Fig. 3.

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This invention concerns improvements in or relating to rotary tobacco cutting machines.

When leaf tobacco is to be cut into shreds, for instance to prepare cigarette tobacco, the leaves are first compressed into a solid mass frequently referred to as a "cheese." As the leaves are of a substantial area relative to their thickness it will be seen that if the mass of leaves is compressed from two opposite sides only, then the mass of leaves will naturally form a "cheese" having strata whose planes are substantially normal to the direction in which the compression is applied. This is so whatever the original orientation of the individual leaves in the mass, for it will be seen that during compression, the leaves which are not already lying in planes substantially normal to the direction in which compression is applied will, due to the compression, have portions turned or folded so that they finally close up in such planes, and their contacting surfaces form the lines of cleavage of the "cheese."

If tobacco is cut by hand the cutter cuts across the end of the "cheese" with a broad knife whose edge moves parallel to itself in the same direction as the above mentioned direction of compression, although the edge of the knife is usually at an angle to the strata of the "cheese" to secure a shearing cut. The earlier forms of cutting machines imitated this motion, being, in effect, guillotines of various designs.

With the introduction of rotary cutters to obtain the large outputs necessary nowadays it was not easily possible to follow this practice, as for practical reasons it is simplest to feed and compress the tobacco so that the strata are substantially parallel to the conveyor on which the leaves are fed and compressed. This is because the conveyor for feeding the stream of tobacco which is compressed into "cheese" form is most easily arranged to move beneath so as to support the tobacco. Above this conveyor another conveyor was provided, the two conveyors being arranged to converge so that the tobacco stream was compressed into "cheese" form by these top and bottom conveyors.

Since, as mentioned above, the strata of the "cheese" are normal to the direction of compression, in such a construction the intersections of the strata with the cutting face of the "cheese" are substantially horizontal.

It will be understood that usually this compression is effected by endless bands or by series of rollers which converge in the direction of feed, but are substantially parallel in planes at right angles to the direction of feed. Thus the expressions "the direction in which compression is applied" and "the direction of compression" are intended to mean the general line along which the tobacco itself is condensed from opposite sides, as distinct from the mathematical directions of the actual forces set up.

In order to obtain a large output with such an arrangement it will be appreciated that it is necessary to have a "cheese" of a suitably large cross-sectional area. Where the tobacco is compressed between top and bottom conveyors it is important that the depth of the "cheese" shall be kept as small as possible, and in practice this latter is between 2½ and 3 inches. The reason is that it is important that the amount of stationary surfaces at the sides of the stream which would tend to hold up the tobacco being fed, should be kept as small as possible, consistent, however, with keeping the stream as large as possible to obtain the maximum output. In practice, therefore, the depth of 2½ to 3 inches at the mouthpiece was found adequate as compared with a width of 16 inches, which width was found to be sufficient to enable the machine to be supplied by hand, and was approximately the accepted size in the trade for tobacco-cutting mouthpieces. Such an arrangement with such proportions for the "cheese" enables the use of relatively large compressing and driving surfaces to engage the tobacco stream, whilst only relatively small stationary surfaces tend to hold up the feeding of the tobacco. With such an arrangement it is only possible, in a construction in which the knife edges rotate in a flat or conical plane, to arrange for the blades on the cutter to cut through the "cheese" in the direction of compression by arranging the center of rotation of the knives at one side of the "cheese." However, such an arrangement requires a considerable amount of floor space, and also requires that the radial extent of the cutter arms and knives should be very long so that the full 16 inches width of the "cheese" is covered; thus a very considerable leverage is applied. Obviously such an arrangement would not be desirable in the case of machines designed primarily for large output. The leverage on the cutter arms can, of course, be reduced by reducing the width of the "cheese," but reducing the width of the "cheese" merely reduces the output unless the width of the side walls is increased. However, increasing the width of the side walls upssets the feeding of the "cheese," and consequently one is left with the same difficulty as originally.

Machines having rotating cutter-heads have been extensively used in practice, such machines having converging top and bottom conveyor bands, and a knife-head rotatable about an axis which is located above the mouthpiece and extends in the same general direction as the tobacco stream. In such machines a large output is maintained by keeping the proportions of the "cheese" substantially the same as mentioned above and by placing the center of rotation of the knives above the "cheese," thus cutting across
the width of the "cheese" and substantially along the strata. With such an arrangement, of course, the radial extent of the cutter arms and knives can be made shorter than would be required if the axis of rotation were at the side of the "cheese." This earlier machine is generally satisfactory for cutting "Virginia" leaf which is large and pliable and is generally worked rather moist. For the small brittle "Turkish" leaf or other cases where the leaf has to be worked in a rather dry condition it is not so satisfactory because the blades cut across the strata more or less edgewise and the shreds tend to break as they pass through the "cheese" and naturally bend the cut portion away from the main body owing to the bevel of the blade. If, however, the blades can be arranged to shear across the "cheese" more or less in the direction of compression, it is thought the leaves will bend away naturally in doing so and as they are relatively flexible in this direction, some breakage will be avoided and shreds of satisfactory length and texture will be obtained.

According to the present invention there is provided a tobacco-cutting machine comprising a bottom conveyor-system arranged to support and convey leaf tobacco to be fed forwardly thereon as a stream, conveyor-systems arranged at each side of the bottom conveyor-system and adapted to feed and subject such moving stream to lateral compression to condense the tobacco, thereby reducing the width of the stream supported by the bottom conveyor-system, a mouthpiece through which the condensed stream is fed, and a rotatable knife-head having a cutting blade arranged to move across the path of the stream in the general direction of the width of the stream as the stream emerges from the mouthpiece.

This combination which feeds the tobacco between two side conveyor systems which compact the stream laterally, and carries the stream on a bottom conveyor system, makes it possible to feed a compressed stream of relatively large cross-sectional area, since at least three sides of the stream are engaged and transported by conveyor systems, but the limitations previously essential in the dimensions of the compressed "cheese" in tobacco cutters, due to the presence of two stationary walls, are removed, so that the present arrangement of conveyors gives much wider latitude in the choice of the cross-sectional dimensions of the "cheese" on the part of the designer of the machine. He obtains the benefit of cutting across the planes of the strata in the "cheese," together with the benefit of doing this without increasing the floor space of the machine, and by suitably choosing the dimensions of the "cheese" he can keep the radial distance of the extremities of the knife edges and the actual lengths of the knife edges within reasonable limits thereby obtaining the practical advantages of such an arrangement.

Further, according to the present invention, there is provided a tobacco-cutting machine comprising the combination of a cutting mouth or mouthpiece with means to feed and compress leaves to form a "cheese," said means including a relatively wide bottom conveyor-system adapted to receive and support the leaves and on which the leaves are fed forwardly as a stream, to compress the leaves during such forward movement laterally so as to reduce the width of the stream and thereby to form the latter into a compact "cheese" whose strata are substantially normal to the supporting surface of the bottom conveyor-system, and a rotatable knife-head having at least one cutting blade, the axis of rotation of the head being so arranged that the edge of the blade in cutting across the "cheese" moves in a direction substantially normal to the strata in the "cheese".
The "cheese" emerges through the mouthpiece 3 across which the blades slice and cut off slices from the "cheese" to the desired thickness of the tobacco shreds. The space between the blade 2 and mouth 3, Figure 1, is exaggerated in the figure for clearness. Preferably the edge of the blade just touches the front face of the mouthpiece.

Top and bottom conveyor systems which are described below are located behind the mouthpiece and extend away therefrom in directions normal to the plane thereof. Lateral conveyor systems are similarly arranged except that they diverge as they extend away from the mouthpiece.

A conveyor consists of a number of links 5 of the kind shown in Figure 4, pivoted together to form an endless chain which is mounted on sprockets 6, Figure 4, which support and drive the chain. The tobacco engaging surfaces of the links are so constructed that they provide a substantially continuous plane for the purpose. In Figures 1, 2 and 3 the chains are shown by single lines and the sprockets by cylinders, owing to the small scale of said figures.

The top and lateral conveyor systems each consist of a single conveyor 7, 8 and 9 respectively, the spindles of the rear sprockets being journaled in brackets 26, which also support a chute 14 described later.

The bottom system consists of three side by side conveyors 10, 11 and 12 respectively, their rear ends being supported on sprockets carried by a single spindle represented in Figure 2 by its axis 13, so that a broad conveying surface is provided nearly as wide as the greatest distance between the lateral conveyors, that is at their rear end. The rest of the rear end of the tobacco supporting surface is formed by fixed plates. The triangular gaps between the bottom and side conveyors at the mouthpiece end are also filled by fixed plates. The lateral conveyors 8 and 9 converge towards the mouthpiece to a distance which is rather less than the width of the middle conveyor 10 of the bottom system and the said middle conveyor is, as shown in Figure 2, of such length as to reach up to the mouthpiece while the two conveyors 11 and 12 at its sides are reduced in length in order to allow space for brackets and other parts which carry the spindles and sprockets which support the lateral conveyors at the forward ends and also because at this position they no longer engage the tobacco owing to the reduced distances between the lateral conveyors.

It is not easy nor entirely necessary to arrange the top conveyor 1 in the same way as the bottom one and therefore a single conveyor is used similar to the middle conveyor 10 of the bottom system and the remainder of the width of the converging passage is filled in by cover plates 23, Figure 6. These overlap recessed parts 24 of the conveyor links, as shown in Figure 6, and in consequence the conveyor would sag with its own weight when the machine is empty.

The conveyors are all driven by gearing coupled to the spindle of the knife head, which is represented in Figure 1 by its axis 4 and the whole machine is driven in an identical manner. The speeds of the conveyors are proportioned according to the disposition of the various conveyors and for the purpose in view. The gearing is omitted from the drawings for clearness but, by way of example, a six-blade knife head for an average machine is driven at 150 R. P. M., that is it makes 900 cuts per minute. Sixty cuts per inch of "cheese" produces satisfactory cut tobacco for cigarette making and the conveyors are geared to the head so as to feed 15" per minute. Thus, as the machine is driven the "cheese" will be fed through the mouthpiece and slices cut therefrom in the desired manner.

In order to assist in the preliminary of the leaves which are to form the "cheese" and to avoid having a machine of inordinate length the leaves are fed, e.g. from a conveyor belt or the bricking of a conveyor system, or as shown in Figure 1, from a feed box 25 into a substantially vertical chute 14 of a cross section similar to that of the conveyor passage at its rear end. This arrangement is similar to that shown in Figures 1 and 2 of prior British Patent Specification No. 516,085. The chute is sufficiently high to cause the leaves to be packed a little under their own weight and the lower end is curved at 15 to lend into the passage. The rear wall 15 of the chute is pivoted at its upper end at 17 and oscillated by an eccentric 18 through the linkage 19, 20 and 21 the eccentric being driven from a suitable part of the machine gearing. This helps the tobacco to move down the chute and also causes the leaves at the bottom of the chute to be fed into the conveyor passage as they are needed.

It is to be understood that the preliminary massing of the leaves by means of the rear wall 16 of the chute is effected only to pack the leaves to an extent such that the leaves are loosely compact and so that the mass has a substantially constant weight per unit volume to enable the leaves to be fed on to the bottom conveyor of the tobacco-cutting machine at a substantially constant rate. This preliminary massing is obtained by only a relatively light pressure compared with a compression such as is necessary for forming the "cheese" or even with a significant proportion of such compression, and is really no more than a packing of the leaves and its purpose is to collect or gather the leaves into a relatively loosely compact form with substantially uniform distribution of the leaves throughout the mass and to pack these gathered leaves against the rear end of the mass of leaves which is being fed and compressed by the tobacco-cutting machine conveyors, into a "cheese."

In order to keep the back of the machine low so as to accommodate a long chute and also to keep the front high to allow for a conveyor to carry away the cut tobacco the front of the frame 22 of the machine is tilted backwards a suitable amount, as shown in Figure 1, so that the axis 4 which is normal to the front of the machine is inclined as previously described and the remainder of the frame is suitably shaped so as to preserve the proper relationship of knife path to conveyor.

It will be seen that in the construction described the tobacco is received on a relatively wide supporting surface, at the rear end of the cutter, from the chute 14. The width of the supporting surface at this point is about 36". Tobacco is fed forward towards the mouthpiece and in so moving it is compressed laterally so as to reduce the width of the stream to form...
a "cheese" approximately 6" in width. In depth the tobacco stream remains constant at about 6". This construction has the advantage of automatically ensuring that the strata in the "cheese" are in planes substantially normal to the bottom tobacco supporting surface which is constituted by the various supporting plates and the conveyors 10, 11, and 12 so that the edge of the blade in cutting across the edges is substantially parallel to the strata and thereby gives the improved cut, but also due to the extreme width and small depth of the tobacco stream at the rear end of the machine at the bottom of the chute 14, the tobacco can be more easily turned through the very sharp angle in the cutter between the four conveyor systems. Owing to the use of the four conveying systems, the tobacco is not liable to be held up by friction as it would be if only two opposing compressing conveyors were employed. Thus it will be seen that the construction according to this invention gives considerable improvements in many respects since the cutting apparatus is improved by the arrangement according to the invention, and further owing to the lateral compression over a very wide width of small depth.

One of the main advantages obtained by the present invention, provided the designer takes advantage of the general system of conveying, compressing and cutting according to the present invention, by choosing suitable dimensions for his "cheese," is that the knife-edges can be relatively short. Further, the shorter the knife-edges, the easier it is to provide for automatic sharpening and feeding to compensate for wear. For instance, a knife edge of about 6" long can be automatically sharpened during the operation of the machine by a single grindstone so that no traversing mechanism for stone or knife is necessary. Also, a knife having a short knife-edge can be fed forwardly in the direction of its edge more easily than a wide knife having a longer edge, since the narrower the knife, the easier it is to guide it in a straight path by a single central screw feed.

At the back the automatic feeding from the vertical chute 14 and the oscillating rear wall 16 is improved relatively to the use of the same construction in a machine having top and bottom compression as such described and shown in British Patent Specification No. 516,805. In cutting across the "cheese," the edge of the blade is parallel to the strata at the centre of the mouthpiece in the case where the blade is radial, though of course there is slight divergence from this position at the beginning and end of the cut, but in all cases it will be appreciated that the edge of the blade is substantially parallel to the strata during cutting. In an alternative construction, instead of having conveyors as described, one or more of the conveyors could be formed by a series of driven rollers.

What we claim as our invention and desire to secure by Letters Patent is:

1. A tobacco-cutting machine, comprising, in combination, a conveyor system to feed a mass of tobacco leaves forwardly as a stream while condensing the mass by lateral compression to form a compact "cheese," a mouthpiece toward which the said stream is fed and through which the stream passes as a "cheese," and a rotatable knife-head having a cutting blade arranged to move bodily across the mouthpiece in the general direction of the horizontal-width of the stream so as to cut the "cheese," said knife-head being supported for rotation on an axis generally parallel to the direction in which the stream is fed and spaced vertically from said mouthpiece, said conveyor system comprising a bottom endless-band conveyor to support the stream and moveable toward the mouthpiece, means providing an upper surface substantially parallel with the said bottom conveyor upon which the bottom conveyor extending beyond said upper surface at the inlet end, whereby the depth of the stream is kept substantially constant, and a pair of opposed lateral endless-band conveyors moveable toward the mouthpiece and converging in their direction of movement, said endless-band conveyors forming with said upper surface a converging compression chamber having an inlet end of a width, measured horizontally, at least several times greater than the depth thereof, and a discharge end dimensioned to conform substantially to the dimensions of said mouthpiece, and of a substantially different from the depth thereof, the construction thus being such that practically the whole of the compression of the tobacco leaves into the "cheese" is affected by the convergence of the lateral conveyor bands so that the resulting "cheese" formed thereby is vertically stratified.

2. A tobacco-cutting machine as claimed in claim 1, in which said upper parallel surface is also comprised by an endless-band conveyor, whereby the tobacco stream is engaged and supported substantially wholly by the moving surfaces of the conveyors, said bottom conveyor being composed of a plurality of endless conveyor bands arranged side by side.

3. A tobacco-cutting machine, as claimed in claim 1, and comprising automatic feeding means to deliver tobacco leaves to the said bottom conveyor at the inlet end of the compression chamber, said automatic feeding means comprising a substantially vertical chute whereby the leaves are partly packed by gravity, a rear wall to said chute, and means to oscillate said rear wall toward and away from the tobacco in the chute to facilitate the downward movement of the tobacco and to provide a preliminary massing of the leaves.

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