June 9, 1953 H. J. FINDLEY 2,641,338

BAND BRAKE

Filed Jan. 20, 1950 2 Sheets-Sheet 1

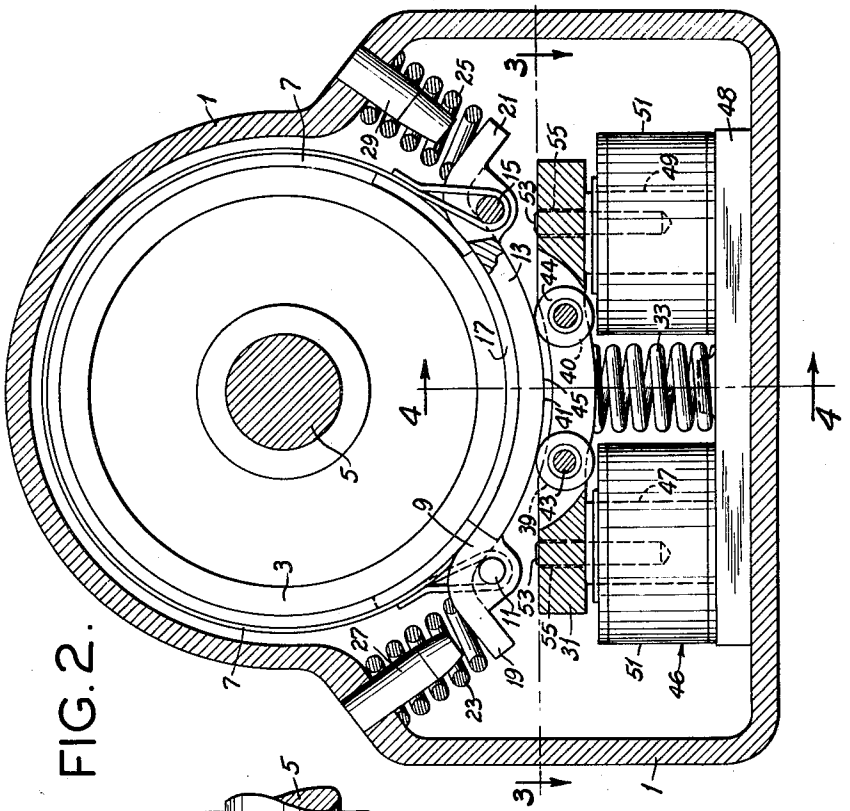


FIG. 2.

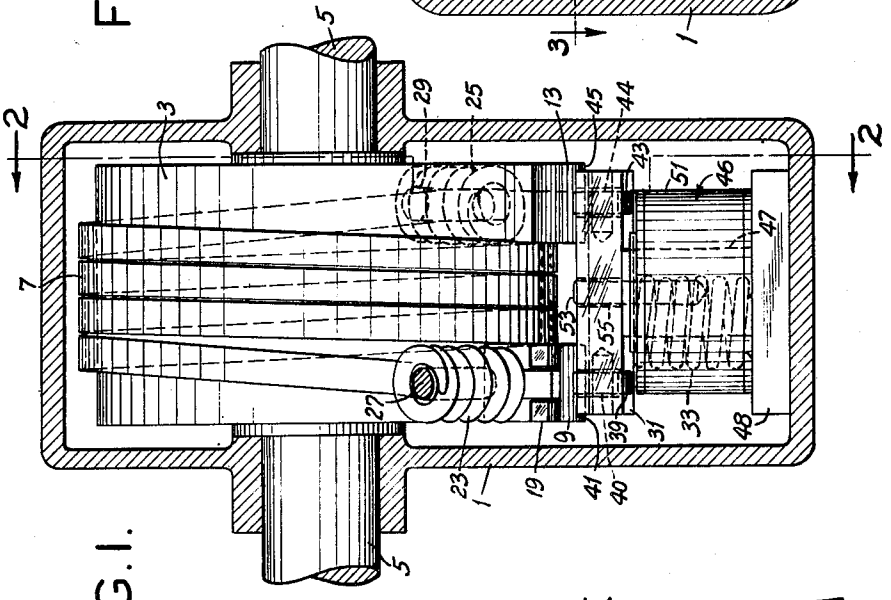


FIG. 1.

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FIG. 3.

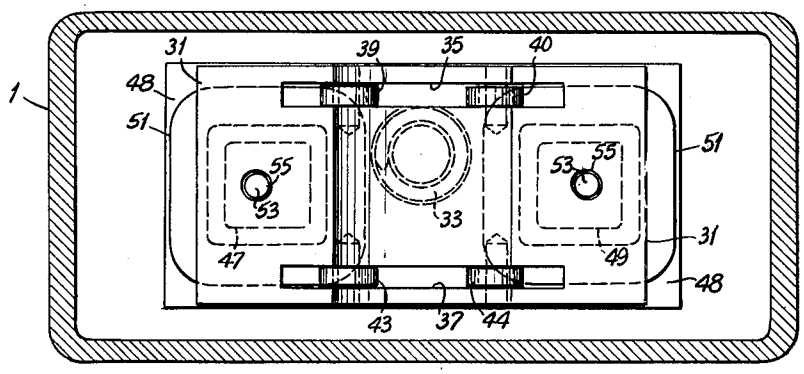
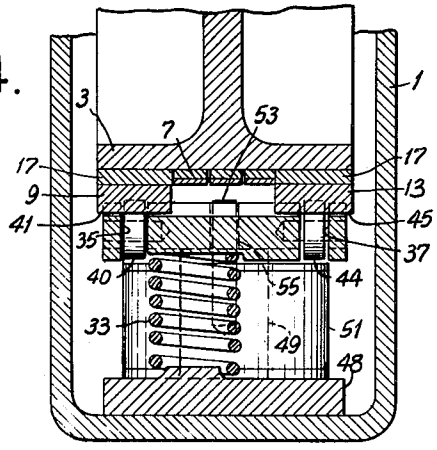


FIG. 4.



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BAND BRAKE

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8 Claims. (Cl. 188—137)

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This invention relates to band brakes and more particularly to two-way band brakes primarily, though not exclusively, useful for braking and locking rotary drums in automatic transmissions or the like.

One object of the invention is the provision of a servo-acting band brake which is adapted normally to be applied and adapted to be released upon actuation, rather than being normally released and adapted to be applied upon actuation. In general, this object is accomplished by providing relatively rotary band anchoring and drum members, with a band coiled around the drum and anchored (at one end to the anchoring member) against movement in the clock direction in which the band extends from its anchor, and by providing a friction shoe on the band which is engageable with the drum, and means for releasably pressing the shoe against the drum.

Another object of the invention is the provision of a two-way servo-acting band brake adapted to brake in either direction of rotation which is adapted normally to be applied and adapted to be released upon actuation, rather than being normally released and adapted to be applied upon actuation, wherein substantially the entire length of the brake band is effective for braking in either direction of rotation. In general, this is accomplished by providing relatively rotary band anchoring and drum members, with a band coiled around the drum and anchored at both ends to the anchoring member, and by providing two friction shoes attached to the band at spaced points along its length, as, for example, at the ends of the band, and means for releasably pressing the shoes against the drum. With this arrangement, the entire length of the band between shoes is effective for braking rotation in one direction or the other. Other features will be in part apparent and in part pointed out hereinafter.

The invention accordingly comprises the elements and combinations of elements, features of construction, and arrangements of parts which will be exemplified in the structures hereinafter described, and the scope of the application of which will be indicated in the following claims.

In the accompanying drawings, in which one of various possible embodiments of the invention is illustrated,

Fig. 1 is a side elevation of a brake embodying the invention, with parts broken away and shown in section;

Fig. 2 is a transverse section taken generally on line 2—2 of Fig. 1, with parts broken away and shown in section;

Fig. 3 is a section taken on line 3—3 of Fig. 2; and,

Fig. 4 is a section taken on line 4—4 of Fig. 2.

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Similar reference characters indicate corresponding parts throughout the several views of the drawings.

Referring to the drawings, there is shown at 1 a casing constituting a brake housing. Rotary in the housing is a brake drum 3 having a smooth cylindric periphery. The drum is shown as fixed on a shaft 5 journalled in bearings in the end walls of the housing. A lined brake band 7 is helically coiled around the drum. A friction shoe 9 is pivotally attached to one end of the band at 11. A friction shoe 13 is pivotally attached to the other end of the band at 15. Each shoe is curved to fit the periphery of the drum and has a friction lining 17 engageable with the periphery of the drum. Each of the shoes 9 and 13 is formed with an outstanding lug at its end where the band 7 is pivotally attached thereto, the lug on the shoe 9 being designated 19 and the lug on the shoe 13 being designated 21.

The band 7 is coiled as a left-handed screw around the drum from one shoe to the other (see Fig. 1). The end of the band attached to the shoe 9 is resiliently anchored against movement in clockwise direction by a compression spring 23 interposed between the lug 19 on shoe 9 and the peripheral wall of the housing 1, but is free to move to some extent in counterclockwise direction. The end of the band attached to the shoe 13 is resiliently anchored against movement in counterclockwise direction by a compression spring 25 interposed between the lug 21 on shoe 13 and the peripheral wall of the housing, but is free to move to some extent in clockwise direction. The springs 23 and 25 are held in position by spring posts 27 and 29, respectively, extending from the peripheral wall of the housing.

When the shoes 9 and 13 are released, the brake band 7 is loose on the drum, both springs 23 and 25 are only lightly compressed, and the lugs 19 and 21 are spaced from the ends of the respective spring posts 27 and 29 as illustrated in Fig. 2. If the drum is rotating clockwise as viewed in Fig. 2, and the shoes are pressed against the drum, the shoe 9 will be carried around clockwise with the drum until the lug 19 on shoe 9 engages the end of spring post 27, spring 23 being compressed, and shoe 13 will be carried around clockwise with the drum away from the end of spring post 29 until the band tightens on the drum and locks it. Conversely, if the drum is rotating counterclockwise as viewed in Fig. 2, and the shoes are pressed against the drum, the shoe 13 will be carried around counterclockwise with the drum until the lug 21 on shoe 13 engages the end of post 29, spring 25 being compressed, and shoe 9 will be carried around counterclockwise with the drum away from the end of spring post 27 until the band tightens on the drum and locks it. When the shoes are released, and in

their Fig. 2 position, the compression of springs 23 and 25 is insufficient to tighten the band enough to lock the drum.

The band 7 takes several turns around the drum and is of such length that the shoes 9 and 13 are located oppositely at the bottom of the drum, as illustrated in Figs. 1 and 4, spaced apart by the intervening convolutions of the band. Both shoes are adapted simultaneously to be pressed against the drum without restraining rotation of the shoes. This is effected by a magnetic armature member 31 which is biased upward toward the shoes by a spring 33. The armature 31 is of generally flat rectangular form and is made of magnetic material such as iron or soft steel. Adjacent the opposite sides of the armature are slots 35 and 37. Rollers 39 and 40 are pinned in the slot 35 for engaging the outer arcuate face 41 of the shoe 9. Rollers 43 and 44 are pinned in the slot 37 for engaging the outer arcuate face 45 of the shoe 13. Rollers 39 and 43 are coaxial with their axes parallel to the axis of the drum. Rollers 40 and 44 are coaxial with their axes parallel to the axis of the drum.

The armature 31 is adapted to be retracted against the bias of the spring 33 by an electromagnet 46 comprising a magnetic yoke 48 fixed to the bottom of the housing 1 and having upstanding poles 47 and 49 at its ends located to act upon opposite ends of the armature, with magnetizing coils 51 surrounding the poles. Guide pins 53 extend upward from the poles through holes 55 in the armature. Coils 51 are adapted simultaneously to be energized or deenergized.

Spring 33 is a compression spring located between the coils reacting from the yoke 48 against the bottom of the armature. Spring 33, as shown in Figs. 1 and 3, is located nearer the rollers 39 and 40 than the rollers 43 and 44 so that the component of the force of the spring acting on shoe 9 is greater than that acting on the shoe 13.

When the two-pole electromagnet 46 is energized, the armature 31 is retracted against the bias of the spring 33 and the shoes 9 and 13 are released so that the drum may rotate in either direction. Assuming that the drum is rotating clockwise as viewed in Fig. 2, and it is desired to lock it from turning, the electromagnet is deenergized. This releases the armature 31, which is driven upward by the spring 33 to press the shoes 9 and 13 against the drum with sufficient pressure that the shoes will be carried around clockwise with the drum, the shoe 9 riding on the rollers 39 and 40 and the shoe 13 riding on the rollers 43 and 44. The shoe 9 is carried around clockwise with the drum until the lug 19 on shoe 9 engages the end of the post 27 and spring 23 is compressed. During this interval, the shoe 13 is also carried clockwise around with the drum. As soon as the lug 19 engages post 27, the end of the band at 11 is anchored against further rotation. Shoe 13 then continues to move clockwise with the drum and initiates tightening of the band on the drum to the point where a frictional servo action occasioned by the increased friction between the coiling band and the drum takes place and causes final tightening of the band to lock the drum. The final locking action of the band is not dependent upon the friction between the shoe 13 and the drum, this friction only initiating the tightening of the band.

When it is desired to release the band to allow the drum again to rotate either in one direction or the other, the electromagnet 46 is energized to retract the armature 31 against the bias of the spring 33. This releases the pressure on the shoes 9 and 13 and releases the band, and spring 23 thereupon returns the shoes to their Fig. 2 position.

Assuming that the drum is rotating counterclockwise as viewed in Fig. 2 and it is desired to lock it from turning, the electromagnet 46 is deenergized, and armature 31 presses the shoes 9 and 13 against the drum so that they are carried around counterclockwise with the drum. The shoe 13 is carried around counterclockwise until lug 21 engages the end of the post 29, and spring 25 is compressed. During this interval, the shoe 9 is carried around counterclockwise so that the band is not immediately tightened. As soon as the lug 21 engages post 29, the end of the band at 15 is anchored against further rotation. Shoe 9 then continues to move counterclockwise and initiates tightening of the band on the drum to the point where a frictional servo action occasioned by the increased friction between the band and the drum takes place and causes final tightening of the band to lock the drum. The final locking action is not dependent upon the friction between the shoe 9 and the drum, this friction only initiating the tightening of the band.

When it is now desired to release the band to allow the drum again to rotate either in one direction or the other, the electromagnet 46 is energized to retract the armature 31 against the bias of spring 33. This releases the pressure on shoes 9 and 13 and releases the band, and spring 25 returns the shoes to the Fig. 2 position.

As herein shown, the spring 33 is located off-center so that the force on shoe 9 is greater than that on shoe 13 to take care of unequal torques occurring upon clockwise and counterclockwise rotation. With a greater force on shoe 9, which brakes on counterclockwise rotation, the brake takes care of a higher torque on counterclockwise rotation than on clockwise rotation. It will be understood that the spring 33 may be centered to exert equal force on the two shoes, or located nearer shoe 13 than shoe 9 to exert more force on shoe 13 than on shoe 9.

It is preferable that the air gaps between the poles 47 and 49 and the armature 31 when the armature is released be somewhat different so that the armature is pulled down first by one pole and then by the other. For example, the air gap between the right pole 49 and the armature may be a few thousandths of an inch greater than the gap between the left pole 47 and the armature. Under such circumstances, the left end of the armature will be pulled down first, the armature rocking about rollers 40 and 44. The holes 55 in the armature are made large enough to permit this rocking action of the armature.

It will be seen that so far as rotation of the drum in one direction is concerned, only one of the shoes is effective for braking. For example, in braking clockwise rotation of the drum as viewed in Fig. 2, shoe 13 is effective to initiate the braking action, the band being anchored at its end 11 against movement in clockwise direction. If two-way braking action were not required, the shoe 9, for example, could be omitted and the end 11 of the band simply anchored to the housing.

The arrangement wherein the brake is constantly under a tendency to be applied, by reason of the armature 31 being constantly biased in brake-applying direction, and wherein the brake

is released by energizing the electromagnet is particularly useful where the drum is to be locked against rotation more than it is released for rotation, since power is supplied to release the brake rather than to apply it.

While in the above-described embodiment of the invention, the brake drum **3** is rotary and the brake band anchoring member is stationary, it will be understood that this relationship may be reversed. That is, the brake drum may be stationary and the brake band anchor rotary. Moreover, it is also contemplated that the invention may be applied in a system wherein both the drum and the brake-band-anchor rotate, in which event, when the electromagnetic shoes are energized, the drum and brake-band-anchor will be clutched together and brought to the same speed. In this event, the device might be called a clutch, and the term "brake" is to be understood to refer to such a system, because the action is still a braking action wherein one element is brought to a stationary relationship with respect to the other when the brake is set.

In view of the above, it will be seen that the several objects of the invention are achieved and other advantageous results attained.

As many changes could be made in the above constructions without departing from the scope of the invention, it is intended that all matter contained in the above description or shown in the accompanying drawings shall be interpreted as illustrative and not in a limiting sense.

I claim:

1. A brake comprising a rotary brake drum, a fixed anchoring member, a brake band coiled around the drum, friction shoes at the ends of the band engageable with the drum, means anchoring one shoe to the anchoring member against rotation in one direction, said direction being that in which the band extends from said one shoe toward the other, but permitting limited rotation of said one shoe with the drum in the opposite direction, means anchoring the other shoe to the anchoring member against rotation in said opposite direction but permitting limited rotation of said other shoe in said one direction, the shoes being located side-by-side spaced apart axially of the drum by the intervening convolutions of the band, and having arcuate outer faces, a magnetic armature spring-biased against the shoes and having rollers engaging their outer arcuate faces, and an electromagnet acting on the armature to retract it against its bias.

2. A brake comprising a rotary brake drum, a fixed anchoring member, a brake band coiled around the drum, friction shoes at the ends of the band engageable with the drum, means resiliently anchoring one shoe to the anchoring member against rotation in one direction, said direction being that in which the band extends from said one shoe toward the other, but permitting limited rotation of said one shoe with the drum in the opposite direction, means anchoring the other shoe to the anchoring member against rotation in said opposite direction but permitting limited rotation of said other shoe in said one direction, the shoes being located side-by-side spaced apart axially of the drum by the intervening convolutions of the band, and having arcuate outer faces, a magnetic armature spring-biased against the shoes and having rollers engaging their outer arcuate faces, and an electromagnet acting on the armature to retract it against its bias, the armature being biased against the shoes by a compression spring acting against the outer side of the armature and positioned closer to one shoe than to the other.

3. A brake comprising a rotary brake drum, a flexible brake band coiled around the drum and anchored at one end with respect to the drum, a friction shoe at the other end of the band engageable with the drum, a magnetic armature mounted for movement toward and away from the shoe and spring-biased against the shoe but retained against rotation with the shoe while permitting the shoe to rotate, and an electromagnet acting on the armature to retract it from the shoe against the bias.

4. A brake as set forth in claim 3, wherein the shoe has an arcuate outer face, and the armature has rollers engaging the outer arcuate face of the shoe.

5. A brake comprising a rotary brake drum, a flexible brake band coiled around the drum and anchored at both ends with respect to the drum by means permitting play, two friction shoes attached to the band at spaced points along its length and engageable with the drum, a magnetic armature mounted for movement toward and away from the shoes and spring-biased against the shoes but retained against rotation with the shoes while permitting the shoes to rotate, and an electromagnet acting on the armature to retract it from the shoes against the bias.

6. A brake as set forth in claim 5, wherein the shoes have an arcuate outer face, and the armature has rollers engaging the outer arcuate faces of the shoes.

7. In combination, relatively rotary band anchoring and drum members, a flexible band coiled around the drum and anchored at one end to the anchoring member, a friction shoe at the other end of the band engageable with the drum member, a magnetic armature carried by the anchoring member for movement toward and away from the shoe and spring-biased against the shoe and retained against rotation relative to the anchoring member while permitting relative rotation as between the shoe and the anchoring member, and an electromagnet acting on the armature to retract it from the shoe against the bias.

8. In combination, relatively rotary band anchoring and drum members, a flexible band coiled around the drum member and anchored at both ends to the anchoring member by means permitting play, two friction shoes attached to the band at spaced points along its length and engageable with the drum member, a magnetic armature carried by the anchoring member for movement toward and away from the shoes and spring-biased against the shoes and retained against rotation relative to the anchoring member while permitting relative rotation between the shoes and the anchoring member, and an electromagnet acting on the armature to retract it from the shoes against the bias.

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