Aug. 6, 1940. O. K. KOLB 2,210,372

SPEED STABILIZING DEVICE FOR SOUND RECORD FILMS

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Fig. 1.

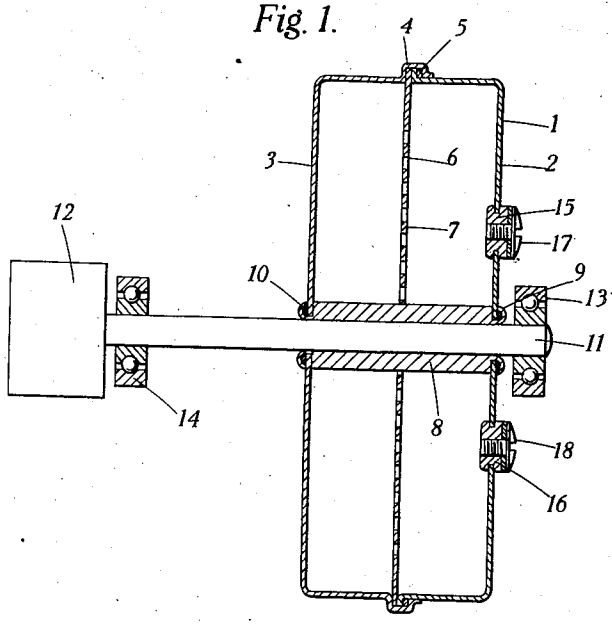
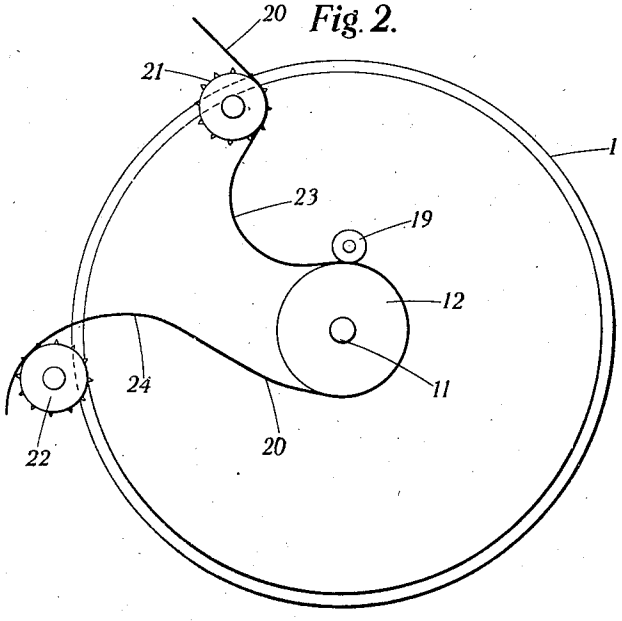


Fig. 2.



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SPEED STABILIZING DEVICE FOR SOUND RECORD FILMS

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11 Claims. (Cl. 271—2.3)

This invention relates to devices for use in film feeding mechanisms for the purpose of rendering the speed of film feed as constant as possible at the point at which sound recording is effected, or at which sound reproduction by photo-electric means takes place.

It has long been known that if a film on which a sound record is to be made or from which a sound record is to be reproduced is taken round a drum so as to embrace an appreciable arc of the periphery of this, and if the film is driven by suitable means so that in turn it drives the drum in the manner of a belt, and if associated with the drum mechanically there is a flywheel, the effect of this system is to add inertia to the film (which in itself is virtually without mass) and this arrangement serves to maintain the film velocity at the recording or reproducing point, substantially constant.

The film is generally deflected out of a straight path on one or both sides of its point of contact with the drum by elastic means either inherent in the film itself or separately applied thereto, whereby vibratory speed changes imparted to the film by or through the driving mechanism are not applied to the drum or are reduced in intensity so that the inertia of the drum system prevents speed changes being present in the portion of a film passing the sound reproducing or recording point. If the system comprising the flywheel, film-driven drum and film form a mechanical oscillatory system, speed fluctuations known as hunting can be set up, and will seriously interfere with the recording and reproduction of the sounds, but by the use of suitable damping means applied either to the flywheel system or to the elastic means referred to such hunting effects and consequent fluctuations in the film speed can be largely eliminated.

Any system having a substantial flywheel mass rigidly attached to the drum over which the film passes has the further disadvantage that in starting up quickly, the film is subjected to considerable tension in accelerating the flywheel up to its normal speed and this leads to film breakages.

Various proposals have been made for overcoming the difficulties mentioned above. In some cases, it was suggested to divide the flywheel mass into two parts coupled by fluid friction or by electromagnetic drag, and this may provide the required damping but still leaves the film subject to considerable starting loads. Other proposals which overcome this latter difficulty involve the use of a thin-walled hollow box rigidly attached to the drum shaft which is power-driven through an elastic coupling, the said box containing the heavy flywheel mass which is carried round by fluid friction, but there are difficulties in constructing such a device in a simple and effective form. The inner flywheel is relatively heavy and must be accurately balanced while being carried on reliable anti-friction bearings within the hollow shell, and the clearances must be correctly adjusted to provide the necessary degree of coupling between shell and flywheel. Yet again, in connection with the shafts of high speed engines and the like in which many of the present problems do not arise, it has been proposed to fix a hollow drum to the shaft and to use liquid in the drum to damp torsional vibrations and to increase the internal surface by the provision of inwardly-projecting fixed gills or vanes.

According to the present invention, a flywheel having a comparatively light hollow shell or container is carried by the shaft of the film drum which is driven solely by the film itself, the shell having no internal bearings or loose parts, but containing a liquid of high viscosity which provides the necessary damping effect. In such an arrangement, the viscous liquid absorbs energy to varying degrees throughout its mass with changes of velocity, and pick-up of the flywheel mass is gradual in starting as is desirable for avoiding excessive film stresses. The liquid should be of high density so as to keep the size of the casing as small as possible. The casing can be light and indeed it may be of material of low specific gravity, as it has only to act as a container and for transmitting the torque to and from the liquid. The damping in the liquid is very effective and makes it possible to use less total mass for the flywheel, so that the compliance of the film acting through the curved portions is increased, and the efficiency of the system as a filter for eliminating transient disturbances is improved.

It is found that the stabilizing effect of a flywheel constructed according to the invention, becomes more considerable as the total mass of the flywheel system is within limits, reduced relatively to the moment of inertia of the viscous liquid and damping factor due to the viscosity of that liquid. With the optimum relation between these factors, the compliance of the film acting through the curved portions or loops is increased owing to the reduction of the tension of the film necessary for driving the flywheel and maintaining it in steady motion. Conse-

quently, the effectiveness of the flywheel system as a mechanical filter in eliminating transient disturbances, is improved.

As no internal mechanical bearings or loose parts requiring accurate clearances are provided, the construction is substantially simplified.

In order that the invention may be clearly understood and readily carried into effect, one form of construction in accordance therewith will now be described merely by way of example, with reference to the accompanying drawing, in which:

Figure 1 is a central sectional elevation of one form of flywheel with the associated driving spindle and drum; and

Figure 2 is a side elevation of the flywheel with its drum and the associated parts.

The shell or container of the flywheel is a light but rigid symmetrical casing 1, formed of two circular dished pieces 2, 3 which are united at the rim by means of a spun-over joint 4 which encloses a suitable packing ring or gasket 5 of rubber or other material.

The two dished pieces 2, 3 are secured to the boss 8 by means of spun-over joints 9, 10. The boss 8 has a central bore enabling it to be mounted on the spindle 11 which carries the drum 12 over which the sound record film passes, and by means of which alone, the whole flywheel system can be spun or rotated. The spindle 11 is carried on the practically frictionless ball bearings 13 and 14. Two filling holes are formed in small bosses 15, 16 secured in the flat wall of the dished piece 2, a liquid-tight joint being made in each case, for example by riveting. The holes are closed by two screwed plugs 17, 18.

It is intended that the shell or container 2, 3 shall be filled with a viscous liquid, which may be glycerine or a mixture of glycerine and water or other solvent, or it may be a thick oil such as castor oil, or a viscous solution such as sugar syrup, cellulose esters or ethers in solvents, and so forth. The specific gravity of glycerine is 1.26 and its viscosity is about 8.5 poises at 20° C. The viscosity of castor oil is sufficient for the purpose, but its density is a little below unity so that a larger bulk of castor oil is needed for the flywheel action. As the efficiency of the damping action depends on the viscosity, it is desirable to use a liquid which has a viscosity of the order of say 5 poises at the working temperature, say 20° C. and the greater the density of the liquid the better for the purpose in view. In some forms of the apparatus, in order to increase the damping, an additional partition or septum 6 may be provided lying in a plane of rotation and secured to the rim at the joint 4, and, indeed, more than one such partition may be provided.

The partition is perforated at 7 to allow of circulation of the viscous liquid and to allow the shell to be easily filled, but instead, there may be a central aperture in it around the hub or boss 8. Instead of being fixed to the outer shell, the partition 6 may be carried by the central hub or boss 8 in which case, a circular space is left between the outer edge of the partition 6 and the casing 1.

As seen in Figure 2 the driving drum 12 is provided with a freely-turning pressure or lay-on roller 19 and around it, the film 20 passes. A feed sprocket 21 carries the film towards the drum 12 and the film 20 is drawn at substantially constant speed over and around said drum by the sprocket 22. Owing to the very small tractive force required to maintain the drum and flywheel in motion, well defined loops 23 and 24 form in the film 20 which having great elastic compliance in conjunction with the inertia and damping of the flywheel system serves very completely to eliminate velocity variations in the travel of the film 20 at the recording or reproducing point.

It is obvious that various small modifications may be made in the construction; for example, although it is not of importance if the casing is slightly distorted by centrifugal forces, the pieces 2, 3 may be stiffened or rendered more rigid, for example, by radial ribs attached to the inside or outside of the flat faces of the pieces 2, 3 or by means of circular corrugations.

I claim:

1. In a feeding mechanism for sound record films, the combination of a drum around which the film passes and driven solely by the film itself, a speed-stabilizing flywheel in driving relationship with said drum and comprising a container and a viscous liquid within said container constituting substantially the whole of the flywheel mass.

2. In a feeding mechanism for sound record films, the combination of a shaft, a drum secured to said shaft around which drum the film passes and which is driven solely by the film itself, a speed-stabilizing flywheel also secured to said shaft and comprising a container and a viscous liquid within said container constituting substantially the whole of the flywheel mass.

3. In a feeding mechanism for sound record films, the combination of a drum around which the film passes and driven solely by the film itself, a speed-stabilizing flywheel in driving relationship with said drum and comprising a light thin-walled container and a viscous liquid within said container constituting substantially the whole of the flywheel mass.

4. In a feeding mechanism for sound record films, the combination of a shaft, a drum secured to said shaft around which drum the film passes and which is driven solely by the film itself, a speed-stabilizing flywheel also secured to said shaft and comprising a light thin-walled container and a viscous liquid within said container constituting substantially the whole of the flywheel mass.

5. In a feeding mechanism for sound record films, the combination of a shaft, a drum secured to said shaft around which drum the film passes and which is driven solely by the film itself, a speed-stabilizing flywheel also secured to said shaft and comprising a container of material of low specific gravity, and a viscous liquid within said container constituting substantially the whole of the flywheel mass.

6. In a feeding mechanism for sound record films, the combination of a shaft, a drum secured to said shaft around which drum the film passes and which is driven solely by the film itself, a speed-stabilizing flywheel also secured to said shaft and comprising a container and a liquid within said container, said liquid having a high viscosity exceeding 5 poises constituting substantially the whole of the flywheel mass.

7. In a feeding mechansm for sound record films, the combination of a drum around which the film passes, means for positively forwarding the film whereby said drum is solely driven by the pull of the film itself, a speed-stabilizing flywheel in driving relationship with said drum and comprising a container and a viscous liquid within said container constituting substantially the whole of the flywheel mass.

8. In a feeding mechanism for sound record films, the combination of a drum around which the film passes, means for positively forwarding the film whereby said drum is solely driven by the pull of the film itself, a speed-stabilizing flywheel in driving relationship, with said drum and comprising a container, at least one partition located internally of said container and fixed to the wall thereof and a viscous liquid within said container and in contact with said partition constituting substantially the whole of the flywheel mass.

9. In a feeding mechanism for sound record films, the combination of a shaft, a drum secured to said shaft and around which the film passes, means for positively forwarding the film whereby said drum is solely driven by the pull of the film, a speed-stabilizing flywheel also secured to said shaft and comprising a light thin-walled cylindrical container, at least one partition located internally of said container in a plane transverse to the axis thereof and fixed to said container to rotate therewith and a viscous liquid within said container and in contact with said partition constituting substantially the whole of the flywheel mass.

10. In a feeding mechanism for sound record films, the combination of a shaft, a drum secured to said shaft and around which the film passes, means for positively forwarding the film whereby said drum is solely driven by the pull of the film, means for forming the film into two loops, one of said loops preceding and the other following the passage of the film over said drum, a speed-stabilizing flywheel in driving relationship with said drum and comprising a container and a viscous liquid within said container constituting substantially the whole of the flywheel mass.

11. In a feeding mechanism for sound record films, the combination of a shaft, a drum secured to said shaft around which drum the film passes and which is driven solely by the film itself, a speed-stabilizing flywheel also secured to said shaft and comprising a container and a viscous liquid within said container, said liquid having a density high in comparison with that of water constituting substantially the whole of the flywheel mass.

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