

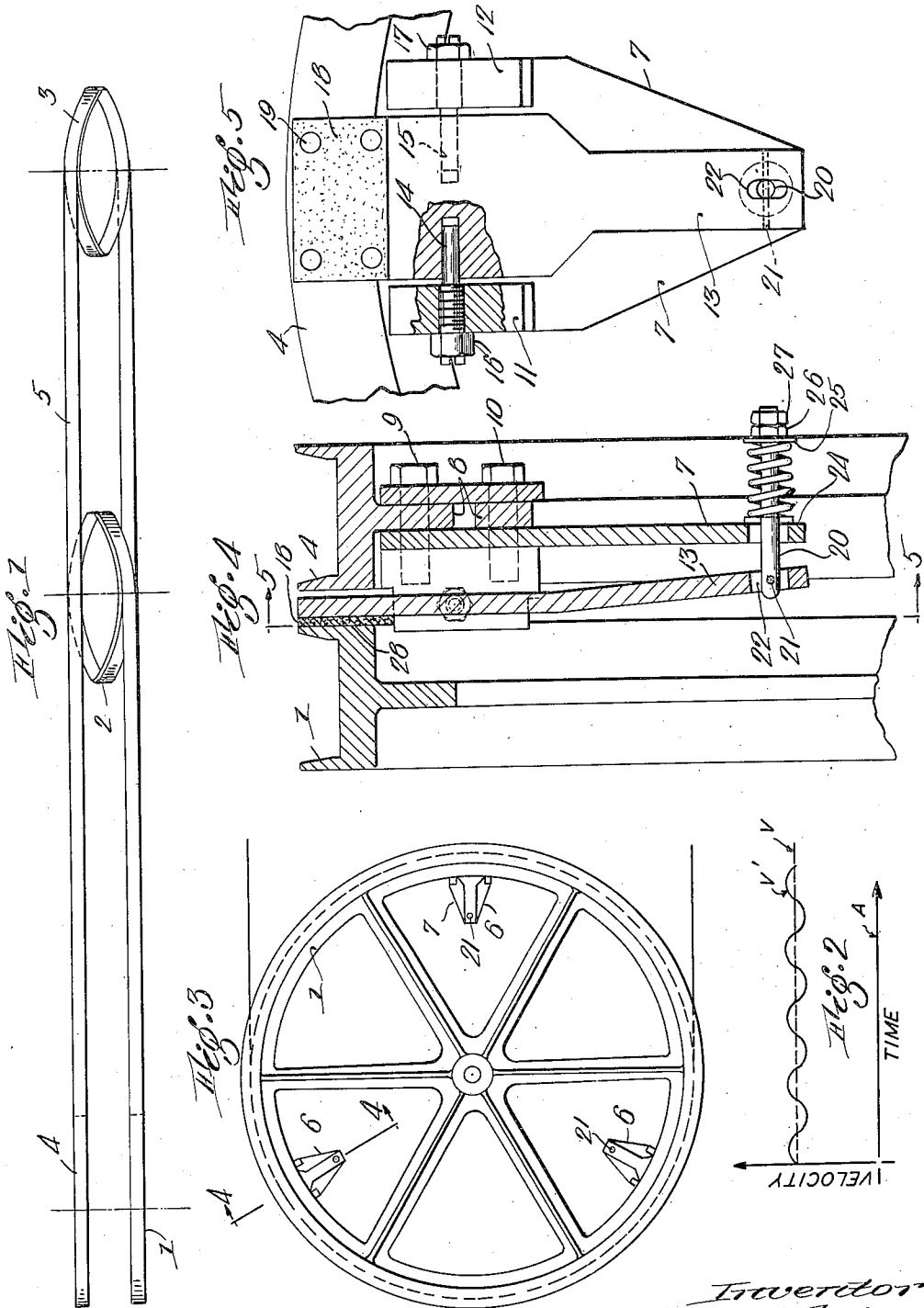
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FILM CONVEYING METHOD AND APPARATUS

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FILM CONVEYING METHOD AND APPARATUS

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This invention relates to apparatus for conveying strip material, and more particularly to damping devices for such apparatus.

Devices for conveying strip material usually comprise a number of rotating rollers, wheels, disks, or pulleys, which may be driven or undriven. The strip frictionally engages these rotating elements, resting upon their peripheral surfaces or being partly wound around these surfaces. Examples of such arrangements are conveying apparatus for motion picture film as employed in developing or printing machines, etc. In certain instances the strip material, as for instance the motion picture film in a printing machine, does not move at uniform speed over the supporting elements as might be expected. To the contrary, quite noticeable irregularities in this movement take place under certain circumstances, which cause the whole drive to oscillate and the motion of the strip material to become irregular, which is quite undesirable with such apparatus, especially if the operation of the machine in which it is employed depends to a high degree upon uniform and smooth motion of the strip, as for instance with machines working with motion picture film material.

It is therefore the main object of the present invention to provide a method permitting the smooth operation of such a conveying device at uniform speed. Other objects are to provide means making use of this method, which are simple and practically applicable to such conveying devices, which can be readily controlled and adjusted, and which will not influence the uniform progress of the strip material.

I have investigated the problems involved in the above-mentioned phenomenon and found a method and device, constituting the present invention, which remedy the bad effect of this phenomenon. The invention will be illustrated by describing a specific embodiment thereof, which is shown in the appended drawing, in which:

Fig. 1 is a schematic view of a conveying device for strip material;

Fig. 2 is a velocity-time diagram of the motion of the strip material;

Fig. 3 is a side view of two adjacent pulleys connected with a damping device according to my invention;

Fig. 4 is a section along line 4—4 of Fig. 3 through the damping device; and

Fig. 5 is a section along line 5—5 of Fig. 4.

Referring now to Fig. 1, 1, 2, 3, and 4 are pulleys supporting and conveying a film strip 5 which passes from pulley 1 to pulley 2, makes a

semi-circle around pulley 2, passes from there to pulley 4, and from there in similar manner over pulley 3 back to pulley 1, in a manner as described in the copending patent of John F. Kenninger, No. 1,803,115, granted April 28, 1931. The strip may either be endless or it may be fed and taken off at any convenient point of the arrangement. One or several or none of the pulleys may be driven, the strip being drawn in the latter case through the device by external means which will thereby also rotate the pulleys.

Theoretically all of the pulleys should have the same circumferential velocity, which is also the progressing velocity of the strip and which should normally be constant, as shown by dotted line V of Fig. 2. However, due to the varying friction, the elasticity of the strip, sudden exterior impulses, the other more or less uncontrollable influences which render the connection of the pulleys by the strip not absolutely rigid, the speeds of the pulleys will not be uniform and they will therefore move relatively to each other. This is indicated by curve V' of Fig. 2.

Taking for instance pulleys 1 and 4, which are adjacent and connected by a rather long stretch of strip material, pulley 1 may move uniformly with speed V at which the film is supplied, whereas pulley 4 may move with a velocity V', which has an absolute velocity if read from the time axis A, whereas it signifies the relative velocity between pulleys 1 and 4 if read with V as axis. In actual practice it is most probable that none of the pulleys move with the strip velocity V, but that they all oscillate out of phase to each other relative to the uniform velocity V, due to wave transmission along the strip or belt, as explained above. This relative movement between the pulleys is very undesirable; it not only imparts an undue stress to the strip and impairs the proper progress of the film, but under certain circumstances it may also cause severe oscillations which make any satisfactory operation impossible. It will be readily understood that the relative motion between the pulleys is not necessarily as regular as shown in Fig. 2, that both or all pulleys may deviate from a uniform absolute speed, and that an irregular curve corresponding to V' signifies the undesirable irregular relative velocity between any pair of pulleys.

In order to overcome this undesirable effect, it is necessary to eliminate the relative motion between the pulleys without influencing the uniform velocity V of the whole system. This can not be attained by braking one or several pulleys

or by increasing their inertias, because this would have the undesirable effect in slowing down or otherwise influencing the system speed V without accomplishing any desirable effect with respect to the relative speed V' . I accomplish the elimination of the relative motion by inserting a damping or braking element between pulleys having a relative motion, as for instance pulleys 1 to 4 in the present case. This damping element may be of any suitable construction, but I prefer a construction as shown in Figs. 3, 4, and 5. Fig. 3 shows the arrangement of three damping devices 6 at equal intervals upon the rims of, and between, pulleys 1 and 4.

Referring now to Figs. 4 and 5, the damping device itself will be described. An extension 7 is fastened upon the flange 8 of pulley 4 by means of screws 9 and 10, this extension having two ears 11 and 12 extending laterally toward the adjacent wheel 1. A lever 13 is pivoted in these ears by means of pin screws 14 and 15 secured with nuts 16 and 17. At one end lever 13 has a lining 18 fastened by suitable means as, for example, rivets 19 and corresponding to a surface of the rim of pulley 1. At the other end lever 13 is resiliently connected to extension 7 by means of a rod 20 pivotally fastened to lever 13 with a pin 21 extending across a perforation 22, and by means of a spring between two washers 24 and 25 and retained with nuts 26 and 27, which also permit adjustment of the tension of spring 23.

It will be seen that any relative motion between pulleys 1 and 4 is substantially eliminated by converting the energy causing this motion into heat at the braking surface 25. The device can be adapted for various requirements, as e. g. to the desired degree of damping, the energy to be dissipated, the nature of the oscillatory movement between the pulleys etc., by varying the number of damping devices, by changing the braking surface and by adjusting the braking pressure. It will also be evident that the damping means in nowise retards the means for driving the strip and pulleys but merely offers resistance to varia-

tions in velocity between different parts of the system.

The above-described embodiment of my damping device is not the only one possible, but a great number of variations can be conceived which would serve the same purpose, the gist of the invention being the interposition of an adjustable energy consuming element between conveying elements with varying relative velocity, without affecting the uniform speed with which the strip material and the pulleys supporting it are supposed to progress.

I claim:

1. A film strip conveying device comprising two co-axially mounted pulleys carrying and frictionally conveying a length of film strip, a lever pivotally mounted on one of said pulleys and having a braking surface, a braking surface on the second of said pulleys, resilient means between said lever and said first pulley tending to engage said two braking surfaces, and means for adjusting the force exerted by said resilient means.

2. A film conveying device comprising pulleys arranged to receive film at one location, deliver the film at another location and, between the two locations, convey the film in at least two loops, some of said pulleys being located in one loop and others in another loop, and means interposed between pulleys in different loops for damping oscillations in the film by mutual counteraction between the oscillations in the respective loops, said means comprising a brake carried by a pulley in one loop to dampen the oscillations of a pulley in the other loop.

3. The method of handling film which comprises conducting the film along a path consisting of a plurality of loops, feeding the film to said looped path at one location and from the looped path at another location, and damping oscillations in the loops by frictional transmission of oscillations from one loop to another transversely of the film so that the oscillations in the respective loops tend to counteract each other.

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