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METHOD OF AND APPARATUS FOR UNWINDING A ROLLED WEB OF MATERIAL

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2 Sheets-Sheet 1

FIG. 1

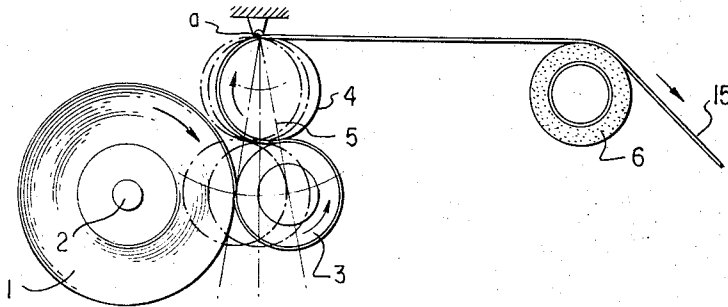
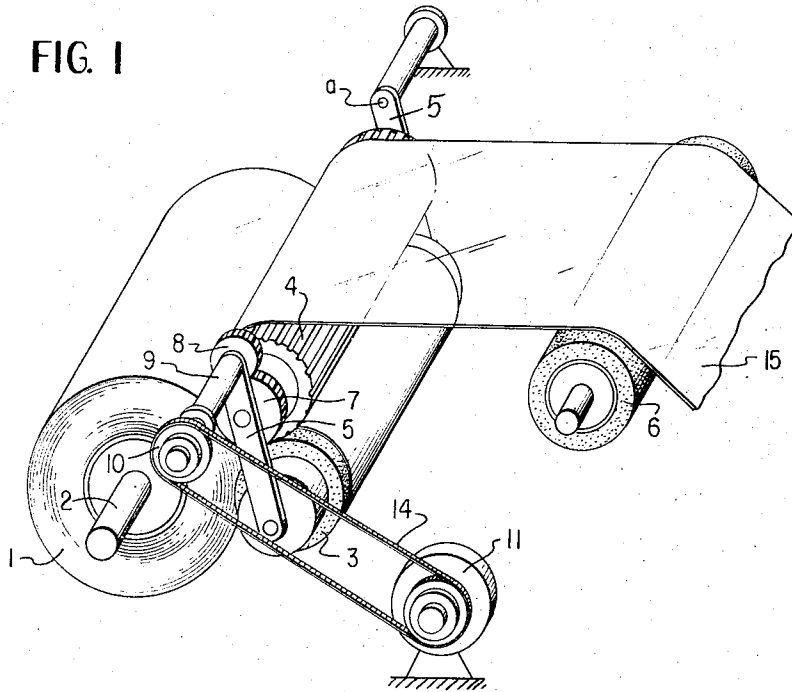


FIG. 2

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FIG. 3

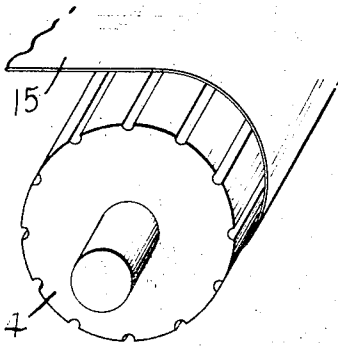


FIG. 4

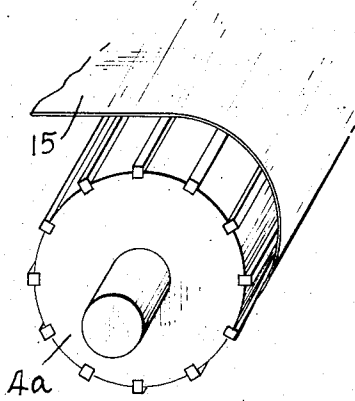


FIG. 5

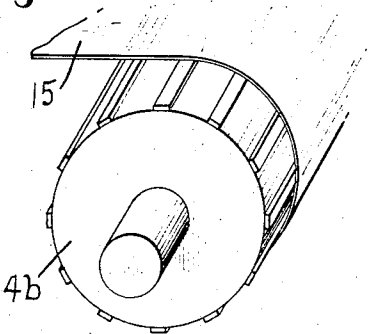


FIG. 6

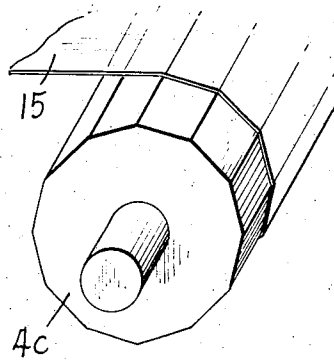


FIG. 7

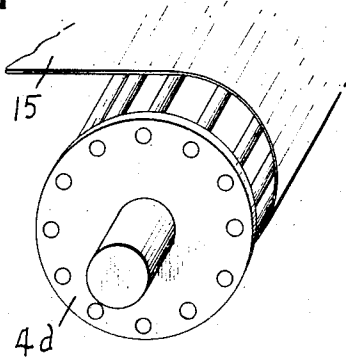
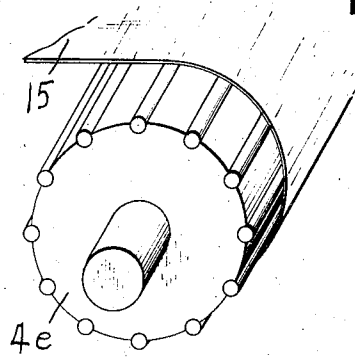


FIG. 8



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**METHOD OF AND APPARATUS FOR UNWINDING  
A ROLLED WEB OF MATERIAL**

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**ABSTRACT OF THE DISCLOSURE**

The present invention provides a method of unwinding a rolled web of material, wherein the web is drawn from the roll and passed partly around a parallel roller adapted for tension regulation in the web, which roller is mounted out of pressure contact with the roll, as hereinafter defined, whereby a web leaving the roll with local variations in tension can leave the roller under substantially constant tension. By "out of pressure contact" is meant that roll and roller may have a space between them or may just touch so long as no appreciable pressure is exerted by the roller on the roll. Although the surfaces of the roll and the roller may be maintained at any practical distance apart, it is most suitable to keep the distance small between the roll and roller a further parallel roller may be interposed, also out of pressure contact with the roll, the web being passed partly around the further roller within the path. In this case, the distance between the roll and the tension-regulating roller may be correspondingly greater. The use of such a second or equalizing roller arranged between the roll and the roller regulating the tension has proved to be advantageous, since it has a desirable equalizing effect in the unwinding of irregularly wound rolls of material.

Methods and arrangements for this purpose are already in use and those which predominate aim in particular at producing a constant tension in the web by a braking action. The braking effect is exerted on the supply spindle or on the periphery of the wound roll.

In the first case, so-called core braking, it is simplest to do this by means of a brake coupled to the spindle. The brake, which acts directly on the spindle, requires continuous regulation, however, since the diameter of the roll being unwound becomes smaller during the unwinding process and, accordingly, the braking torque also decreases. In simple devices, the regulation is effected manually, while in more accurately operating devices it is effected by electrical, optical, pneumatic, hydraulic or mechanical methods. The greatest drawback of core braking, however, resides in that in spite of regulation it is not possible to carry out the unwinding of very loosely wound rolls with sufficient accuracy. In these cases, at first the outer layers of the roll may be tightened by the processing machine, the tightening effect passing backward to the core, while the winding spindle runs more slowly than it otherwise would or even remains stationary. Moreover, it also often happens in this process that two adjacent rolled layers are displaced laterally with respect to one another.

Those arrangements in which braking occurs at the periphery of the wound roll avoid the drawback which has just been mentioned, but they are inadequate in other respects.

In a known arrangement of this kind, a constant web tension is obtained in that the wound roll rests on two rollers mounted parallel to it and a third or jockey roller, also in a parallel arrangement, rests on top of the roll

and is movably mounted in a rocker arm to produce a required bearing pressure. This simple arrangement, however, cannot be used without disadvantage in the case of delicate webs of material, such as thin plastic films, since the surface of the webs easily may be damaged by the constant pressure of the jockey roller.

In another braking device which similarly acts on the periphery of the wound roll, a rotatable roller is mounted at the end of an arm pivoted about a fixed spindle and rests on the wound roll with a regulatable pressure. The roller is provided with a regulatable friction braking system, the braking action of which is transmitted to the periphery of the wound roll by way of the roller. In this known unwinding arrangement, the web of material, which is pulled by feed rollers of a succeeding processing machine, runs over a secondary roller mounted at the same end of the arm on the other side of the braked roller, the secondary roller so guiding the web of material that it makes contact with at least one half of the periphery of the braked roller. This braking device has the drawback that an obstruction may develop at the place where the braking roller is pressed against the periphery of the wound roll. Very loose turns, which cannot be entirely avoided in practice, also promote obstruction in that they permit too great a penetration of the roller into the yielding upper layers of the roll. The occurrence of an obstruction becomes apparent in a disadvantageous manner especially in the case of thin plastic films. Moreover, with non-circular rolls, oscillating movements of the holding arms are produced which result in variations in length, and thereby in variations of the tension of the web of material.

In the method of the invention, the web of material also may be carried around a part of the periphery of additional rollers, but such a procedure does not produce further advantages, so that the use of such a larger number of rollers is necessary only when this is indicated for reasons of space or in order to guide the web of material in a desired direction. The equalizing roller is advantageously provided with a yielding surface and this aspect will be referred to in detail below.

One embodiment of the invention is illustrated in the accompanying drawings, in which:

FIGURE 1 is a perspective view of the apparatus,

FIGURE 2 is a simplified diagrammatic elevation of the apparatus, and

FIGURES 3 to 8 show simplified perspective views of a part of a roller provided with venting passages in six different constructional forms.

Referring to the drawings, through the apparatus shown in FIGURES 1 and 2 runs a web of material 15 which is unwound from a roll of material 1 and is drawn off by a machine for further processing, of which only a feed roller 6 is illustrated. The roll of material 1 is mounted on a winding spindle 2, which latter is supported in known manner at both ends. The web of material 15 running off the roll first passes around part of the periphery of a roller 3 covered with an elastic layer, is then transferred to a braking roller 4 provided at its periphery with venting passages (see below) and finally leaves the roller 4 from a line in the surface thereof which coincides with the axis *a* on which pivot a pair of rocking levers 5 between which the rollers 3 and 4 are rotatably mounted. The web of material 15 preferably runs off the roller 4 perpendicularly to the rocking levers 5.

The roller 4 receives torque from the web of material 15. This torque is transmitted by way of a pinion 7 fixed on one end of the supporting shaft of the roller 4 to another pinion 8 which is also mounted rotatably, being secured to a spindle passing through a hollow shaft 9 and having secured to the other end thereof a sprocket 10

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which, in turn, transmits the torque delivered by the roller 4, by means of a chain 14, to a regulating device 11. The axis of the pinion 8 is shown to coincide with the axis *a*, so that its movements are independent of the pivoting movements of the rocking levers 5.

The venting passages at the periphery of the roller 4 may take a variety of forms, as shown more clearly in FIGURES 3 to 8 and described in detail below. All the forms shown are of general rectilinear configuration, but they could be of spiral form or of combined annular and rectilinear or spiral form.

The roller 3 has a surface layer of elastic material. This layer on the one hand compensates for the local distortions that are inherent in a particular web of material and which extend in the longitudinal direction and are due, for example, to variations in thickness, and on the other hand owing to a slight contact pressure on the roller 4, it displaces the film of air which is drawn in between the web of material 15 and the roller 4.

Additional rollers also may be mounted between the rocking levers 5 in addition to the rollers 3 and 4. These additional rollers may, similar to the roller 3, have an elastic surface or, as the roller 4, be provided with venting passages and be equipped with a regulating device. One or more simple looping rollers also may follow a roller of the type of roller 4 provided with a regulating device. In each case it is advantageous that the pivoting axis of the rocking levers 5 coincide with the axis of the uppermost roller mounted on the rocking levers. Normally, however, the provision of a single roller 3 and a single braking roller 4 on the rocking levers 5 is sufficient.

The regulator 11 instead may be coaxial with the spindle of the pinions 8 and 10, the chain 14 shown in FIGURE 1 then being dispensed with.

The roller 3 provided with an elastic surface either may bear without substantial pressure on the periphery of the roll 1 to be unwound, or, for example where the roll 1 has been wound so that it is very loose, may be maintained at a distance from the roll.

FIGURE 1 shows the arrangement of the rollers 3 and 4, which are rotatably mounted between the levers 5 and are thereby able to perform an oscillating movement about the pivoting axis *a*. The effect of the arrangement is as follows: In the case of rolls of film having a cross-section deviating from the circular, a uniform drawing off of the web of film from the roll itself naturally does not occur, so that greater or lesser variations in tension occur and, if the web were directly conveyed to a further processing machine, could frequently result in considerable disturbances. When the roller 3 makes contact with the periphery of the wound roll, it oscillates in conformity with the diameter variations. Since, however, the axis *a* of the rocking levers 5 coincides with the line from which the web runs off the roller 4, the variation in tension in the web of film, which is related to the lengthening and shortening of the web of film as it is being unwound from the non-circular roll, is completely compensated when the position of the rocking levers 5 is perpendicular to the web of film running off and is very substantially neutralized in all normal relative positions of the web and rocking levers. The web therefore passes uniformly into any machine for carrying out further processing.

The elastic surface of the roller 3 compensates for small surface defects, for example humps and/or creases, in the material of the roll 1 and, on the other hand, it also has a compensating effect locally at parts of the web of material exhibiting length variations, possibly owing to uneven thickness thereof or local stretching during manufacture. Advantageously, the rollers 3 and 4 either make contact or are separated by a distance up to 10 mm. The roller and lever assembly may be provided with damping means.

The tension of the web is maintained constant with great accuracy by the apparatus of the invention, irrespective of whether the roll is a full one or has been almost

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completely unwound. Since, if the winding spindle of the roll 1 has been carefully mounted, it should be able to turn with the latter without any difficulty, for example having only to overcome the friction of end ball bearings, there is no danger of differential rotation causing tightening of the web on the core and lateral displacement of the upper layers of the roll.

The venting passages in the surface of the roller 4 may be produced in various ways, regard being had in each case to the material to be processed. The object in all cases is to enable the air between the web of material and the surface of the roller to escape completely to the side. As shown in FIGURE 3, longitudinal grooves are milled into the roller 4, these grooves enabling any remaining air to escape even at very high peripheral speeds. It may be equally advantageous, as shown in FIGURE 4, to provide the roller 4a with radially projecting rods distributed over its periphery, which rods space the web of material from the major part of the surface of the roller, the air being provided with relatively wide escape passages. FIGURES 5 to 8 show further examples of modifications of the surface of the roller. In FIGURE 5, thin laths are mounted on the periphery, the basically round surface of the roller 4b being substantially retained. FIGURE 6, however, shows a substantial modification of the shape of the roller 4c, which in this case is in the form of a dodecahedral prism. In FIGURE 7, the roller 4d consists of a number of circularly arranged round bars. In this case in particular the open construction allows free escape of air. FIGURE 8 shows a roller 4e in which round rods are half sunk into the roller body and half project therefrom.

The apparatus according to the invention provides many advantages. During unwinding, the tension of the web of material finally drawn off remains constant irrespective of the change in the diameter of the wound roll and, at the same time, owing to the light contact of the web of material on the periphery of the braking roller, no damage occurs to the web, even if it is very mechanically sensitive, as are, for example, very thin webs of plastic film. Tightening of the roll of material being unwound does not occur and axial displacement of the outer layers of the roll is thereby obviated. Furthermore, there is practically no obstruction in operation. The braking can be controlled with a high degree of accuracy. The apparatus therefore renders possible the handling of rolls that are loosely wound, non-circular rolls, rolls with local irregular tension, and rolls with variations in the thickness of the web of film. The apparatus thereby also produces an improvement in the quality of the articles made from the unwound web of material. The improvements which can be obtained with the apparatus are due primarily to the fact that, owing to the extremely even tension, the web of material is able to assume very rapidly a particular direction of running, which it then retains unchanged, so that, for example during winding up after division of a wider web into a plurality of narrower webs, completely plane end faces are formed on the wound rolls, which have not been possible to obtain in the unwinding and rewinding of webs of material with the means hitherto known.

It will be obvious to those skilled in the art that many modifications may be made within the scope of the present invention without departing from the spirit thereof, and the invention includes all such modifications.

What is claimed is:

1. An apparatus for unwinding a rolled web of material which comprises means for rotatably supporting a roll, and a pair of lever means having a pivoting axis and supporting a pair of rollers between them, the pivoting axis and the roller axes being coplanar and the pivoting axis coinciding with the periphery of the second roller reached by the web withdrawn from the roll and passed partially around one roller and then the other.

2. An apparatus according to claim 1 including means

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connected to the second roller to be reached by the web for regulating the speed of rotation of the second roller, whereby the tension in the web leaving said roller is also regulated.

3. An apparatus according to claim 1 in which the roller first reached by the web has a surface formed from a resilient material.

4. An apparatus according to claim 1 in which the distance between the two rollers is in the range of 0 to 10 mm.

5. An apparatus according to claim 1 in which the two rollers are mounted between a pair of pivoted levers, the pivoting axis and the roller axes being coplanar and the pivoting axis coinciding with the periphery of the second roller reached by the web in a line from which the web can be drawn off perpendicularly to the common plane.

6. An apparatus according to claim 1 in which the

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pivoting axis of the levers, in the idle position of the apparatus, is vertically above the roller axes, the roller first reached by the web being closer to the roll support axis.

7. An apparatus according to claim 1 in which the second roller to be reached by the web has air venting means on the surface thereof.

#### References Cited

##### UNITED STATES PATENTS

10	1,263,419	4/1918	James	-----	242-75.2
	1,977,720	10/1934	Fowler	-----	242-75.2
	2,067,755	1/1937	Dyer	-----	242-75.2
	2,259,202	10/1941	Cooper	-----	242-47.01

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