This invention relates to guide members for travelling webs, particularly although not necessarily exclusively webs of relatively fragile material e.g. paper. In many forms of apparatus in which a web of material such as paper travels, it is necessary to provide means for guiding the travelling web at one or more positions, especially where the web is required to change direction. In the latter instance, there is frequently employed a “turner bar”; such bars have been simply in the form of a polished rod or tube which may or may not rotate but with the use of higher speeds of web travel, it has been necessary to reduce frictional resistance and it has become an established practice to use air lubrication, the bar being in the form of a tube with a compressed air supply connected to its interior and a series of holes allowing air to escape to the outer surface of the bar. As use of such a bar has been found liable to create ridges in the travelling web, a more recent expedient has been to employ air-permeable sintered material, through the pores of which the air passes to create a more uniform effect at the outer surface of the bar. Bars embodying sintered material have been found satisfactory in operation, although the tiny pores in the material easily become clogged e.g. by paper fluff, but are relatively expensive to manufacture, and each such bar tends to be suitable only for one given set of conditions. It is an object of the present invention to provide an improved guide member for a travelling web. According to the invention, there is provided a guide member for a travelling web, comprising a plurality of laminar elements, each of said elements having at least one perforation extending between its faces and having airways extending between the edge of the element and one of the perforations, and clamping means holding said elements assembled in a stack with their edges aligned to form a guide surface and their perforations aligned to form at least one air duct extending longitudinally of the stack. It will be understood that in the stack of elements, grooves in the face of any element will be confronted by the face of an adjacent element and thus provide air passages between the surface of the stack (formed by the edges of the elements) and the one perforation. Such grooves therefore, in the stack are functionally indistinguishable from drillings in the elements. We prefer to employ grooves in the faces of the elements, because (as will be apparent) the elements are simpler to manufacture than elements with drillings. In an alternative preferred form, each element includes porous material, the pores of which constitute the airways. Preferably such material forms only a portion of the element, such portion being asymmetric where the element has two or more perforations (so that the pores communicate with only one of the perforations), and the remainder of the element being of air-impervious material. With such elements, it can be advantageous (when the porous material is such that it cannot readily be bonded to the air-impervious material) to provide holder plates between each adjacent pair of elements, the holder plates having projections arranged to engage and locate the porous material portions of the adjacent elements. Said projections are of course pressed into the porous material when the clamping means is brought into effect after assembly of the stack. With a guide member embodying the invention, compressed air supplied to the duct or ducts formed by the aligned perforations of the several elements reaches the guide surface formed by the aligned edges of the elements through the grooves in the face of the elements or the pores of the porous material. In a simple form of guide member embodying the invention, all the elements may be of like form, each having a single perforation, so that the member has a single air duct extending along the entire length of the stack of elements. However, apparatus in which such guide members are employed is frequently required to handle webs of width less than the maximum width which can be accommodated. While the length of the stack of elements of the or each guide member is determined by such maximum width, and it must be possible to supply air to the guide surface along the whole length of said stack, when a web of less than maximum width is travelling over the guide member or members it is preferable to be able to supply air only to that part of the guide surface at which it is needed i.e. to a length of the guide surface corresponding to the web width. Accordingly, a guide member embodying the invention may incorporate two or more air ducts, the elements forming one part of the stack having grooves (or drillings) connecting their edges with one of said ducts while the elements elsewhere in the stack have grooves (or drillings) connecting their edges with the other duct. If only two ducts are required, each element may have two symmetrically disposed perforations and may have one of its faces an asymmetric pattern of grooves connecting desired regions of its edge with only one of said perforations; such elements are in this instance so assembled in the stack that the grooved faces of the elements in one part of the stack (e.g. a central portion) face one end of the stack while those in the remainder of the stack (e.g. end portions) face the other end of the stack. The aligned perforations of the elements form the required two air ducts, the grooves of the elements facing in one direction communicating with one duct while the grooves of the remaining elements communicate with the other duct. Thus by selectively connecting either one or both of the two ducts to a compressed air supply, air may at will be fed to the guide surface over only the one part of the stack or over the remainder of the stack (e.g. the central portion or end portions) or over the whole length. Similar arrangements may be employed with elements having drillings, or embodying porous material. By employing two forms of elements, differing in the pattern of grooves formed in one of the faces of each element, or in the form of the portion of porous material, but each having three or four perforations, provision may be made for a selective application of air to a greater number of separate zones along the length of the guide member.
While reference has been made to grooves in one face of each element, said elements may if desired be grooved on both faces in complementary manner.

The clamping means may take various forms; one simple type provides an air pipe extending through the whole length of the or each duct, (the portion of such pipe within the stack of elements having its wall slotted to allow egress of air) and to provide said pipe with threaded end portions carrying clamping nuts bearing against the end elements directly or through end plates. The slot in such pipe may be of limited length, so that adjustment of the pipe longitudinally of the stack may be used to vary the length of stack over which air is supplied by the pipe. Alternatively, there may be end-plates secured to a support member extending along the length of the stack of elements; such support member may be of T-section, the elements being recessed to accommodate the leg of the T which thus serves to maintain the elements positively in correct alignment.

In order that the invention may be well understood, preferred embodiments thereof will now be described with reference to the accompanying drawings, in which:

FIG. 1 is a side elevation (with parts in section) of a guide member embodying the invention;

FIG. 2 is a section on line II—II of FIG. 1;

FIG. 3 is a section on line III—III of FIG. 1;

FIG. 4 is a view of an extra part for the member of FIG. 1;

FIG. 5 is a view similar to FIGS. 2 and 3 of a somewhat simpler form of such a guide member; and

FIG. 6 is a view similar to FIGS. 2 to 5 of an element embodying porous material.

The guide member illustrated in FIGS. 1 to 3 comprises a support member 1 of T-section, disposed with the leg 2 of the T directed upwardly while the cross-bar of the T serves as a base 3. Two end-plates 4 having mounting feet 5 bolted to the base 3 at spaced positions, and between said end-plates 4 is held a stack 6 of laminar elements.

The laminar elements of stack 6 are all of similar external form and are all recessed to receive the leg 2 of the support member 1, as shown in FIGS. 2 and 3 (the outline of each face of said elements may be described as comprising a major segment of a circle superimposed upon a symmetrical trapezium, the non-parallel sides of the latter forming tangents to the circle). Each individual element has a pattern of grooves on one face, the other face being plain, and two different forms of laminar element are included in the stack 6. These two forms of element will be termed type A elements and type B elements and their grooved faces are illustrated in FIG. 2 and in FIG. 3 respectively.

In FIG. 1, the type A and type B elements have reference 6A, 6B respectively where they are assembled with their grooved faces directed to the right (as drawn) while references 6A, 6B respectively indicate type A and type B elements with their grooved faces directed to the left.

The stack 6 comprises seven groups of laminar elements, symmetrically disposed. From end to end, the elements of the seven groups are in the order 6B, 6A, 6A, 6B, 6A, 6B, 6B; much of the right-hand half of the stack is omitted from FIG. 1, to reduce the size of the figure, as it is merely a mirror-image of the left-hand half.

The grooved faces of the type A elements and the type B elements are as shown in FIGS. 2 and 3 respectively. The element has four type B elements each have an arcuate groove (7A, 7B respectively) disposed coaxially with the cylindrical part of its edge, and a number of radial grooves 8 connecting said groove 7 with said cylindrical part. Each type A element has four symmetrically disposed perforations 9A, 10A, 11A, 12A, while each type B element has correspondingly placed perforations 9B, 10B, 11B, 12B.

The above dispositions of the perforations in the two types of elements give the result that in any stack of these elements, however they may be mixed, the perforations will be aligned to provide four ducts through the length of the stack. If all the elements have their grooved faces directed in the same sense, then perforations 9A, 9B form one duct, perforations 10A, 10B form a second duct, and so on, if holes of type A elements are reversed, then the one duct will be formed by perforations 9A, 9B, and 10A, the second duct by perforations 9A, 10A, and 10B and so on. Each duct has a liner (9L, 10L, 11L, 12L) in the form of a longitudinally slotted pipe, which serves to prevent lateral displacement of the elements.

Considering the disposition of elements illustrated in FIG. 1, nearest to the viewer are a duct formed by perforations 11A, 12A, 11B, 12B and a duct formed by perforations 9A, 9B, 10A, 10B, these ducts being referenced 11, 9 respectively. By comparison of FIGS. 1, 2, and 3 it will be seen that duct 11 is formed by perforations 11B of the left-hand group, perforations 12B of the second group from the left (elements 6B), perforations 11A of the third group (elements 6A) and so on.

Duct 9 is formed by perforations 9B of the left-hand group (elements 6B), perforations 10B of the second group (elements 6B), perforations 9A of the third group (elements 6A), perforations 10A of the fourth group (elements 6A), and then perforations 9A, 10B, 9B of the remaining groups respectively. Duct 9 has external connecting pipes 9P for the supply of compressed air; similarly duct 11 has external pipes 11P, and further ducts 10, 12 lying behind ducts 9, 11 (as seen in FIG. 1) have external connecting pipes 10P, 12P respectively.

Returning to FIGS. 2 and 3, the arcuate groove 7A of the type A element is prolonged at one end to communicate with the perforation 9A, while the arcuate groove 7B of the type B element is prolonged at one end to communicate with the perforation 11B. Thus in the stack of FIG. 1, the radial grooves 8 of the elements of the extreme left-hand and right-hand groups (elements 6B) communicate with duct 11 and pipes 11P; the grooves 8 of the groups second from the left and right (elements 6B) communicate with the duct 12 and pipes 12P; the grooves 8 of the groups third from the left and right (elements 6A) communicate with the duct 9 and pipes 9P; and the grooves 8 of the central group (elements 6A) communicate with the duct 10 and pipes 10P.

By selective application of compressed air to the pipes 9P, 10P, 11P, 12P, therefore, various portions of the length of the stack can be caused to allow air to pass through the grooves 8 while the web is being turned through approximately a right-angle. Grooves 8 being provided over a sufficient angle to provide proper lubrication, i.e. to tend to hold the web off the assembly where it tends to be milled against the cylindrically curved surface (the guide surface) of the stack of laminar elements.

It will be understood that the arrangement just described with reference to FIGS. 1–3 is intended for use with single webs which, although they may be narrower than the maximum width (i.e. than the length of the stack 6), are always positioned centrally on the guide member. Thus for the narrowest webs, air need only be supplied to the central group of laminar elements (6A) through pipes 10P; for webs a little wider, air is also supplied through pipes 9P to the groups adjacent to the central groups on each side (6B); for webs wider yet, air is also supplied through pipes 12P and for webs of maximum width all the connecting pipes are supplied with air.

If desired, blanking plates may be included in the stack of elements, to interrupt one or more of the ducts 9, 10, 11, 12; such a plate is illustrated in FIG. 4. It will be seen that its outline is similar to the elements, and it has three perforations, so placed that when assembled in the stack they register with ducts 9 and 10 and with either duct 11 or duct 12 (depending on the
orientation of said blanking plate), so that duct 12 or duct 11 respectively is interrupted. Assuming that the blanking plate thus interrupts duct 11, then air supplied through external pipe 11P at the left of the member (as seen in FIG. 1) will only reach the grooves of the extremity; the left-hand group of elements while the right-hand pipe 11P communicates only with the grooves of the extreme right-hand group of elements, thus giving more selective control of the application of air to the various parts of the length of the guide member.

Turning now to FIG. 5, there is shown the grooved face of a further type of laminar element, conveniently termed type C. This type of element is in outline similar to types A and B and may be assembled on a support member similar to member 1 of FIG. 1. However, the type C element is primarily intended for use in arrangements where the stack of laminar elements has only three groups; it has grooves 8 similar to those of FIGS. 2 and 3, but extending over a larger part of the cylindrical part of its edge so as to accommodate a web being turned through substantially 180°. Also, the type C element has an arcuate groove 7C (similar to grooves 7A, 7B) but only two perforations 11C, 12C in positions corresponding to those of the perforations 11B, 12B (FIG. 3) the groove 7C being prolonged to communicate with the perforations 12C. It will be apparent without detailed explanation that type C elements may be assembled into a stack having a central portion supplied with air through one duct and end portions both supplied with air through a second duct.

The type C element also has a third perforation 13, at the centre of its segmental part, which does not communicate with the groove 7C but permits a rod 14 to be placed through a stack of type C elements as the stack may be clamped together by applying nuts (not shown) to the ends of the rod.

Turning to FIG. 6, there is shown an alternative form of element for use as B type elements in the guide member of FIG. 1. The element of FIG. 6 is therefore functionally similar to that of FIG. 3 (although shown in reversed position) but is modified in that the element of FIG. 6 is in part made of porous material 14 and in part of air-impervious material 15. The pores of the porous material provide airways between the curved top edge of the element and the perforation 11B.

Between each adjacent pair of such elements, there is a thin air-impervious holder plate (not visible in FIG. 6), perforated in register with the perforations 9B, 10B, 11B, 12B of the adjacent element. The perforations in the holder plates, where they engage the porous material, have small projections 16; upon clamping the stack of elements together (FIG. 1) these projections 16 are pressed into the porous material and serve to locate it positively. This permits the porous and air-impervious portions of the elements, if desired, to be made as two separate parts, which can be advantageous if the materials employed for these two parts cannot readily be bonded together.

The porous material may, for example, be foamed plastics material, sintered metal, or woven material, or may be formed of corrugated laminar.

It will be apparent from the foregoing examples that a wide variety of arrangements are possible within the scope of the invention. Thus considering the element of FIG. 3, a third pair of perforations (not shown) could be provided, permitting the use in the stack of additional elements, facing grooves or perforations communicating with one of these further perforations; said additional elements would therefore derive their air supply through one or the other of two additional ducts formed by the third pair of perforations, according to the way in which said additional elements were assembled in the stack.

A guide member embodying the invention need not be used to separate control of air supply to various parts of its length; for example, using elements as shown in FIG. 4, a stack may be assembled in which the majority of the elements are facing one way and hence are associated with one of the two ducts formed by their perforations, through which one duct air is supplied as in the foregoing examples. The remaining elements, forming one or more small groups facing the other way and the second duct (with which said remaining elements are associated) may be connected to an air pressure sensing device. With a paper web running around such a guide member, some of the air supplied via the majority of the elements will reach the second duct, and the pressure thus created in said second duct, and hence operating the sensing device, will be influenced by the tension in the paper web, which tension will affect the spacing between the web and the guide member. Hence the response of the sensing device may be used to indicate and/or control web tension.

The laminar elements of a guide member embodying the invention may be made of a variety of materials; when made with grooves in one or more of their faces, such elements may very conveniently be made by die-casting metal or may be injection-moulded in plastics material. If desired, paper or other gaskets may be provided between adjoining elements in the stack, although in general will only be necessary where the liquids which high air pressures are to be applied; even then the use of such gaskets may be unnecessary if the laminar elements are made of slightly deformable (preferably resilient) material and the stack is firmly clamped.

Where such a guide member is to be used in a machine which always handles two or more narrow webs, it is possible to provide one or more inactive sections in the guide member, by including in the stack one or more groups of elements having perforations but no grooves, drillings or porous material. These inactive sections will of course be so placed along the length of the guide member as to correspond to the gaps between adjacent webs.

What I claim as my invention and desire to secure by Letters Patent is:

1. A guide member for a travelling web, comprising a plurality of laminar elements, each of said elements having faces on opposite sides thereof, at least two symmetrically-disposed perforations extending between its faces and an asymmetric pattern of airways extending between the edge of the element and only one of said perforations, and clamping means holding said elements assembled in a stack with their edges aligned to form a guide surface and air passages between their faces; said air ducts extending longitudinally of the stack, said elements being so assembled in the stack that elements in different parts of the stack are oppositely oriented to those elements in other parts of the stack whereby the airways of the elements in said different parts communicate with different ducts formed by the aligned perforations.

2. A member as claimed in claim 1, in which elements in a central portion of the stack are oriented in one direction and the elements in end portions of the stack are oriented in opposite directions respectively.

3. A member as claimed in claim 1, including elements of two types, the elements of one type having a different asymmetric pattern of airways from that of the other type, each said element having at least three perforations, the elements of each type being oriented in one direction in some portions of the stack and being oriented in the opposite direction in other portions of the stack.

4. A member as claimed in claim 1, in which the airways of each element are provided by a pattern of grooves on one of its faces.

5. A member as claimed in claim 1, in which the clamping means comprises a support member extending along the length of the stack of elements and end plates secured to said support member.

6. A guide member for a travelling web, comprising a plurality of laminar elements, each of said elements
having faces on opposite sides thereof, at least one perforation extending between its faces and being composed at least in part of porous material, the pores of said material constituting airways extending between the edge of the element and said perforation, and clamping means holding said elements assembled in a stack with their edges aligned to form a guide surface and their perforations aligned to form at least one air duct extending longitudinally of the stack.

7. A member as claimed in claim 6, in which each element has a portion of porous material extending between the edge of the element and one of the perforations, the remainder of said element being of air-impermeable material.

8. A member as claimed in claim 7, including holder plates between each adjacent pair of elements, said holder plates having projections arranged to engage and locate the porous material portions of the adjacent elements.

9. A guide member for a travelling web, comprising a plurality of laminar elements, each of said elements having faces on opposite sides thereof, at least one perforation extending between its faces and airways extending between the edge of the element and said perforation, and clamping means holding said elements assembled in a stack with their edges aligned to form a guide surface and their perforations aligned to form at least one air duct extending longitudinally of the stack, said clamping means comprising an air pipe extending through the whole length of at least one duct, the portion of said pipe within the stack of elements having its wall slotted to allow egress of air, said pipe having threaded end portions carrying clamping nuts to press said elements toward each other.

10. A guide member for a travelling web comprising a plurality of laminar elements each of said elements having faces on opposite sides thereof, at least one perforation extending between its faces and airways extending between the edge of the element and said perforation, and clamping means holding said elements assembled in a stack with their edges aligned to form a guide surface and their perforations aligned to form at least one air duct extending longitudinally of the stack, said clamping means comprising a support member of T-cross-section extending along the length of the stack of elements with end plates secured to said support member, said elements being recessed to accommodate the leg of the T.

11. A guide member for a travelling web, comprising a plurality of laminar elements, each of said elements having faces on opposite sides thereof, at least one perforation extending between its faces and airways extending between the edge of the element and said perforation, clamping elements holding said elements assembled in a stack with their edges aligned to form a guide surface and their perforations aligned to form at least one air duct extending longitudinally of the stack, and at least one blanking plate between adjacent elements, said plate having less perforations than each element so as to interrupt at least one of the ducts.

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