Oct. 12, 1937. D. A. CUMFER 2,095,631

CUTTING DEVICE

Original Filed Dec. 11, 1935 3 Sheets-Sheet 1

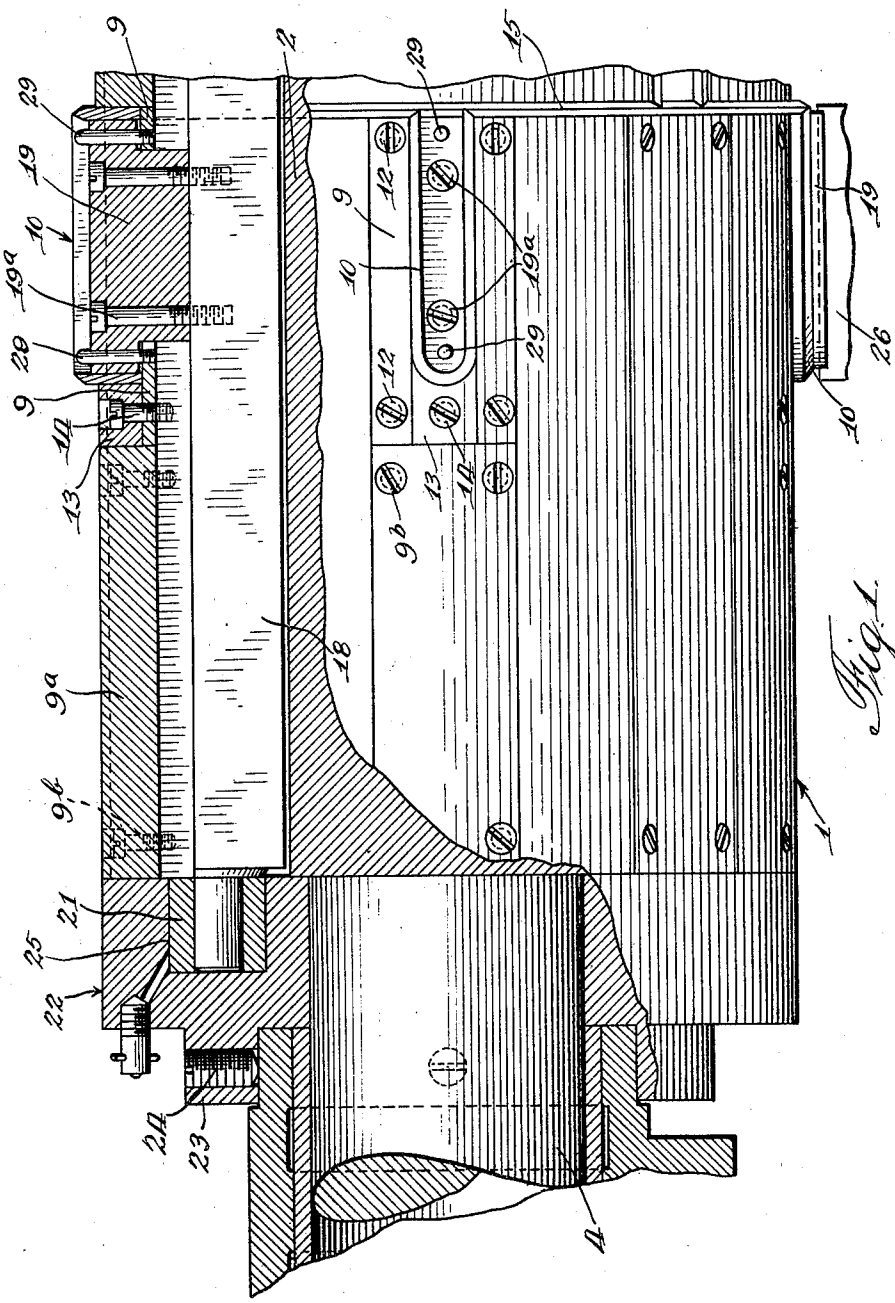

Fig. 1.

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CUTTING DEVICE

Original Filed Dec. 11, 1935 3 Sheets-Sheet 2

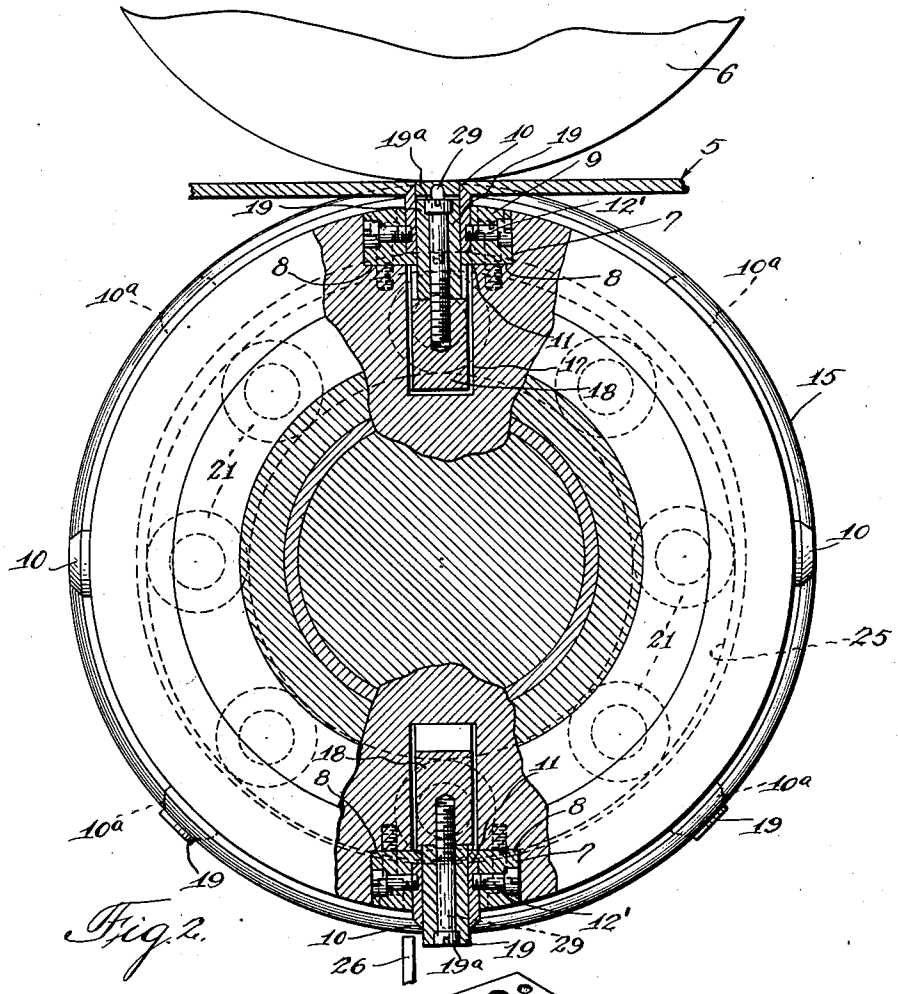

Fig. 2.

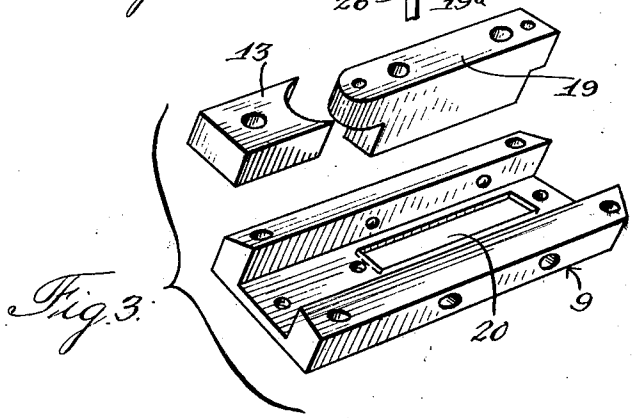

Fig. 3.

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CUTTING DEVICE

Original Filed Dec. 11, 1935 3 Sheets-Sheet 3

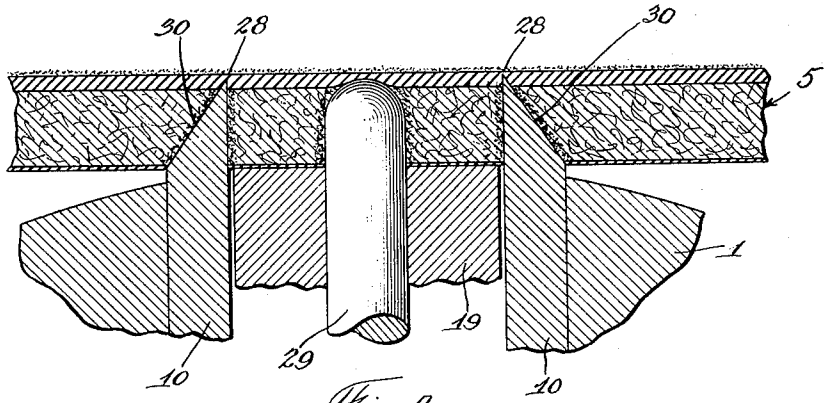

Fig. 4.

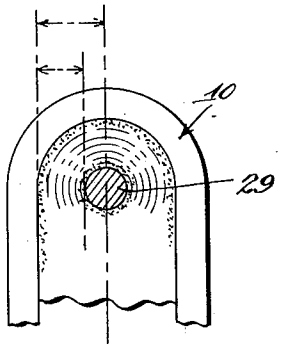

Fig. 5.

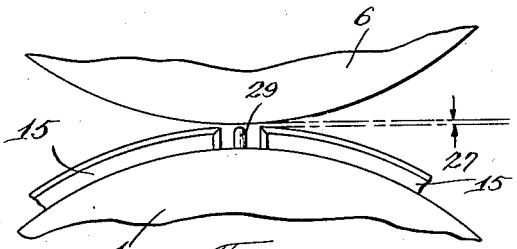

Fig. 6.

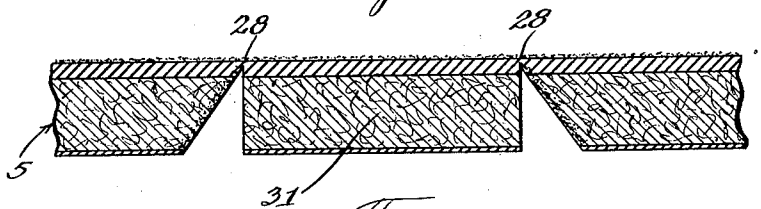

Fig. 7.

Fig. 8.

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Patented Oct. 12, 1937

2,095,631

UNITED STATES PATENT OFFICE

2,095,631

CUTTING DEVICE

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Continuation of application Serial No. 53,856, December 11, 1935. This application July 6, 1936, Serial No. 89,225

15 Claims. (Cl. 164—28)

This invention relates to the manufacture of covering elements, and more especially to the production of roofing elements intended to simulate a plurality of shingles or similar roofing elements.

This is a continuation of my prior application, Serial No. 53,856, filed December 11, 1935. The invention relates to producing, from comparatively thick sheets of fabric impregnated and coated with bituminous materials and preferably having a thin layer of granules on the bituminous coating, covering elements in which the units are simulated by tabs upon the element separated by spaces or cut-outs formed by removal from the sheet of a portion thereof.

Roofing strips intended to be laid in courses with the length of the strip in the coursewise direction and having formed upon one lengthwise edge of the strip a plurality of tabs separated by cut-outs heretofore have been proposed in many forms. Such strips have been made by various forms of cutting devices, including the so-called cylinder cutters in which the cutting knives are mounted upon the periphery of a rotor, and the sheet is delivered in tangential or peripheral contact with the rotor and in such relation to the blade of the knife by means of a so-called "anvil roll" that when the knife has passed through the point of tangency of the sheet with the rotor, the sheet will have been severed by the knife. In this action the motion of the knife in its peripheral movement about the axis of rotation has a component which is in a direction transversely of the surface of the sheet, which effects the cutting of the sheet to sever one portion thereof from the other. The present invention is particularly concerned with cutting cylinders or equivalent devices which are utilized for cutting sheets in this manner.

The material from which the roofing elements are made is usually a sheet of felt or similar fibrous material thoroughly impregnated with bituminous material, such as asphalt or other mastic, which is very adhesive. The bottom of the sheet is usually provided with a thin so-called "skin coating" of the same or similar mastic material, and a light coat of talc or mica is then applied to obviate the stickiness of the mastic surface. The top surface of the felt is provided with a comparatively thick layer of asphalt or other mastic, and this, in turn, is ordinarily coated with granules of slate or other stone.

In practice the cutting roll is provided with so-called "cut-out" knives for cutting out and removing small portions of the material. The roll is also provided with so-called transverse knives for slitting the material into a plurality of strips of a width corresponding to the length of the shingles. The cut-out knives cut completely through the material and usually actually contact with the anvil so that the cut-out portion will be held in the knives and carried around with the roll and finally ejected, or when ejectors are not used the cutting roll may be provided with hollow punches and recesses whereby the material is forced through the knives and out of the recesses by successive cutting operations. The latter structure is disclosed in the Cumfer et al. Patent No. 1,276,881.

In these prior devices it has been common practice to space the transverse knives slightly from the anvil roll to prevent the cutting edges of the knives from injury by the coating of granules adjacent the anvil roll. However, due to this spacing the strips remain connected by a thin uncut film on the cutting line. The material is then delivered to the usual combination of belts which are angularly disposed in different planes so that the film is ruptured by the spreading movement of the strips. However, in these prior devices it has been necessary to make the cut-out knives longer than the transverse knives for reasons stated above and these knives quickly become dull and nicked by the granules and require frequent sharpening or replacement. It is, therefore, an object of the present invention to provide a cutting device in which all of the knives may be of the same radial length and having their cutting edges spaced slightly from the anvil roll.

The present invention is particularly directed to an improved construction whereby the adhesiveness of the cut-out portions to the knives is sufficiently increased to cause the film to be ruptured and the portions retained in the knives until they are moved out of alignment with the sheet and discharged from the knives by means of a suitable ejector.

While a single embodiment of the invention is shown in the drawings and is described in the specification, the invention finds application to cutting devices having different forms. The invention finds particular application in those devices in which the cutting action proceeds in a continuous manner from the start of the cutting to the completion thereof, especially with concomitant motion of the sheet. This concomitant motion which, in the embodiment illustrated, is that occuring in feeding the sheet tangentially

to the peripheral motion of the rotor, is combined with a motion of the knife as stated above, which is transversely of the movement of the sheet or has a component in said transverse direction. In the embodiment illustrated, this is accomplished merely by the motion of the knife along the circumference of the circle about the axis upon which the rotor rotates.

Further objects will be apparent from the specification and the appended claims.

In the accompanying drawings,

Figure 1 is a side elevation partially in section of a cutting roll or cylinder and illustrates one embodiment of the invention;

Fig. 2 shows an end elevation of the device of the invention, parts being shown in section;

Fig. 3 shows parts of the knife holder and ejector block in perspective;

Fig. 4 is a transverse section through the knives and roofing material and shows the knives at the limit of their cutting movement;

Fig. 5 is a diagrammatic top view of one of the knives, and illustrates the method of compressing the cut-out portion while it is being cut to increase its adhesiveness and cause it to be retained in the knife until the operation of the ejector;

Fig. 6 is a diagrammatic view illustrating the clearance between the cutting edges of the knives and the anvil roll;

Fig. 7 is a sectional view of the roofing material after the cutting operation and before the cut-out portion has been removed, and illustrates the material when cut without the use of the compression pins; and

Fig. 8 is a slightly modified form of compression pin.

In the drawings, the embodiment illustrated comprises a rotor 1 constructed with a body 2 which may be cast or forged in generally cylindrical form, and may be provided with a shaft 4 cast integrally therewith and turned concentric with the axis of the cylinder. In the drawings the shaft 4 is shown extending at one end only of the rotor, only a portion of the length of the particular rotor illustrated being shown in the drawings. The shaft when mounted in suitable bearings makes possible the rotating of the rotor upon its axis in any desired way, usually by a spur gear on the end of shaft 4, which gear meshes with the driving train of the machine in which the rotor is located. A sheet of material 5 may, therefore, be contacted and severed when passed between the cutting rotor 1 and a counter cylinder or anvil roll 6.

In the periphery of the body 2 of the rotor is formed a substantially T-shaped slot 7 having shoulders 8 on which may be mounted a block 9 carrying a cut-out knife 10. The knife, as formed in the particular embodiment illustrated, is U-shaped and rests upon shoulders 11 formed in the block 9. By means of screws 12 passing laterally through the block 9 from each side thereof and having their heads countersunk in the block 9, the knife 10 may be held in place in the block 9, the screws being threaded into the knife 10. The block 9, together with the knife 10 securely held therein as described, may be inserted in and removed from the slot or recess 7. Bolts 12', having their heads countersunk in the block 9 and threaded into the body 2 of the rotor, securely but removably hold the block 9 in the recess 7. By removal of the block 9 from the recess, the knife 10 may be removed for the purpose of grinding or replacement. A smaller block 13 (Figs. 1 and 3) fits into the end of the knife supporting recess in block 9, with its concaved end fitting the outer curved side of the blade 10. It is secured in place by a countersunk screw bolt 14 threading into the bottom of the block 9.

The free ends of the blades of the knife 10 may abut the side of a circumferential so-called transverse knife or blade 15, preferably made in two parts or sections and carried by the rotor in any desired way in a peripheral groove at the ends of the U-knives. One or more transverse knives may be provided and secured in place in the usual manner. The blade 15 slits the sheet 5 along a corresponding longitudinal line. It will be understood that the form of the knife or blades 10 may differ, as also the area surrounded thereby, the particular form or forms shown being those present in the particular rotor chosen for illustration.

Suitable filler blocks 9^a may be provided to close the spaces in the rotor grooves or recesses at the ends of the knife blocks 9, and may be secured to the body of the rotor by suitable screws 9^b.

The stem of the T-slot forms a recess at 17 throughout the length of the rotor, as shown in cross-section in Fig. 2, to provide a space within which an ejector bar 18 may be arranged, said bar being of such cross-section with respect to the recess that it may be moved transversely of its length in a direction outwardly and inwardly of the axis of the rotor. As illustrated in Figs. 1 and 2, the ejector bar 18 is at the portion of the recess toward the axis when the knives are in cutting position. Outwardly of the bar 18 may be seen a space between the bar 18 and the bottom face of the block 9.

An ejector block 19 is secured to the ejector bar 18 by means of bolts 19^a threaded into the bar 18. This block is of such cross-section adjacent the bar as to fit the slotted portion 20 of the knife block 9, and at its outer portion is arranged to freely pass up between the blades of the knives 10. The dimension of the block 9 outwardly from the bar 18 is such that when the bar is in the recessed position, as shown at the top of Figs. 1 and 2, the outer end or face of the block 19 is inwardly of the cutting edges of the knives 10, so that, as may be seen in Fig. 2, the sheet 5 may be cut by the knives without interference of the block 19.

Upon the ends of the ejector bar 18 are mounted rollers 21 which are preferably exterior to the body 2 of the rotor.

A cam or eccentric plate 22 is formed as a ring with its internal diameter fitting to the shaft 4 and stationarily held against the body 2 of the rotor by means of an annular flange 23 fitting over the end of the shaft bearing and secured against rotation by means of set screws 24. In the face of the cam plate 22 is formed a cam groove 25 to operatively receive the roller 21.

The cam surfaces, which are shown in dotted line in Fig. 2 in the particular embodiment illustrated, are cylindrical surfaces parallel to each other. These surfaces, however, are formed eccentric with the axis of the rotor. A cam plate 22 may be provided at each end of the rotor 1, each cam plate having a similiar groove formed with eccentric cam surfaces and positioned in like relation as to direction of eccentricity with respect to the axis of the rotor.

In view of the eccentricity of the cams and the engagement of the rollers therewith, it will be understood that as the rotor rotates upon its axis and as the body 2 of the rotor carries the bar 18

and its block or blocks 19 around the axis, the cam rollers 21 will be moved outwardly and inwardly with respect to the axis of the rotor in a complete revolution or rotation upon its axis. Thus, the ejector block 19 will be moved outwardly and inwardly within the space between the blades of the knife. In the rotation from the position shown in Fig. 2, where the upper knives are in cutting engagement with the sheet 5 and the block 19 is withdrawn below the edges of the knife blades 10, the block 19 will be moved outwardly between the blades until at the quarter revolution substantially the outer face of the block 19 may be at the periphery corresponding to the cutting edges of the knife blades 10. In this movement the piece of material which may be retained in the knives from the cut just finished has been pushed out between these blades and may fall clear of the rotor. If by the adhesiveness of the saturating or coating materials or for other reason the piece adheres to one or the other knife or pins in the next quarter revolution, a further movement of the block 19 is produced to completely push the severed piece clear of the knife blades. Thereafter, upon further rotation of the rotor, the block 19 recedes again between the knife blades; and when the blades are about to again come into cutting relation with the sheet 5, the face of the block 19 has receded below the edges of the blades, so that the cutting may be started and completed without interference by the block 19.

It will be understood that although in the illustrated embodiment the cam surfaces have been shown in the simple form provided by parallel cylindrical surfaces eccentric to the axis of the rotation of the rotor, other forms of cam surfaces may be used to effect a quick ejection or a dwell in the different portions of the revolution. The device illustrated, however, provides an easy motion which is mechanically positive and is effective to move the ejector block between the knife blades and to eject the severed piece from between the blades.

Any desired number of cutting knives 10, ejector bars, recesses therefor, etc., in circumferential alignment around the rotor or cylinder may be provided. In the embodiment shown there are four, which are at 90° apart around the cylinder. A second set of the same number, but with the knives 10 reversed as to their open and closed ends, is similarly arranged on the other side of the circumferential knife 15, but with the individual knives midway around the cylinder between those of the first set. The rotor is recessed longitudinally for the ejector bars for this second set as well as for the first set, making eight such recesses and bars in all. The position of this second set of knives around the rotor is indicated in Fig. 2 at the points.

The rotor, in practice, is ordinarily of such length as to accommodate such a double row of knives at each end, the same longitudinal recesses and ejector bars serving both rows or sets. There is thus a plurality of ejector blocks on each ejector bar. A suitable circumferential knife, such as 15, may be provided on the rotor midway between these double sets to slit the sheet of material longitudinally, thus forming the sheet into four strips of shingles, and suitable longitudinal knives may be located on the periphery of the rotor to cut the shingle strips into lengths to form sheets for packaging.

A resilient sheet-like member 26 may be suitably secured to the frame of the machine to brush across the face of the ejectors 19 in their lower positions to remove any cut-out pieces tending to stick to the ejectors.

As previously stated, the present invention is particularly desirable for cutting and removing portions from an asphalt-impregnated and granule-coated web of roofing material. Cutting through the latter requires considerable mechanical effort and results in a speedy dulling of the cutting tool. In the present invention, therefore, the cutting tool is arranged to cut the grit-surfaced roofing from the bottom up, and the cutting movement is limited so that the cutting edges of the knives are not brought into appreciable dulling contact with the granules. In order to accomplish this desirable result, the cutting rotor 4 and the anvil roll 6 are spaced to provide a slight clearance between the cutting edges of the knives and the anvil roll, as diagrammatically indicated at 27 in Fig. 6. This clearance may be predetermined in accordance with the thickness of the granule coating. All of the knives on the roll may be of the same radial length to provide the same clearance.

An approximate depth of cut is illustrated in Figs. 6 and 7, and it will be noted that the granules themselves, together with the small amount of asphalt associated therewith, form a retaining film at 28, and this film must be positively broken along the cut lines in order to remove the cut-out portion from the material. A problem is therefore presented which is entirely different from that encountered in cutting plain sheets of paper in which the sheet is completely severed by the knives.

In order to assure the rupture of the film and the positive removal of the cut-out portion from the sheet of material, means are provided for causing a much greater frictional engagement of the cut-out portion between the knives than would normally be present. For this purpose pins 29 are secured in the knife supporting blocks 9 and extend through the ejector blocks 19. These pins terminate adjacent the plane of the cutting edges of the knives and assist in guiding the ejector blocks. The outer ends of these pins are preferably rounded, as in Fig. 4, or may be slightly tapered, as in Fig. 8, although other forms of pins may be used with satisfactory results.

As shown in Fig. 4, the inner surfaces of the knives are preferably flat and substantially parallel, while the outer surfaces are beveled at 30 to provide cutting edges at the inner surface line. The beveled outer surfaces allow the knives to withdraw freely from the body of the material 5, while the flat parallel inner surfaces tend to hold the cut-out portion therebetween by friction. However, it has been found that this tendency is ordinarily not sufficient to rupture the uncut film. Therefore, the pins 29 have been provided to co-operate with the knives to provide a retainer sufficiently positive in its action to cause the film to be ruptured at 28 and retain the cut-out portions in the knives until they are ejected by the ejector blocks 19.

Fig. 7 is a sectional view of the material as cut without the use of the compression pins and illustrates the cut-out portion, 31 retained in the body of the material by the films 28. It will be noted that when the pins are not used there is no tendency for the material to be compressed between the blades, and the knives are therefore withdrawn without rupturing the film.

In the operation of the present invention as

illustrated in Figs. 4 and 5, the compression pins 29 are forced into the material substantially simultaneously with the cutting operation, and the material is pressed outwardly against the parallel sides of the knives. Fig. 5 in particular clearly illustrates that a relatively very large volume of material may be displaced by the pins, and this material is tightly compressed between the pins and the knives. Furthermore, the adhesive impregnating material is squeezed to the surface adjacent the knives and pins and assists in retaining the cut-out portions snugly within the knives until they are ejected.

The anvil roll and cutting roll may be operated at any desired relative speed by means of a suitable gear train. The gear train may be driven from any suitable power source. The rolls may be independently driven from a suitable power source if desired. It will, of course, be understood that, if desired, the rolls and knives may be adjusted so that some or all of the knives may cut completely through the material.

Various modifications and changes may be made without departing from the spirit or scope of the invention as intended to be covered by the claims.

Having thus described the invention, I claim:

1. In an automatic device for cutting material of the character described, means providing a cutting edge for severing a portion from said material, means for forcing the severed portion of the material cut from contact with the cutting edge, and means for pressing said material against said cutting means to positively retain said severed portion until so forced from said contact by said forcing means.

2. In an automatic device for cutting material of the character described, a knife having a blade in a plane transverse to the surface of the material to be cut, means movable in a direction transverse to said surface of said material and arranged to displace from contact with said blade the severed portion of the material, and means by which said severed portion is engaged by compression between said means and said blade and retained until said movable means acts so to displace said severed portion.

3. In an automatic device for cutting material of the character described, a rotary body, radially extending knives on the periphery of the body arranged to cut portions from a sheet of material moving tangentially of the body, and retaining means for penetrating and squeezing said cut portions between said means and said knives to positively engage and retain the cut-out portions in the device until the knife is out of cutting position, and means thereafter operative to remove said portions from said rotary body.

4. A cutting device for the purpose described comprising a movable knife for cutting portions from a web of material, means for moving said knife to cut said material, means to limit the depth of the cut to less than the thickness of the material, and means cooperating with said knife to rupture the material on the line of the cut and to remove said portion from said web.

5. A cutting device for the purpose described, comprising a movable knife for cutting the outline of a portion to be removed from said material, means to limit the depth of cut to less than the thickness of the material, and means within the cutting outline of said knife and constructed and arranged to cause the said portion to be retained within the knife and forcibly removed from the material during movement of the knife.

6. A cutting device for the purpose described, comprising a hollow movable knife for cutting a portion from a web of material, means to limit the depth of cut to less than the thickness of the material, and means within said knife to cause said cut portion to be retained in said knife and rupture the material on the line of the cut during withdrawal of the knife from said web.

7. A cutting device for the purpose described, comprising a hollow movable knife for cutting a portion from a web of material, means to limit the depth of cut to less than the thickness of the material, means within said knife to cause said cut portion to be retained in said knife and rupture the material on the line of the cut during withdrawal of the knife from said web, and means for automatically ejecting said portion from said knife after withdrawal of the knife from the material.

8. A cutting device for the purpose described, comprising a hollow movable knife for cutting a portion from a web of material, means to limit the depth of cut to less than the thickness of the material, and means within said knife constructed and arranged to squeeze said portion against said knife to cause said portion to be retained in said knife and to rupture the material on the line of the cut during withdrawal of the knife from said web.

9. A cutting device for the purpose described, comprising a hollow movable knife for cutting a portion from a web of material, means to limit the depth of cut to less than the thickness of the material, and fixed means in said knife and arranged to penetrate and laterally displace the material toward said knife with sufficient pressure to retain the cut portion therein and rupture the uncut material on the line of the cut when the knife is withdrawn from the web.

10. A device for removing portions from sheet building material comprising a knife, an anvil, means to cause relative movement thereof to cut material inserted therebetween, said knife and said anvil being operatively related to limit the depth of the cut to less than the thickness of said material, and means cooperating with said knife to rupture the uncut material on the line of the cut and to remove said portion from said sheet by further relative movement.

11. A shingle cutting device, comprising a cutting roll having circumferential knives for cutting portions from a web of impregnated building material and transverse knives for cutting the web into strips, the cutting edges of all of said knives being substantially the same radial distance from the axis, an anvil roll for cooperation with said cutting roll, said anvil roll being spaced slightly from the cutting edges of the knives whereby the depth of cut is less than the thickness of the material, and means on said cutting roll for rupturing the uncut film at the cutting line of the cut out portion.

12. In a device for cutting material of the class described, a rotary body, spaced knives on said body and having their cutting edges extending beyond the surface of said body, said knives being arranged for cooperation with an anvil to sever a portion from a sheet of said material moving in tangential relation to said body, means between said knives and within the plane of the cutting edges and constructed and arranged to laterally compress the severed material against

the sides of the knives whereby the severed portion is retained within the contour of the knives by adhesive frictional engagement therewith.

13. In a device for cutting material of the class described, a rotary body, spaced knives on said body and having their cutting edges extending beyond the surface of said body, said knives being arranged for cooperation with an anvil to sever a portion from a sheet of said material moving in tangential relation to said body, means between said knives and within the plane of the cutting edges and constructed and arranged to laterally compress the severed material against the sides of the knives whereby the severed portion is retained within the contour of the knives by adhesive frictional engagement therewith, and means to eject said severed portion from frictional engagement when said knives are moved out of cutting position.

14. In a device for cutting material of the class described, a rotary body, spaced knives on said body and extending substantially radially therefrom and constructed and arranged to cooperate with an anvil to sever a portion of said material inserted therebetween, means between said knives and within the plane of the cutting edges to retain said severed portion within the contour of the knives, and movable means to eject said severed portion when said knives are moved out of cutting position, said retaining means comprising pins on said body extending through said ejecting means and terminating substantially at the plane of the cutting edges and arranged to be forced into and to laterally compress said material against said material substantially simultaneously with the cutting operation.

15. In a rotary cutting device for material of the character described, the combination with a rotor having a peripheral recess, a supporting block in said recess, a knife carried by said block and having its cutting edge arranged to cut a portion from a sheet of material moving in peripheral relation to the rotor, and a reciprocating ejector block substantially filling the space within the knife and having a reduced portion passing through a corresponding aperture in the bottom of said supporting block, of a plurality of fixed pins secured to said supporting block and passing freely through said ejector block, said pins being within the contour of said knives and the plane of the cutting edges and constructed and arranged to forcibly compress said cut portion against said knives simultaneously with the cutting operation and to cause said portion to adhere to the side of said knife and to be retained by adhesive frictional engagement therewith.

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