

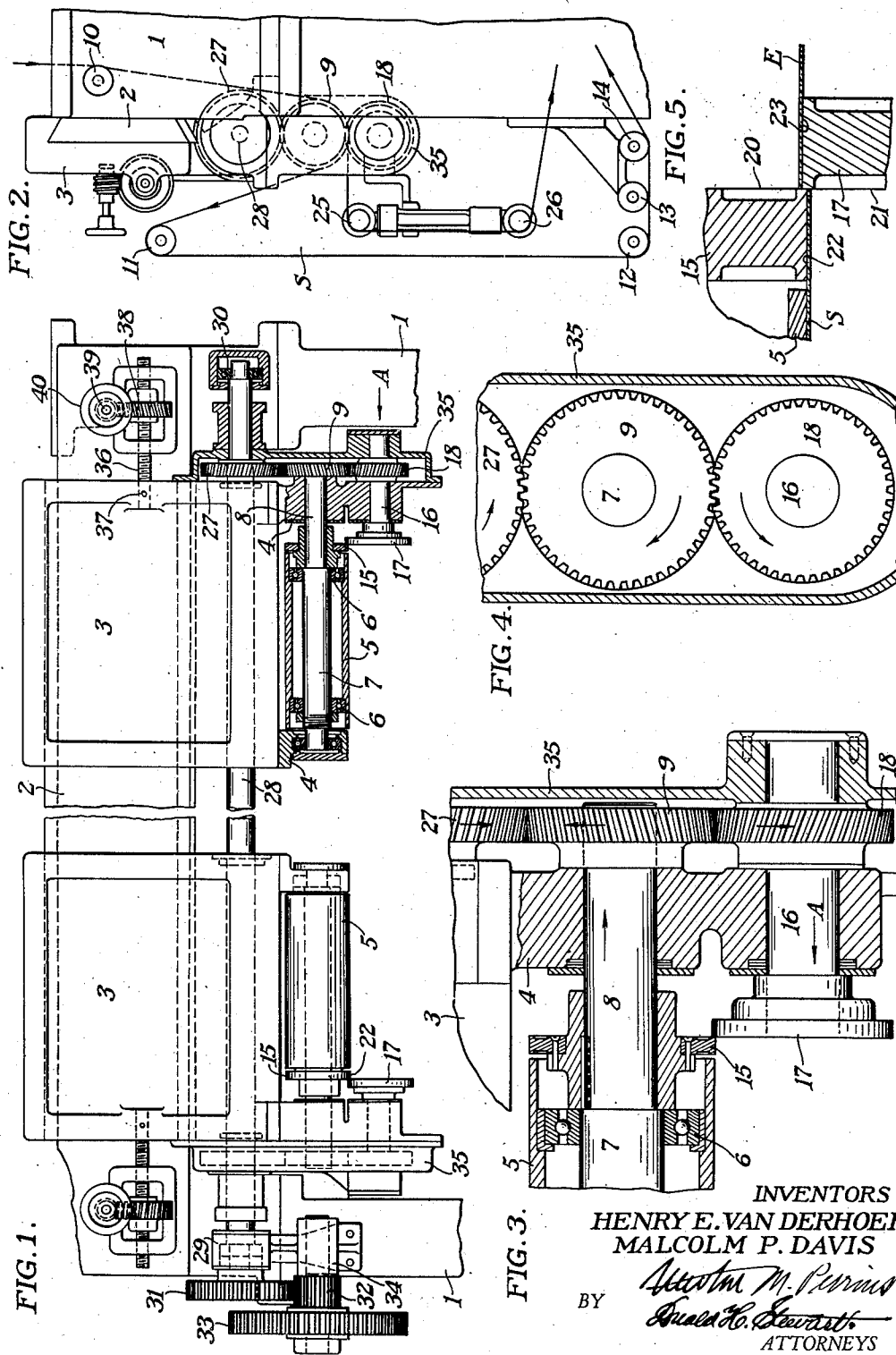
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SLITTING MACHINE

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SLITTING MACHINE

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This invention relates to machines particularly designed for producing accurately-formed slits in strip material, such as cellulose nitrate, cellulose acetate, or the like. One object of our invention is to provide a machine for slitting strip material in which the slitting knives can be readily held in operative relationship. Another object of our invention is to provide a machine of the class described, in which the moving parts, insofar as possible, are enclosed, and in which the lubricating means is enclosed to prevent soiling the sheet to be slit. Another object of our invention is to provide a means for holding the slitting knives in operative relationship which entirely omits the usual use of springs for this purpose. A still further object of our invention is to provide a slitting machine in which the position of the slitting knives relative to the strip material can be easily and accurately adjusted to different positions relative to the width of the sheet. A still further object of our invention is to provide a slitting mechanism which can be readily set up and taken down with a minimum of difficulty in accurately aligning the parts of the machine, in setting up the machine for operation, and other objects will appear from the following specification, the novel features being particularly pointed out in the claims at the end thereof.

This slitting machine may be considered an improvement over the slitting machine construction shown in Patent 2,238,481, granted April 15, 1941, in the name of Henry E. Van Derhoef.

Coming now to the drawings wherein like reference characters denote like parts throughout:

Fig. 1 is a fragmentary front elevation and part section of a typical embodiment of a slitting machine constructed in accordance with and embodying a preferred form of our invention;

Fig. 2 is a fragmentary side elevation of the machine shown in Fig. 1 with certain parts omitted for the sake of clearness;

Fig. 3 is an enlarged detailed section showing the relationship of the circular slitting knives when the machine is set up for operation;

Fig. 4 is a fragmentary detailed section of the gear drive for the slitting knives; and

Fig. 5 is an enlarged fragmentary sectional view showing the relationship of the slitting knives and their relation to a sheet being slit.

It has been comparatively difficult to provide machines which will satisfactorily slit long strips of material with a high degree of accuracy, particularly where the material may be of a cellulose acetate or cellulose nitrate sheeting. Many materials, and particularly such acetate sheet-

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ings, are liable to have undulations, or wrinkles, in the material as it passes through its normal path, so that if the material is slit in this wrinkled condition, it is impossible to obtain accurate dimensions between slits. Moreover, there is quite a variety of thicknesses of material which may require somewhat different types of machines for producing the desirable clean, accurate slits in the material. The embodiment of our machine, which we are about to describe, has been particularly designed for slitting cellulose acetate, or nitrate, sheeting of from perhaps .002 to .15 inches in thickness, although, obviously, such a machine is also useful for other types and thicknesses of material. The parts of our machine have been particularly designed to exclude all dust, oil, dirt, and foreign matter from the sheeting wherever possible, and to avoid any lubricating materials from coming in contact with the final sheet. Where such material is to be used for photographic film, it is particularly necessary to avoid contacting the sheet with any foreign matter, and to provide a construction in which the knives themselves must be arranged to prevent the knives from producing even minute quantities of metal dust from the knives during the slitting operation. This may occur from knives which to the naked eye appear to be finely ground, but which under microscopes appear to be somewhat rough or irregular. Such irregularities may be removed by honing.

Our invention comprises broadly providing a slitting machine in which there is a support carrying a horizontal track on which one or more carriages bearing slitting knives are slidably mounted and on which they may be accurately adjusted by means of a hand wheel to the exact position required. The sheet material to be slit is led around one or more rollers having contact through a considerable angle, such as 170 or 180 degrees, and since this contact causes the material to produce a part cylinder as it passes about the supporting rollers, any undulations or wrinkles in the material are smoothed out, and the material is held stretched across its width while the slitting operation takes place on a portion of the part cylinder of the material thus formed. By providing a means for holding the slitting knives together under the desired pressure without the use of springs, we have been able to eliminate wear and increase the efficiency of the cutting edges.

More specifically, our improved machine may consist of a support designated broadly as 1 on which there is mounted a transverse track 2

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which, as shown in Fig. 2, is dovetailed in cross section or end elevation. On this track are mounted one or more carriages 3 which are preferably similar in construction, although they may be made both right and left-handed, as shown in Fig. 1. The carriage 3 is provided with brackets 4 which revolvably support a roller 5 as by means of ball bearings 6, these ball bearings being carried by a shaft 7, a reduced end 8 of which may carry a helical gear 9. The roller 5 may turn freely upon the shaft 7 and receives its movement from the movement of the strip material S which passes through a path which may be defined by the rollers 10, 5, 11, 12, 13, and 14. The strip material S is driven at a predetermined number of feet per second by suitable rollers which are not shown in the present drawing, although any roller frictionally engaging the sheet material S could be used for this purpose. The roller 5 therefore turns at the same number of feet per minute as the strip material S, because the roller is turned thereby.

The shaft 8 carries one cutting knife 15 so that this knife will be driven through the gear 9 at a rate of speed which is preferably slightly in excess to the speed (in feet per minute) of the sheet material S passing around the roller 5. The circular knife 15 is fixedly mounted with respect to the carriage 3 because precautions have been taken to prevent end play in the shaft 7-8. However, a second stub shaft 16 is preferably provided with slight end play as, for instance, $\frac{1}{16}$ of an inch, so that the cutting knife 17 may be held into contact with the cutting knife 15 because of the thrust on shaft 16 exerted by a helical gear 18 meshing with a helical gear 9. The angle of the teeth of these helical gears is selected to exert the desired pressure on the knife 17 against the knife 15 and by increasing the angle of the teeth, the pressure may be increased, and by decreasing the angle of the teeth, the pressure may be decreased. We have found that a tooth angle of approximately 20 degrees from the shaft 16 gives very desirable results with the machine shown in the drawings.

As indicated in Fig. 5, the knives 15 and 17 have cutting edges 20 and 21 which are substantially at right angles to the peripheries 22 and 23 of these knives. The edges are undercut, as shown, and in operation there is only a slight overlap between these edges so that a clean cut may be made through the sheet material, while the peripheries 22 and 23 are at least partially supporting the sheet material S being slit.

In the present instance, the machine is set up to slit the two edges of the strip material S; the edges E to be removed being led from the slitting knives 15 and 17 over rollers 25-26, and thence to a suitable take-up mechanism, not shown. The present machine is also provided with two carriages 3, one being right-hand and the other being left-hand, the set-up being intended to cut off the two edges E of a sheet S, leaving the remaining part cut accurately to the desired width dimension.

In order to drive the helical gears 18 and 9, there is a third helical gear 27 which is mounted to turn with, but slide on, a shaft 28. This shaft is carried by suitable bearings 29 on the support 1 in which ball bearings 30 are preferably provided and one end of the shaft 28 is provided with a gear 31 which derives its power through a pinion 32 and a main drive gear 33 carried by a shaft 34.

The gears 9-18 and 27 are enclosed in a hous-

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ing 35 which confines the lubricating means inside of the housing, leaving a clean exterior.

Each carriage 3 is mounted to slide on the track 2 and in order to adjust the carriage accurately to the proper position, a screw 36 is provided; this screw being pinned at 37 to the carriage and carrying a wormwheel 38 meshing with a worm 39 so that by turning the handwheel 40, the carriage 3 may be moved along the track 2.

It should be noticed that the gear 18 is slightly smaller than the gear 9, the reason for this being that it is desirable to have one cutting knife 17 turning slightly faster than the other cutting knife 15. This differential movement may be obtained by having a difference of one or more teeth in the gears 9 and 18 and as a result, the two knives 15 and 17, turning together, do not tend to score each other by one part of one knife always striking another part of the other knife. Since there is a constantly changing relationship between the knives, the edges 20 and 21 (which are the cutting edges) are preserved against undue wear. We have found it desirable to both grind and hone the cutting edges 20 and 21 and we have found that with such edges, the knives will wear an extremely long time without deterioration and produce clean and accurate slits in the material. This, in part, is due, no doubt, to the fact that there is an ever-present, even, endwise thrust on the shaft 16, so that knife 17 bears against the knife 15 with a substantially constant and even pressure due to the angle of the teeth of the gears 9 and 18. It should be noticed that the periphery 22 lies in substantial alignment with the periphery of the roller 5 and may be considered to form a continuation of the supporting surface of the roller 5 on which the strip material S lies as the knives slit the material to free the unwanted edge E therefrom.

The position and the number of the carriages 3 will depend, of course, on the number of strips into which it is desirable to slit a single sheet. The strip material S, in passing around the rollers 5, will readily bridge the gap between the ends of these rollers because it will be remembered that in this position the material is in the form of a part cylinder in which the material is comparatively rigid and which supports an even and smooth arch so that the total distance between any pair of slitting knives can be accurately determined and maintained.

Our present construction particularly avoids the use of springs which, under many instances, may work satisfactorily but which have the disadvantage of being difficult to arrange so that perfectly even axial pressure is exerted on the knives because it is difficult first, to cut the ends of the spring in such a manner that they will exert even pressure and, second, it is difficult to prevent lubrication from failing because where a machine is set with a constant spring tension for use over a long period of time, movement of the spring may be retarded by thickened lubricant, tending to prevent free movement of the spring and consequently uneven pressure upon the cutting knives. In our present slitting machine, the pressure is obtained by the constant meshing of the angularly-positioned helical gear teeth, so that there is always an end thrust on the shaft 16 in the direction shown by the arrow A. The direction and slope of the teeth of the helical gears is always so arranged and selected that the end thrust will cause the movable cutting knife 17 to lie in firm contact with the rela-

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tively-fixed cutting knife 15 so that a cleanly-sheared edge will result.

We claim:

1. A slitting machine comprising, in combination, a support, a track carried thereby, a carriage movably mounted on the track, a roller carried by the carriage, a shaft, a slitting knife positioned coaxially of the roller and on the shaft, a stub shaft carried by the carriage, a slitting knife carried thereby, there being axial play in the stub shaft, helical meshing gears positioned one on the shaft coaxially with the roller and the other on the stub shaft to exert an end thrust on said stub shaft to operably engage the knife on the stub shaft with the knife coaxially mounted with respect to the roller.

2. A slitting machine comprising, in combination, a support, a track carried thereby, a carriage movably mounted on the track, a roller carried by the carriage, a shaft, a slitting knife positioned coaxially of the roller and on the shaft, said roller being mounted on said shaft for relative rotation thereto, a stub shaft carried by the carriage, a slitting knife carried thereby, there being axial play in the stub shaft, helical meshing gears positioned one on the shaft coaxially with the roller and the other on the stub shaft to exert an end thrust on said stub shaft to operably engage the knife on the stub shaft with the knife coaxially mounted with respect to the roller, means for leading strip material about the roller, the helical gear means for driving the slitting knives may thus move said knives at a peripheral speed higher than the predetermined speed of the strip material passing over said roller.

3. A slitting machine comprising, in combination, a support, a track carried thereby, a car-

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riage movably mounted on the track, means for moving the carriage along the track to position the carriage thereon, a roller carried by the carriage, a shaft, a slitting knife positioned coaxially of the roller and on the shaft, a stub shaft carried by the carriage, a slitting knife carried thereby, there being axial play in the stub shaft, helical meshing gears positioned one on the shaft coaxially with the roller and the other on the stub shaft to exert an end thrust on said stub shaft to operably engage the knife on the stub shaft with the knife coaxially mounted with respect to the roller.

4. A slitting machine as defined in claim 1 characterized by the slitting knife, arranged coaxially of the roller, and the roller both being carried by a shaft parallel to the track carried by the carriage, a shaft passing through the carriage, a gear on said last-mentioned shaft for driving the helical gears connected to the slitting knives, said shaft passing through the carriage and being carried in bearings on the support.

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