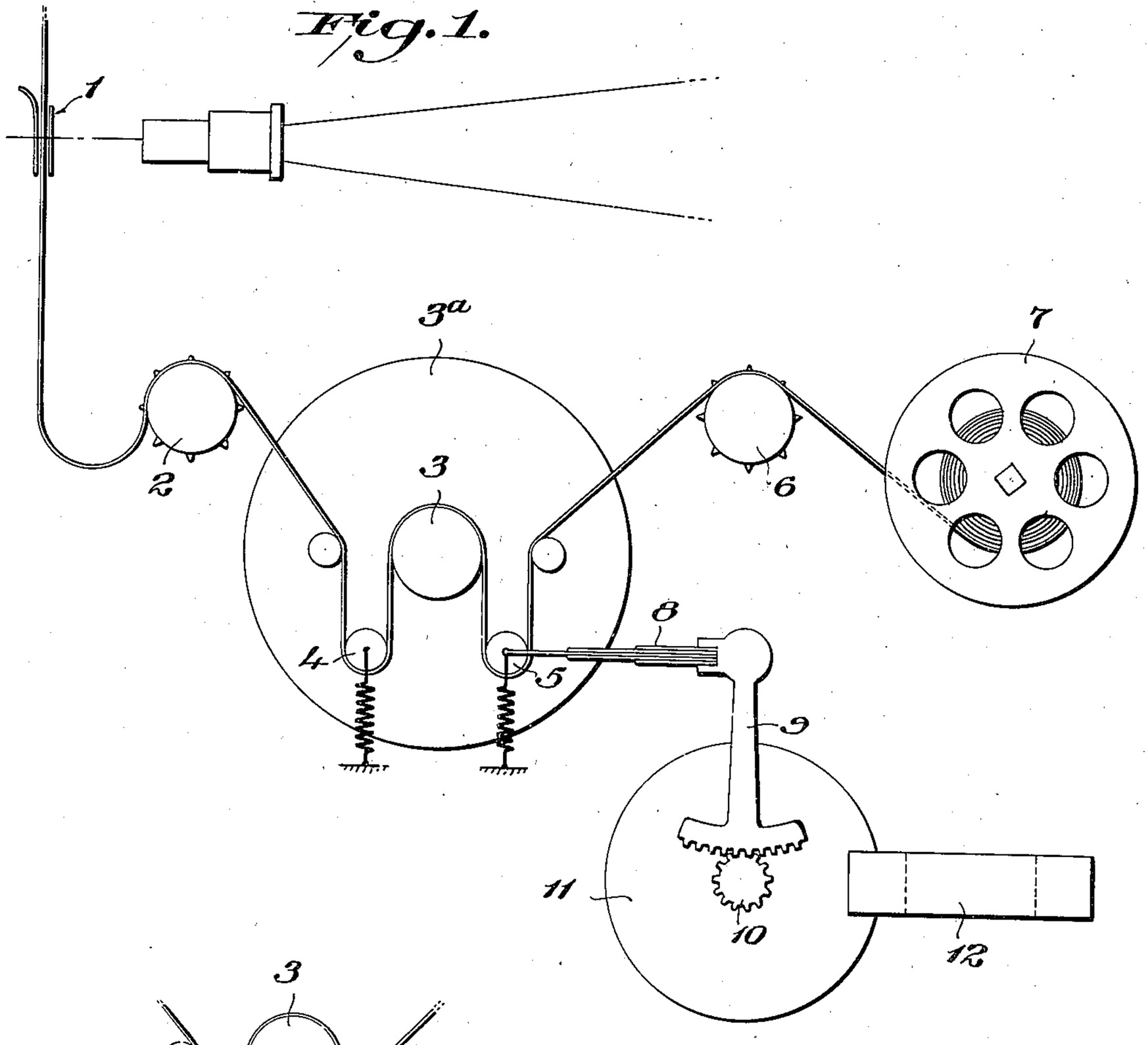
Dec. 23, 1941. E. JUILLARD 2,267,107

DAMPING DEVICE

Filed April 1, 1940

Fig. 1.



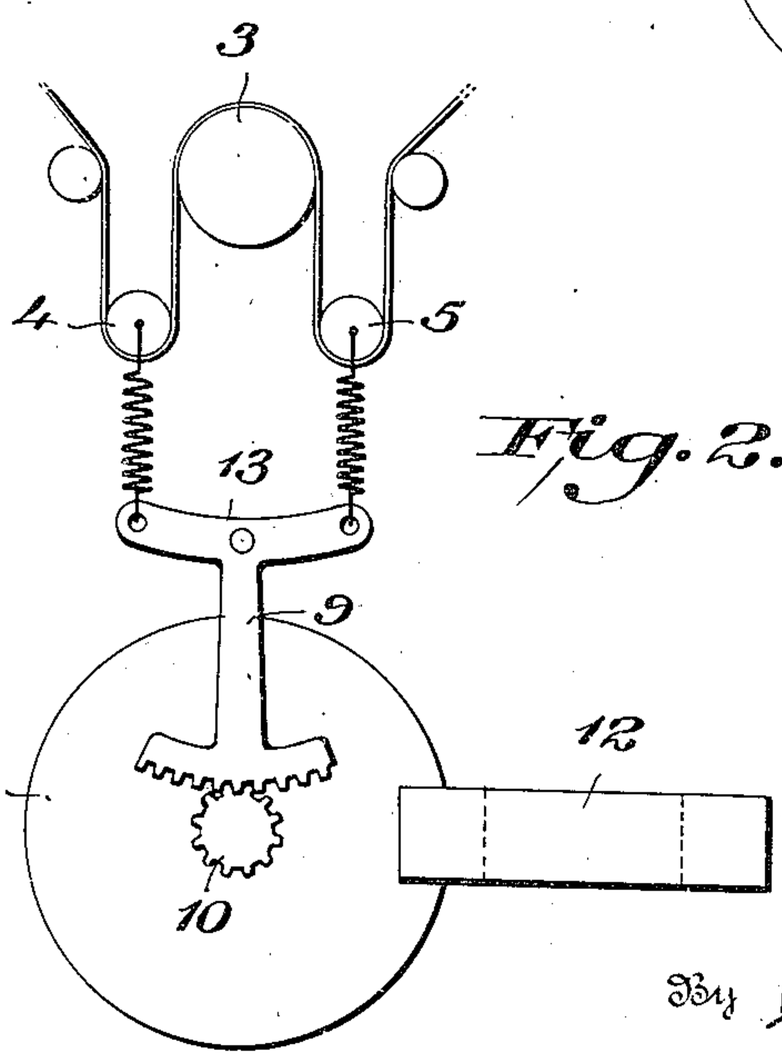


Fig. 2.

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DAMPING DEVICE

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4 Claims. (Cl. 271—2.3)

It is known that for passing from the intermittent unwinding of a film through a projection apparatus to a rigorously continuous movement necessary for sound reproduction, use has been made of a fly-wheel of which the inertia opposes the fluctuations produced by various causes, such as the flapping of the film when leaving the projector, irregularities in the perforations, irregularities or clearances in the gearings and actuating devices. In order that the fly-wheel may distribute the whole of its action it is necessary for the film to be subjected on opposite sides of the fly-wheel to a resilient traction which ensures or contributes in ensuring the adhesion of the film to the fly-wheel and stores the variations in speed which the fly-wheel allows to subsist.

However it is also known that a resilient member, being a type of energy accumulator, restores this energy to the fly-wheel as a result of which there occurs a fluctuating speed which is superposed on the average continuous speed of the film.

To prevent these oscillations from continuing over too long a period of time, various solutions have been proposed. The most simple of these consists in relying upon the natural friction in the bearings of the fly-wheel or of some of the tensioning rollers. This effect is frequently reinforced by the slipping of the film on the driving pulley of the fly-wheel. This solution depends on chance as it relies upon a phenomenon (friction of the bearings) which to a high degree is variable and only provides a fairly rough result, especially when the film is caused to slip on the pulley of the fly-wheel.

The use of a roller which presses the film against the pulley of the fly-wheel has other disadvantages. Another solution consists in using a fly-wheel in which shocks are absorbed by means of an internal fly-wheel.

In this case the fly-wheel proper is hollow and contains in the interior a second fly-wheel which is absolutely free on the shaft and operates in oil. As long as the speed is uniform the inner fly-wheel rotates at the same speed as the outer fly-wheel. If as a result of any disturbance in the speed of the film, the outer fly-wheel is accelerated, there results a variation in the relative speed between the outer and inner fly-wheels and a braking action due to the viscosity of the oil which absorbs the excess energy communicated to the outer fly-wheel in the form of an increase in speed.

The essential disadvantage of this arrangement, in addition to the difficulties which are caused by questions of fluidtightness, is the considerable variation in the viscosity of the oil according to the temperature and consequently the rate of damping the oscillations. It is known for example that the viscosity of oil in normal machines passes from one to two for a variation of temperature of from about 10–25° C.

The object of the present invention is a damping device which ensures a disappearance of the oscillations within a predetermined period of time, which is under the control of the manufacturer, the means employed being independent, within a very wide range of temperature, consequently do not necessitate the enclosure of any fluid in a receptacle and are only provided with members which are purely mechanical.

The precision of this device is the greater the more the natural friction of the members in movement in their bearings is reduced.

According to the present invention the damping is obtained by connecting at least one vibrating member in contact with the film, to a damping device by members which are purely mechanical.

In the accompanying drawing:

Fig. 1 shows diagrammatically, by way of example, a complete view of one form of construction of the subject of the invention.

Fig. 2 shows a modification of a detail.

In Fig. 1 the projection gate is indicated at **1**, the upward feed sprocket by **2**, the pulley of the fly-wheel by **3**, the fly-wheel by **3***a*, the two tensioning or vibrating rollers by **4** and **5**, these being subjected to the action of springs, the downward feed sprocket by **6** and the winding up spool by **7**.

One of the vibrating rollers **5** is connected by a flexible rod **8** to a sector **9** which gears with a pinion **10** of a disc **11** of aluminium or other light and conducting metal, secured to the pinion **10** and rotating between the poles of a magnet **12**.

The operation of this device is as follows.

When the film is unwound at a rigorously uniform speed, the fly-wheel **3***a* is not subjected to any acceleration (change of speed), the two tensioning rollers **4** and **5** remain stationary and apply to the film the same tension on both sides of the pulley **3**. The spring **8** is not subjected to any tension; in fact when it is tensioned it exerts on the sector **9** a force which causes the disc **11** to turn.

This will then be turned into a position in which the spring **8** is no longer subjected to tension.

The parts will remain in this position as long as the film continues to be unwound uniformly.

Assuming that for one reason or another (ir-

regularities in the perforations for example) the film reaches the pulley more slowly and there is a backward pull by the sprocket **6**, the roller **4** rises and the roller **5** descends. The rise of the roller **4** tensions the film when passing on the pulley **3** of the fly-wheel. The downward movement of the roller **5** slackens the film in such a manner that the fly-wheel **3***a* is subjected to a deceleration which tends to reduce its speed.

Assuming that the members **8—12** are not in existence.

Under the action of the retarding force which is applied to the fly-wheel **3***a*, the speed of the latter is reduced, the roller **4** descends and the roller **5** rises. These two new positions result in the acceleration of the fly-wheel **3***a* in the direction of an increase in speed. As a result of this acceleration the fly-wheel rotates faster, the roller **5** descends whilst the roller **4** ascends and the fly-wheel is again subjected to a retarding force.

This procedure restarts and takes place indefinitely, the fly-wheel carrying out, about its average speed, a periodic fluctuation in speed.

When the members **8—12** are provided the following is the operation.

When the roller **4** rises, the roller **5** does not descend by the corresponding amount as it has to tension the resilient blade **8**. The retarding action on the fly-wheel **3***a* is weakened. When however the speed of the fly-wheel **3***a* is changed, the disc **11**, which is subjected to the tension of the spring **8**, turns slightly and relieves this spring. When the roller **4** again descends, the roller **5** again tensions the spring **8** and the acceleration of the fly-wheel **3***a* is reduced by the supplementary force applied by **5** on **8**, thus resulting in a fresh reduction of the acceleration.

It is to be observed that the tension of the spring **8**, by reason of the movement of the disc **11**, always acts in the necessary direction for opposing the fluctuation in the speed of the fly-wheel. As the disc **11** turns in the interior of a magnet **12** and consequently loses energy, which is converted into heat, this lost energy dampens the oscillation of the fly-wheel and restores the latter rapidly to a uniform speed.

It will be understood that a number of magnets **12** may be provided which all act on the disc **11**.

The roller **5** may be connected to the sector **9** by a rigid rod instead of being connected thereto by a spring.

As shown in Fig. 2, the two rollers **4** and **5** may be connected by their springs to the ends of an arm **13** secured to the sector **9**.

The operation is in principle the same as that above described.

In the two forms of construction the electromagnetic damping device may be replaced by a hydraulic damping device, such as an air, oil or other fluid dash-pot, or by a mechanical damping device such as for example a blade turning in air, that is to say an air brake.

In the device described the disc **11** may naturally be replaced by a cylinder of conducting metal and the magnet **12** may be replaced by an electromagnet.

I claim:

1. In a device for damping the unwinding movement of a film in an apparatus for the recording or reproduction of sound, comprising in combination with a guide pulley for said film and a fly-wheel to which said guide pulley is secured, of a pair of rollers engaging with said film on opposite sides of said pulley, springs acting on said rollers for tensioning said film, a resilient member connected at one end to one of said rollers, a toothed sector connected to the other end of said resilient member, a pinion gearing with said sector, a disc secured to said pinion and a magnet mounted adjacent said disc, said disc turning between the poles of said magnet.

2. In a device for damping the unwinding movement of a film in an apparatus for the recording or reproduction of sound, comprising in combination with a guide pulley for said film and a fly-wheel to which said guide pulley is secured, of a pair of rollers engaging with said film on opposite sides of said pulley, springs acting on said rollers for tensioning said film, a pivotally mounted arm, said springs being connected to opposite ends of said arm, a toothed sector secured to said arm, a pinion gearing with said sector, a disc secured to said pinion and a magnet mounted adjacent said disc, said disc turning between the poles of said magnet.

3. In a device for damping the movement of a film in apparatus for recording or reproducing sound, the combination, comprising, a pulley driven by contact with said film, a flywheel connected with said pulley to entrain motion imparted thereto as a result of said film contacting the pulley, means for tensioning the film over the pulley, and electro-mechanical damping means connected to said means for tensioning the film, said electro-mechanical damping means comprising a pivotally supported lever having a toothed segment, a disc having a pinion meshing with said segment, and an electro-magnet having its poles disposed adjacent the periphery of the disc.

4. In a device for damping the movement of a film in an apparatus for recording or reproducing sound, the combination, comprising, a pulley driven by contact with said film, a flywheel connected with said pulley to entrain motion imparted thereto as a result of said film contacting the pulley, means for tensioning the film over the pulley comprising a pair of tensioning rollers on opposite sides of the pulley and in contact with that side of said film which is opposite to the side in contact with the pulley, and electro-mechanical damping means connected to at least one of said rollers of said means for tensioning the film, said electro-mechanical damping means comprising a pivotally supported lever having a toothed segment, a disc having a pinion meshing with said segment, and an electro-magnet having its poles disposed adjacent the periphery of the disc.

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