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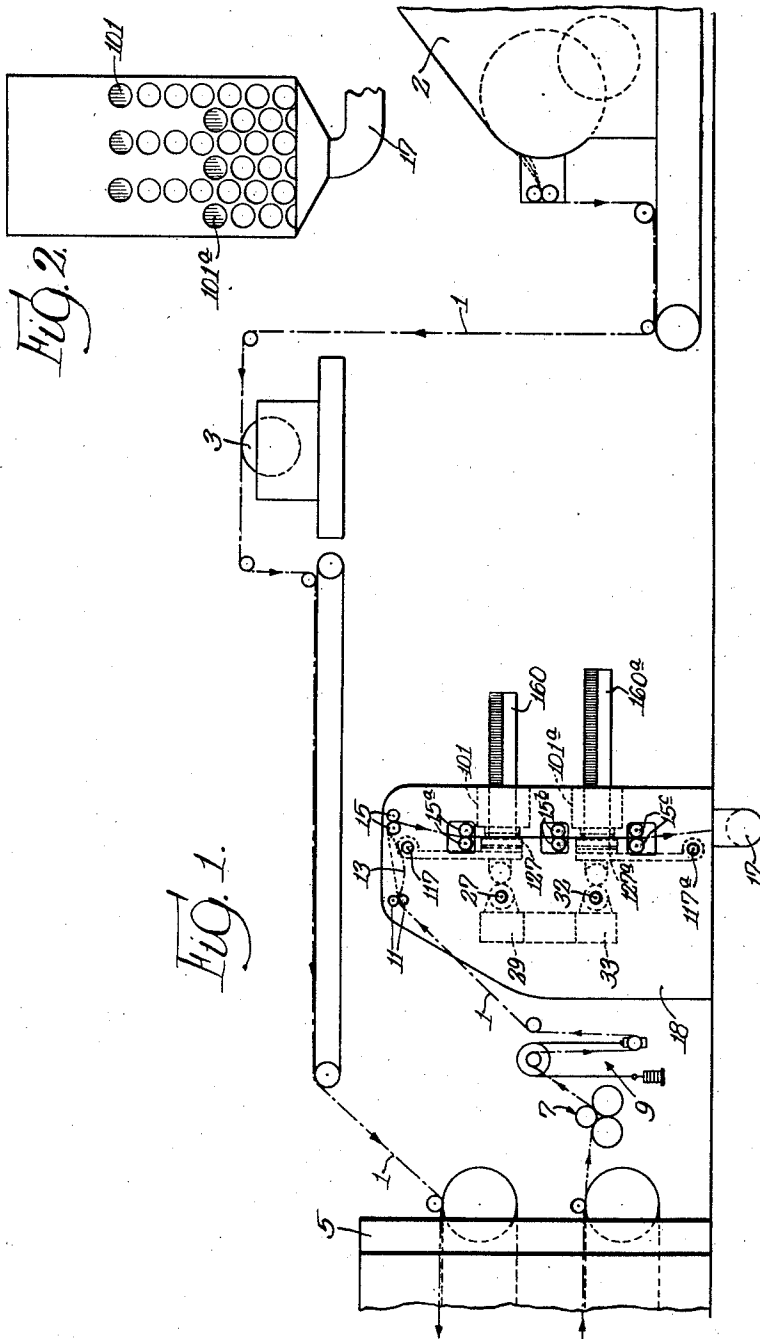
P. KORSGAARD

2,307,889

METHOD AND APPARATUS FOR CUTTING WEBS

Filed Aug. 13, 1941

3 Sheets--Sheet 1



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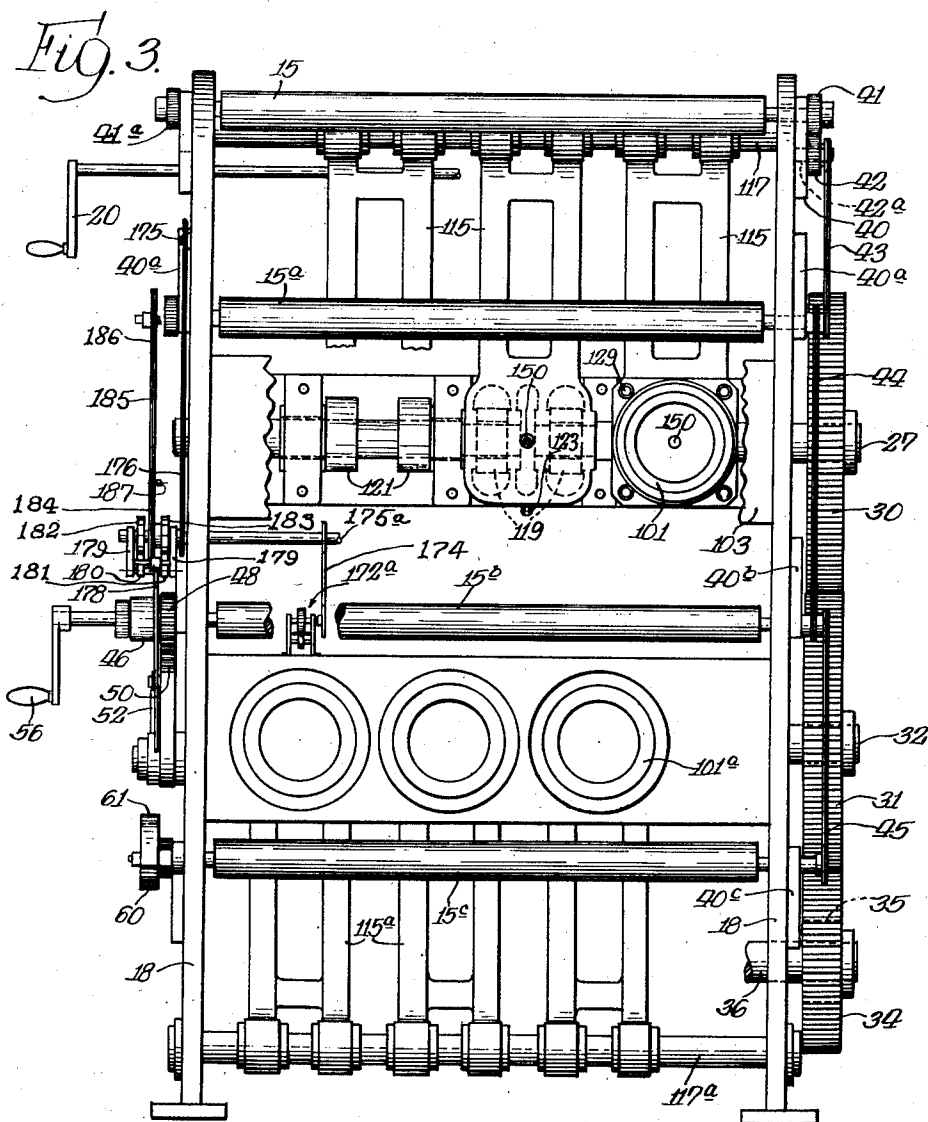
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METHOD AND APPARATUS FOR CUTTING WEBS

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3 Sheets-Sheet 2



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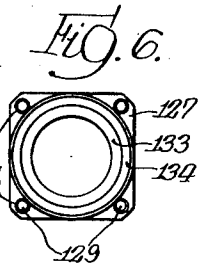
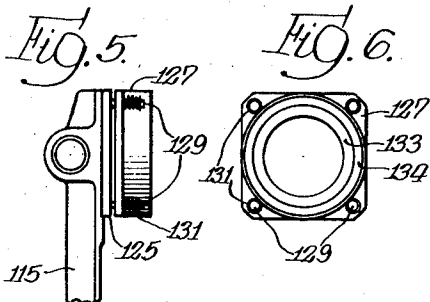
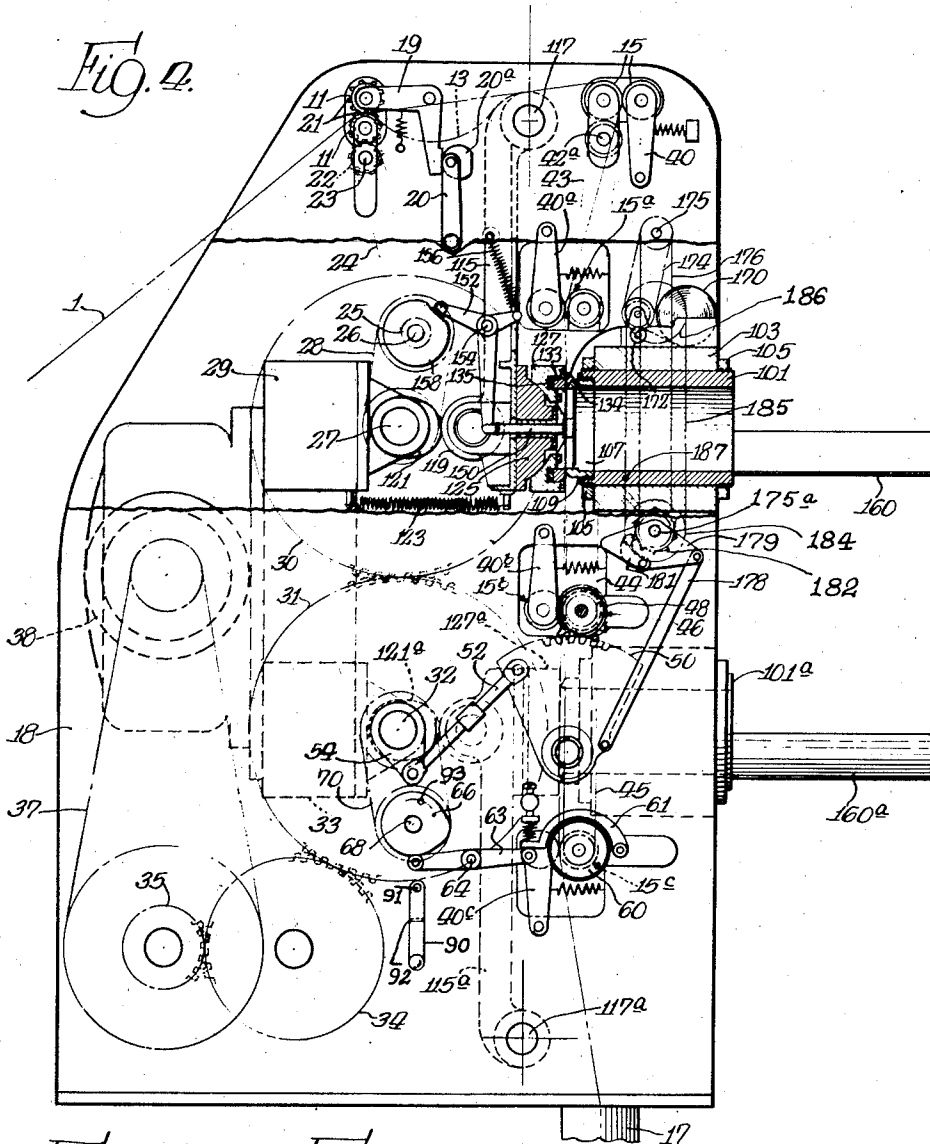
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METHOD AND APPARATUS FOR CUTTING WEBS

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3 Sheets--Sheet 3



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UNITED STATES PATENT OFFICE

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METHOD AND APPARATUS FOR CUTTING
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Application August 13, 1941, Serial No. 406,643

22 Claims. (Cl. 164—22)

This invention relates to the manufacture of filter discs and more particularly those manufactured from thin tenuous sheets of material.

Filter discs of this type are used extensively in the processing of milk where discs of thin webs of carded cotton are employed. In some instances these carded webs of cotton are faced on one side with a disc of gauze, in other instances they are faced on both sides with discs of gauze, and in still other instances the carded webs are used without fabric reinforcing.

It has been the practice in the past to die-out or punch these discs from a strip of material either by punching a single disc at a time, or by punching a plurality of discs at one time with a multiple die head. In the latter instance, it also has been customary to stack a plurality of cut sheets of web together and punch through these stacked sheets with a multiple die head. The foregoing procedures, however, are unsatisfactory, i. e., when a single disc is being punched and when plurality of discs are being punched because even in the latter procedure it is necessary first to stack the multiple piles of webs, align them properly under the die head, cause the die head to puncture through the stacked sheets, and then remove both the cut discs and the remainder of the web, and repeat this procedure for each successive stack of webs. Obviously such procedures are uneconomical both as to cost and time consumed.

As is appreciated by those skilled in the art, many problems are involved in handling tenuous webs of material such as carded slivers of cotton and particularly in cutting clean-cut sections such as discs therefrom. The very filmy nature of the material makes it difficult to feed in a continuous manner and the structure of the sheets, that is, the fibrous character thereof makes it difficult to sever in a clean-cut manner without drawing or dragging more or less fibers. This latter difficulty is particularly troublesome when it is attempted to cut discs from a continuously traveling web of filmy material such as a carded web of cotton or other cellulose fibers. The matter of retaining the web taut and properly supporting it while accurately and cleanly cutting and the carrying away of the scrap material presents even further problems particularly in a continuously operated machine.

It is the purpose of this invention to provide an improved method and machine for cutting filter discs from a continuous web of tenuous fibrous material such as a carded web of cotton in a continuous operation and in such a manner

as to permit economical and efficient manufacture of filter discs on a mass production scale as distinguished from piece operation.

Other objects and advantages will be apparent from the following description given in connection with the drawings in which:

Figure 1 is a schematic lay-out drawing illustrating the method and mechanisms used in manufacturing filter discs in accordance with this invention;

Figure 2 is a front elevation of a section of web illustrating the pattern or position of the cuts made by the several cutting dies;

Figure 3 is an end elevation of the die-out machine taken from the discharge end of the machine;

Figure 4 is a side elevation of the die-out machine partly in section and taken on three different planes, the better to illustrate certain interior portions thereof;

Figure 5 is an enlarged side elevation of the anvil for engaging the cutting die; and

Figure 6 is an end elevation of the same.

General operation

Referring to the drawings, the general lay-out and method will first be described for a better understanding of the mechanisms involved. As illustrated in Figure 1, a web of cotton 1, is illustrated as coming off a card machine 2, of any well known construction from which the web is passed through a starch mangle 3, and a drier 5, after which it is passed between a set of draw rolls 7, and then through a constant tension or take-up device 9, to the constant feed rolls 11, for receiving the web at the upper end of the die-out machine. From the constant feed rolls 11, the web is permitted to form a take-up loop as at 13, and is then fed to the upper of four sets or pairs of vertically arranged and intermittently rotated feed rolls 15, 15a, 15b, and 15c, and into a suction pipe 17, which receives the remnant or scrap web after the discs have been cut therefrom, and transfers the scrap to a re-work machine (not shown). The loop 13 is necessary to accommodate the alternately taut and slack condition of the web created in converting the continuous feed to an intermittent feed.

The change from continuous to intermittent feed is desirable because the web is initially formed and is passed through the starch, drying, and drawing apparatus and thereafter discharged in a continuous manner whereas due to the structural character of the web, it is very difficult, if not impossible, to cut portions therefrom while

there is any appreciable relative linear movement between the web and cutting device. It is therefore desirable to feed the web intermittently and in such a manner through the cutting device, that the web is stationary while the actual cut is made and is fed or moved between cutting operations of the cutting mechanism. With the foregoing in mind, the feeding mechanism will first be described.

Feeding mechanisms

As previously stated, the carded web either with or without a fabric facing on one or both sides is guided by any suitable means from the constant tension take-up roll to the upper constant speed feed rolls 11, extending across the machine between the side plates 18. The upper feed roll 11, is carried by the rear end of the arms 19, pivoted to the side plates, and is spring urged toward the lower roll journaled in the side plates 18, as illustrated in Figure 4. In order to permit separation of the two rolls 11, for insertion or release of the web, arms 19 may be rocked clockwise by the release mechanism 20, which actuates a pair of cams 20a to rock arms 19 clock-wise (Fig. 4) and raise the upper roll 11.

The rolls 11, are geared together for positive rotation by gears 21, and the lower feed roll is driven through the lower gear 21, carried upon one end of said roll and which engages a reversing gear 22, on a counter shaft 23, which latter gear in turn is driven by a chain 24, passing over a sprocket on shaft 23, and also over a sprocket 25, on the upper stripper cam shaft 26, also journaled in the side plates 18. Shaft 26, is in turn driven from the upper main cam shaft 27, by a chain 28. The upper cam shaft 27, is journaled in bearings carried by the upper rear bolster plate 29, and is driven through a gear 30, secured to the shaft and which engages a gear 31, carried by the lower main cam shaft 32, journaled in bearings carried by the lower rear bolster plate 33. Both bolster plates 29 and 33, are supported by the side plates 18. Gear 31, is driven by an intermediate gear 34, which in turn is driven by gear 35, on a shaft 36, which in turn is driven through V-belt 37, from the main motorized variable speed unit 38, also carried by the bolster plates 29 and 33. It will be understood that the foregoing train of driving mechanism is so selected that the various shafts and the continuous feed rolls are driven at the desired speeds.

As previously stated, the web which is received by the constant feed rolls 11, is fed thereby to the first or upper set 15, of a series of four pairs of vertically arranged, intermittently driven feed rolls 15, 15a, 15b, and 15c. Each pair of these rolls is arranged so that one roll may be moved away from the other to facilitate threading the web through the machine, and for relief in case of jams. Each pair is geared together on the left side of the machine, and powered on the right side, a reversing gear being employed to obtain the desired direction of rotation as will be explained hereafter. A take-up loop or slack is provided between the constantly driven rolls 11, and the intermittently driven upper rolls 15, as previously stated.

In the case of the upper rolls 15, the outer roll is the movable roll and is supported by the free ends of arms 40, pivoted on the side plates 18. The arms 40, are spring urged counterclockwise thus urging the rolls 15, together. The two rolls 15, are geared together by gears 41a (Fig. 3) and the inner roll of the upper rolls 15, is driven

through gear 41, which engages a reversing gear 42, on the stub shaft 42a. The latter shaft is driven by a chain 43, which engages a sprocket on the stub shaft 42a, and a sprocket on the outer roll of the adjacent lower pair of rolls 15a, which rolls are also journaled in the side plates 18, and are geared together by gears similar to gear 41a. The inner roll of rolls 15a, is the movable roll and is supported by the free ends of arms 40a pivoted to the side plates 18, and spring urged counterclockwise (Fig. 4) to cause the rolls 15a to approach each other. The outer roll of the rolls 15a, is driven by a chain 44, engaging a sprocket on the outer of rolls 15a and the outer of rolls 15b, the latter also being journaled in side plates 18. The rolls 15b, are geared together on the left side of the machine (Fig. 3) and the outer roll 15b, is driven by means later to be described. The inner roll of the pair of rolls 15b is the movable roll of this pair and is supported by spring urged arms 40b, similar to arms 40a. The lowermost pair of rolls 15c are also geared together and the outer roll is driven from the outer roll 15b by a chain 45, traveling over sprockets on the outer of rolls 15b and 15c. The inner roll 15c is the movable roll and is supported by arms 40c pivoted to the side plates 18, and spring urged clockwise so as to cause the two rolls 15c normally to engage each other.

In order to intermittently rotate all four sets of rolls 15, 15a, 15b, and 15c, the outer roll 15b, is provided with a one-way clutch 46, which carries a gear 47, engaged by a toothed sector gear 50, which is connected by connecting rod 52, to a crank 54, secured to the lower cam shaft 32, which in turn is driven from the drive unit 38, as previously explained. Variations in feed may be obtained if desired by an eccentric stud (not shown) at one end of the rod, the angular position of which stud increases or decreases the crank circle. The latter mechanism is so constructed that upon clock-wise movement of sector 50, the four pairs of feed rolls 15, 15a, 15b, and 15c are all rotated in a direction to feed a web therebetween downwardly the proper distance for one series of cutting operations by the cutting mechanism as will be later described. Upon return or counterclockwise movement of sector 50, the feed rolls remain stationary due to the over-riding of the one-way clutch 46.

In order to facilitate initial insertion or feeding of a web through the intermittently driven feed rolls, the outer feed roll 15b, is provided with a hand crank 56, (Fig. 3), by means of which the intermittently driven feed rolls may be manually operated.

In threading the machine, with clutch 46, disengaged or power off, as the end of the material is passed through rolls 11, 15, 15a, etc., slack may accumulate between the press and drier. This may be taken up by hand cranking the feed rolls at a higher rate of speed than the power rate. After the slack is taken up and proper tension obtained, the clutch is engaged or power turned on, and the power feed picks up from the hand feed.

To insure for more accurate feeding of the web by the intermittently operated feed rolls, and to prevent the momentum of the rolls from causing them to over-ride the one-way clutch at the end of the power stroke of the sector gear, the inner lowermost roll 15c, carries a brake drum 60, which is engaged by a brake arm 61, spring urged into contact with the drum thus preventing any free and unwanted movement of

the feed rolls. The brake arm 61, is automatically periodically released, so as to permit rotation of the feed rolls, by rotation of a lever 63, pivoted intermediate its ends at 64. The other end of the lever 63, carries a roller which engages a cam 66, carried by the lower stripper cam shaft 68, which in turn is driven by a chain 70, from the lower main cam shaft 32. Cam 66 is so shaped and timed as to release the brake just before the power stroke of the sector gear commences, and to gradually apply the brake just before the end of the power stroke and prevent any over-running of the feed rolls and accurately controlling the movement thereof. Thus the brake mechanism in combination with the accurately adjustable feeding mechanism produces an extremely accurate control of the feed of the web.

To facilitate insertion or threading of the web with the machine stationary and in open die position means are provided for releasing the brake to permit hand cranking of the machine. This means consists of a crank 90 pivoted at 91 and carrying a wedge 92. When the crank is rotated clockwise wedge 92 enters between the cam 66 and the cam roller rocking lever 63 counter-clockwise to release the brake. When the machine is again operated under power a small lug 93 on the cam 66 strikes the lug 92 and removes it from between the cam and the cam roller thus restoring the brake to automatic operation.

From the foregoing, it will be understood that the web to be cut is led from the carding machine through the starcher, drier, draw rolls, tension rolls, and feed rolls 11, in a continuous manner, which continuous feed is converted to an intermittent feed by rolls 15, 15a, 15b, and 15c, by which the web is fed through the machine and the remainder into the suction pipe 17. During the intermittent periods when the web is stationary the cutting of the discs takes place.

Cutting mechanisms

The cutting of the discs takes place in two stages of successive cuts, i. e., first a series of three discs are cut out successively across the width of the web and immediately thereafter a second series of three discs are cut successively and in staggered relation to the first three discs across the width of the web. It has been found slightly preferable to so arrange the cutting of the discs that each of the six discs cut from the web are cut successively over a short period of time all within the stationary period of the web rather than in a succession of groups of cuts and much preferably to cutting all discs in one single cut. The mechanism for cutting the discs from the web of material will now be described.

The illustrated machine has provision for die-cutting six discs from the web of carded material as it is passed between rollers 15a, 15b, and 15c. Three discs are cut, preferably in rapid succession, with their centers upon a common horizontal line extending midway between and parallel to rollers 15a, and 15b, during that period when the web is stationary, between feeding movements. A second series of three discs is cut by a second but similar set of dies and associated mechanisms, also preferably in succession and with the centers of the discs arranged on a common horizontal line midway between and parallel to rolls 15b and 15c. These latter discs are preferably cut a little later in the cutting cycle than the cutting of the first three discs and furthermore are arranged in staggered relation to

the first three discs both vertically and horizontally as is clearly shown in Figure 2.

The mechanism for cutting these discs from the web is of the type employing a stationary cylindrical die and a movable anvil although it is conceivable that the reverse order could be employed. The mechanism for cutting the upper three discs is similar to that for cutting the lower three discs, therefore the upper series only will be described in detail. As can be seen particularly from Figs. 3 and 4, there are provided three cylindrical horizontally arranged upper die holders 101, carried by a horizontal rigid upper and outer bolster plate 103. The die holders are preferably threaded and adjustably retained within the bolster plate by means of inner and outer adjusting nuts 105. The cutting edge of the die is preferably made of a separate and removable insert 107, fitted into the end of the die member 101, and detachably held thereto by a lock ring 109.

Operatively associated with each of the dies 101 is an oscillating anvil. It is preferred to mount each anvil independently in order to provide for separate adjustment of each anvil relatively to its die although the three anvils may be carried by common support and operated as a unit from a single cam, if desired. As illustrated, each anvil is carried by an arm 115, pivoted about a horizontal axis 117, above the dies, and offset from the plane of the cutting edge of the knife portion 107, of the die 101, for reasons which will appear more clearly hereafter. The lower end of the arm which carries the anvil is provided with a pair of rollers 119, which engage a pair of cams 121, carried by the upper main cam shaft 27, and is retained in engagement therewith by a tension spring 123, secured to the arm 115, and the bolster plate 29. The cams 121, are so arranged and timed that the arm 115, and the anvil carried thereby, is moved into engagement with the cutting die during that period in the cycle of operation when the web is stationary and held taut by the rolls 115a, and 115b, i. e., between feeding movements.

The anvil is carried by the lower end of arm 115, in such a manner as to permit universal adjustment of the anvil relatively to the cutting die and for this purpose is supported upon a dome-shaped base 125, rigidly secured to the lower end of arm 115, and comprises a cap or anvil block 127, having an under concave surface or socket, shaped to fit the dome-shaped base and to permit universal adjustment of the anvil to bring the outer die abutting face thereof in exactly the same plane as the plane of the die. The anvil block 127, is frictionally retained in contact with the base 125, by means of studs 129, (Figs. 5 and 6) projecting outwardly from the base member 125, and through the annular portion of the anvil block 127, in conjunction with springs 131 as shown in Fig. 5. The anvil block 127, is preferably provided with a hardened annular insert or anvil ring 133, seated within a groove formed within the outer face of the anvil holder and retained therein by a locking ring 134, in position to engage the annular cutting die 107. Anvil ring 133, may be cushioned within the anvil block 127, by means of a resilient seating ring 135, to permit minute and final adjustment of the anvil relatively to the die, as the two engage each other, and also to take up the shock of impact as the anvil strikes the die.

From the foregoing construction it will be obvious that complete and accurate adjustment of

the anvil relatively to the die is permitted and assured. In other words, cutting contact between the anvil and the entire cutting edge of the circular die is permitted and in fact caused whereby the thin tenuous web of fibrous material usually cotton, is cleanly cut upon contact of the anvil with the die.

As previously described, the die supporting arm 115, is pivoted about a point 117, offset from the plane of the cutting edge of the die 107. This offset distance is slightly greater than the thickness of the anvil and block, i. e., it is not merely an offset to compensate for the thickness of the anvil. Because of this construction, the anvil approaches the die through an arcuate path or compound movement having a component substantially normal to the plane of the die and a component inclined thereto and somewhat parallel to the plane of the web. The result is that although the anvil strikes the die squarely throughout the entire cutting edge of the die as the anvil first engages the die, the rubber insert yields slightly and there is a slight additional movement of the anvil along its arcuate path producing a slight wiping, or, in effect, combination cutting and tearing action of the anvil after it first strikes the die. This latter movement which is in addition to the movement of the anvil toward and from the die separates the cut disc from the web thus assuring absolute clean-cut separation of the fibers after engagement of the anvil and die and eliminates any pulling action or raveling of the fibers as the discs are separated from the web.

In the preferred embodiment of this invention there is a separate arm 115, pair of cams 121, and anvil mechanism for each die 107, and the cams 121, for the three upper anvils and associated dies are so arranged on shaft 27 that their high points are approximately 10 degrees apart from each other, thus each anvil is actuated at a little different period in the cycle of cutting operation and the operating load is distributed throughout the cutting cycle rather than being concentrated at one point. This tends to provide for a smooth operating machine having less vibration, shock, and strain upon the motor. It further permits of individual adjustment of each anvil to its associated die without affecting the setting of the other anvils and die.

To provide for a second series of three discs to be cut from the web, a second series of three dies 101a, are positioned between the feed rolls 15b and 15c. Cooperatively associated with these discs 101a are three anvil mechanisms 127a carried by arms 115a pivoted below the dies at 117a and at a point offset from the plane of cutting as explained in connection with the upper group of anvils. It is also preferred that these lower anvils be operated successively by cams 121a as described in connection with cams 121 and also successively with relation to the upper cams 121 so that the load and shock caused by the lower cams is spread over the cycle of cutting operation, while the web is stationary between feeding movements. As shown in Figures 2 and 3, the lower dies 101a are staggered so as to come in between the upper dies both laterally and vertically, thus permitting an extremely close grouping of the discs and minimizing the waste of web material. By spacing the lower dies an appreciable distance below the upper dies and operating the upper dies prior to the lower dies, sufficient web material remains after the first three discs are cut to permit proper feeding of the web

by the web itself and proper holding of the web while the second series of three discs is being died-out.

Stacking mechanism

A stripper mechanism is provided for positively ejecting the cut discs through the center of the die and stacking them. The ejector mechanism comprises a plunger 150, which projects through the center of the anvil and is connected to one arm of the three-armed lever 152, pivoted at 154, and urged counterclockwise by spring 156, attached to the second arm of the lever. The third arm of the lever carries a roller which engages a cam 158 carried by the shaft 26. While the plunger 150 could be actuated from the main cam shaft 27 it has been found preferable to drive the plunger from the upper shaft 26 to avoid congestion on shaft 27 and to give better control of the stripper mechanism. Cam 158 is so arranged and timed that plunger 150 is actuated to push the cut disc into the interior of the die immediately after it is cut by the anvil, and prior to the succeeding feeding movement of the web.

As the cut discs are discharged through the die they pass out on to a half circular rack 160, where they are stacked and may be collected and removed at will.

There is a stripping mechanism and discharge rack for each of the associated upper anvils and dies, and also a stripping mechanism (not shown) for each of the lower anvils which discharges the cut discs through the dies 101a and out through racks 160a.

Counting mechanism

In manufacturing filter discs of the tenuous material commonly used and contemplated being cut in the machine of this invention, it is desirable, although difficult, to count the discs after they have been cut, particularly at the speed at which the discs are cut.

For this reason a counting and indicating mechanism has been embodied in the machine which inserts an indicating medium such as a strip of paper into the stack of cut discs, after a predetermined number has been cut, as they are being discharged through the die, thus facilitating packaging of the discs after they are cut from the web. For this purpose a roll of paper tape 170, is supported above each die in position to be fed between a pair of feed rolls 172 (Fig. 4) thence through a sheet metal paper guide and over the cutting edge of the die 107. The upper roll is driven by a chain 174 (Fig. 4) from a shaft 175, which functions as a line shaft for three paper feeding mechanisms located on the upper bolster plate. Shaft 175 is driven by a chain 176 (Figs. 3 and 4) from another shaft 175a which functions as a line shaft for three paper feeding mechanisms located on top of the lower bolster plate. When shaft 175a is rotated a fraction of a turn, all six paper feeding mechanisms are actuated and eject a short piece of paper therefrom.

Shaft 175a is driven or actuated once in any desired number of cutting cycles by a pawl and ratchet arrangement driven by the sector gear through a connecting rod 178. The connecting rod rocks a pair of plates 179 journaled on the shaft 175a, which plates carry between them a pair of pivoted pawls 180 and 181, engageable with ratchets 182 and 183. The ratchet 182 is fixed to a sprocket 184 both being free to rotate on the shaft 175a, and advances one tooth each

stroke of the connecting rod 178, driving a chain 185, around an idler sprocket 186, spaced far enough away to allow for the number of chain links desired, this being the number of discs to be counted or indicated. The other pawl 181 is normally held out of engagement with the ratchet 183, by a spring. The ratchet 183 is fixed to the shaft 175a and when it is engaged by pawl 181, it will turn the shaft 175 and actuate all of the paper feeding mechanisms.

The engagement of the pawl 181 with the ratchet 183 is brought about at the proper intervals by a small roller 183, carried by an extended chain pin of the chain 185, which roller engages a laterally projecting lug on the pawl 181, and forces the pawl into engagement position with the ratchet. According to the number of links on the chain and the number of teeth on the ratchet the feed rolls 172 will be operated to feed a length of paper tape along with the web of material being cut so that upon the next cutting operation the tape will be cut and left projecting into the pile of discs. If the paper tape is of some readily distinguishable color, it will appear very plainly as the discs are discharged through the die and on to the racks 160, thus indicating any desired number of discs. It will be understood that there is also a counting mechanism as described, for each of the lower dies, a portion of which latter mechanism is shown at 172a (Fig. 3).

From the foregoing, it is believed to be apparent, particularly to those skilled in the art that there has been provided a method and machine capable of cleanly cutting and stacking discs from a relatively wide web of flimsy, tenuous material in a continuous operation and with a minimum of waste. It will also be readily understandable that when such a machine is used in connection with a series of devices as described complete processed, starched, and counted discs can be provided by a continuously operable system in an economical and efficient manner.

It will be obvious to those skilled in the art that minor deviations and variations may be made from the apparatus and method disclosed without departing from the spirit and scope of the invention as defined in the appended claims.

I claim:

1. The method of forming filter discs which comprises the steps of, intermittently feeding a web to a series of cutting dies, and successively cutting a series of discs with said dies while the web is stationary between each feeding movement.

2. The method of forming a filter disc from a web of material which comprises the steps of, intermittently feeding a web of material to a plurality of series of cutting dies, successively cutting a series of discs from said web of material while said web is stationary between feeding movements, and thereafter cutting a second series of discs successively in staggered relation to said first discs also while said web is stationary between feeding movements.

3. The method of forming filter discs which comprises the steps of, constantly feeding a web of material to a cutting machine, converting said feed to an intermittent feeding movement to a series of cutting dies, successively cutting a series of discs with said dies from said web while the latter is stationary between each feeding movement, and thereafter discharging the cut discs and scrap web.

4. The method of forming filter discs which

comprises the steps of, intermittently feeding a formed, treated, and dried web to a series of cutting dies; cutting a series of discs from said web while said web is stationary; and thereafter discharging said discs and scrap web from said machine.

5. The method of forming filter discs which comprises the steps of, intermittently feeding the formed, treated, and dried web to a series of cutting dies; cutting a series of discs from said web in succession while said web is stationary between feeding movements; and thereafter discharging the cut discs and scrap web from said machine.

6. The method of forming filter discs which comprises the steps of, constantly feeding a carded web to a die-cutting machine, intermittently feeding said formed web to a plurality of series of cutting dies, cutting a series of discs from said web while said web is stationary, thereafter cutting a second series of discs from said web while said web is stationary between feeding movements and in staggered relation to said first series, and discharging said discs and scrap web from said machine.

7. The method of forming filter discs which comprises the steps of, constantly feeding a carded web to a die-cutting machine, intermittently feeding said formed web to a plurality of series of cutting dies, cutting a series of discs from said web in succession while said web is stationary between feeding movements, thereafter cutting a second series of discs from said web successively and in staggered relation to said first series while said web is stationary between feeding movements, and discharging said discs and scrap web from said machine.

8. The method of forming filter discs from tenuous sheets of material which comprises the steps of, holding a web at two spaced points and cutting the web while so held by moving a cutting means into contact with said web in a direction normal to the plane of said web between said spaced points and also in a direction other than normal to the plane of said web after contact with said web.

9. The method of forming circular filter discs from tenuous sheets of material which comprises the steps of, supporting a web at two spaced points and cutting the web while so held by moving a circular cutting means into engagement with said web through an arcuate path.

10. The method of forming filter discs from thin tenuous webs which comprises the steps of, intermittently feeding a web to a cutting knife to be cut thereby when said web is stationary between feeding movements, holding said web between two spaced points, and moving the cutting knife toward said web through an arcuate path about an axis which is without the plane of said web between said two points.

11. The method of forming circular filter discs from thin tenuous webs which comprises the steps of feeding the web to a circular cutting knife, holding the web, moving the cutting knife toward said web and causing it to engage the web with a movement having a component substantially normal to the plane of the web where supported and a component diverging from said normal component.

12. The method of forming filter discs from a thin tenuous web of material which comprises the steps of, feeding a web of material to a cutting mechanism, interrupting the feed movement of said web momentarily, cutting a series of discs

successively from said web at each interruption of said feed, discharging the scrap material, and stacking the cut discs.

13. A machine for cutting discs from a filmy, tenuous web comprising two sets of intermittently driven feed rolls for feeding a web through said machine, a series of cutting dies and associated anvils arranged between said sets of feed rolls, and actuating means operable to move said series of dies and anvils together in succession to cut discs from the web therebetween while said web is stationary.

14. In a machine for cutting discs from a filmy, tenuous web in combination, constantly driven feed rolls for receiving the web, two sets of spaced and intermittently driven feed rolls for feeding said web through the machine, a common driving medium for driving said constantly and intermittently driven rolls, a series of cutting dies and associated anvils arranged between the two sets of intermittently operated feed rolls, and actuating means operable to move said dies and anvils together to cut discs from said web while said web is stationary between feeding movements.

15. In a machine for cutting discs from a filmy, tenuous web, in combination, feed rolls for receiving a web, driving means for continuously operating said feed rolls, sets of spaced feed rolls for feeding the web through said machine, a one-way clutch for operating said latter feed rolls, and means driven by said driving means for intermittently operating said one-way clutch to intermittently drive said sets of feed rolls, a series of cutting devices and associated anvils arranged between the sets of intermittently operated feed rolls, and actuating means operable to move said dies and anvils together to cut discs from said web while the latter is stationary between feeding movements.

16. In a machine for cutting discs from a filmy, tenuous web, in combination, sets of spaced feed rolls for feeding the web through said machine, driving means for intermittently operating said feed rolls, a series of cutting dies and associated anvils arranged between the sets of intermittently operated feed rolls, actuating means operable to move said dies and anvils together to cut discs from said web while the latter is stationary between feeding movements, a trough for receiving the cut discs, and means for inserting slips of material between the cut discs, after a predetermined number of discs have been cut.

17. A machine for cutting discs from a filmy, tenuous web comprising a plurality of sets of intermittently driven feed rolls, a plurality of series of cutting dies and associated anvils arranged with one series between adjacent sets of feed rolls, and actuating means operable to move said series of dies and anvils together successively to cut discs from said web while said

web is stationary between intermittent feeding movements.

18. In a machine for cutting discs from a filmy, tenuous, fibrous web, in combination, a plurality of sets of intermittently driven feed rolls for feeding a web through said machine, a plurality of series of cutting dies and associated anvils arranged with a series thereof between adjacent sets of feed rolls, and actuating means operable to move each of said dies and its associated anvil together successively to cut discs from said web while said web is stationary between intermittent feeding movements.

19. In a machine for cutting discs from a thin, filmy, tenuous web, cutting members comprising a die and a cooperating pivoted anvil adapted to be moved into contact with said cutting edge, the pivotal point of said anvil lying without the plane of said cutting edge whereby said anvil engages said cutting die with an arcuate tearing and cutting movement and resilient means carried by one of said cutting members and cushioning said member.

20. In a machine for cutting discs from a thin, filmy, tenuous web, in combination, cutting members comprising a cylindrical die having a circular cutting edge lying within one plane, a pivoted arm mounted for swinging movement toward and from said die and an anvil carried by the free end of said arm in position to engage the cutting edge of said die, the pivotal point of said arm lying without the plane of said cutting edge, whereby said anvil engages said cutting die with a movement in a direction substantially normal to the plane of said die and also in a direction other than that normal to the plane of said die to sever and separate the cut discs from the web and resilient means carried by one of said cutting members for cushioning said member.

21. In a machine for cutting discs from a filmy, tenuous web, in combination, a cylindrical die having a circular cutting edge, a pivoted anvil mounted for movement toward and from said die, said anvil being supported for universal adjustment with respect to the plane of said circular cutting edge, and a resiliently mounted contact ring carried by said anvil in position to engage the cutting edge of said die.

22. In a machine for cutting discs from a filmy, tenuous web, in combination, a cylindrical die having a circular cutting edge, a pivoted arm movable toward and from said die, an anvil carried by said arm in position to engage said die, an adjustable ball and socket connection between said arm and said anvil to provide a frictionally resistant universal adjustment between said anvil and said die, a contact ring carried by said anvil in position to engage the cutting edge of said die, and a resilient member between said anvil and said ring.

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