units in the control panel.

Referring to Figure 1 there is shown diagrammatically part of the wet end of a Fourdrinier paper making machine.

The wire **1** passes around a breast roll **2** and table rollers **3** and beneath a flow box **4**, from which stock is supplied to the wire for the production of paper in a generally known manner.

The flow box **4** has a top slice lip **5** and a bottom slice lip **6** which extend across the whole width of the flow box. The top slice lip **5** is carried by a supporting plate **7** which is rigidly secured to the front wall **8** of the flow box. This front wall **8** is so mounted to the flow box that it can be raised or lowered with respect to the remainder of the flow box by means of bevel gears **9** and hand wheel **10** in order to vary the space between the top and bottom slice lips.

The bottom slice lip **6** is carried by a supporting plate **11** and the construction of the two supporting plates **7** and **11** is substantially identical.

As will be seen from Figures 1 and 3 the supporting plates **7** and **11** each have a flange **12** by which they are secured respectively to flanges **13**, and **14** on the front of the flow box. The slice dips **5** and **6** are made of stainless steel and are secured to the web **15** of their respective supporting plates by means of bolts **16** and a carrier block **17**. Along the inner surface at the front edge of each supporting plate is a rib **18** which is directed towards the slice lip itself and against which the slice lip bears firmly due to its inherent resilience.

Referring to Figures 3, 4 and 5 it will be seen that the supporting plate **7** has a plurality of pockets **19** formed and extending over its whole length. Each of these pockets **19** is bounded by a front wall **20**, a rear wall **21** and side walls **22**. The rear wall **21** and side walls **22** serve to stiffen the supporting plate **7** the rear wall **21** is drilled at **23** to provide a passage for a fluid inlet pipe **24**.

In each pocket **19** there is disposed a polyethylene bag or capsule **25** of flat rectangular form each such capsule being connected to its fluid inlet pipe **24** centrally of the rear wall of the capsule. The bags or capsules **25** are so disposed in the pockets **19** that their larger rectangular surfaces abut respectively against the inner surface of the supporting plate **7** and the outer surface of the actual slice lip **5**. The arrangement of capsules in the supporting plate **11** for the bottom slice lip **6** is similar.

Each fluid inlet pipe **24** passes via a connector **26** secured in the body of the supporting plate and is individually connected to a pressure controlling bellows **27** (Fig. 6).

As will be seen from Fig. 2 the pipes **24** leading from the capsules **25** in the top supporting plate **7** are grouped together and led along the front wall of the flow box **4**. They are retained in position by securing straps **28** and at one side of the flow box are led off to a control panel **29** which carries one pressure controlling bellows **27** for each capsule. The fluid inlet pipes for the bottom slice lip which are not shown are similarly grouped together and each lead to a pressure controlling bellows in the control panel **29**.

The control panel **29** which is disposed at any location convenient to an operator houses all the bellows units **27** required there being one such bellows **28** for each capsule **25** provided on the top and bottom slice lips. As will be seen from Figure 6 the bellows **27** is a closed compressible bellows unit known per se having a hand wheel **30** by which the compression or expansion of the bellows and hence the pressure of the fluid therein can be closely controlled.

Each unit consisting of a capsule **25** its inlet pipe **24**, and associated bellows **27** constitutes a closed system and is filled with a suitable fluid, e. g. oil or water. It is thus possible selectively to vary the pressure of each capsule along the length of either slice lip **5** or **6**.

It will be appreciated that when it is desired to vary the profile of either slice lip during operation of the paper or board machine it is merely necessary to raise or lower the pressure in one or more of the bags or capsules **25** in order to change the curvature of the lip. Since the flexible bags or capsules **25** will be smoothly curved over the length of their pressure applying surfaces a distributed pressure is applied to the slice lip which will therefore, be deformed in smooth curves across its length. By having an appropriately large number of small bags for the length of slice lip a much improved control of the profile of the lip along its length can be achieved.

In Figure 4 which shows a part only of the top and bottom slice lips **5** and **6** it will be noted that one capsule **25** in the bottom slice lip **6** have been subjected to increased pressure with the result that the slice lips **5** and **6** are smoothly curved to produce a reduced spacing from each other in the region of those two capsules.

Since with slices according to this invention no mechanical means of the kind hitherto used are required for deforming the lip, it will be appreciated that the flow box can be disposed so that the slice feeds straight into the nip of the top and bottom wires of machines which use two wires.

Furthermore since the control of the lip profile is effected by pressure variation of the fluid in the bags, this can be carried out at any desired point remote from the flow box to which the fluid lines can be run. Thus the cumbersome mechanical lip deforming mechanism on known flow boxes can be dispensed with altogether. It is also possible to provide an automatic control of the profile of the slice lip by arranging for the signals from a substance gauging device e.g. of the beta ray type or from any other detecting device which directly or indirectly measures the thickness or substance of the paper, board or other fibrous material to effect the appropriate correcting pressure variations in the bags across the slice.

It will be understood that we have only described in detail one preferred embodiment by way of example of the invention and that variations and modifications may be made therein without departing from its scope. Thus for example, we may incorporate a pressure gauge in the fluid line to each bag, which will enable the pressure applied to the lip at different parts of its length to be noted.

It will furthermore, be understood that it is within the scope of this invention to provide machines for making paper, board, or other fibrous products having a single wire only or a top and bottom wire and incorporating a flow box having a slice as above set forth.

We claim:

1. A slice for the flow box of a paper or board machine

in which said slice is provided with a top lip and a bottom lip, one of said lips being provided with at least one flexible, fluid impervious closed chamber device extending across its length and arranged to exert pressure on said lip, said closed chamber device being adapted to be filled with fluid, and means for varying the fluid pressure in said closed chamber device in order to vary the profile of the lip.

2. A slice as claimed in claim 1 in which said one lip has a single flexible fluid impervious bag extending a substantial distance thereacross, said bag being of varying width over its length so that varying pressures can be applied to the lip over the length of the bag.

3. A slice as claimed in claim 1 in which said one lip is provided with a plurality of said closed chamber devices of substantially the same shape and size extending thereacross.

4. A slice as claimed in claim 1 in which said closed chamber device comprises a bag having side walls, one of which engages said lip, the remaining walls being thicker than said one side wall.

5. A slice as claimed in claim 1 in which said closed chamber device is a bag of rectangular shape.

6. A slice as claimed in claim 1 including a plurality of said closed chamber devices, each of said devices being

connected to a separate source of fluid pressure to form a closed system therewith whereby the pressure of fluid in each device can be individually adjusted.

7. A slice as claimed in claim 6 including means for applying a common pressure variation to all of the said closed systems.

8. A slice as claimed in claim 6 in which said devices are filled with a liquid.

9. A slice as claimed in claim 1 including a fixed supporting plate adjacent said one lip, a pocket in said plate facing said lip, said closed chamber device being disposed in said pocket.

10. A slice as claimed in claim 9 in which the forward edge of said suporting plate has a rib which normally bears on said lip.

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