May 5, 1953 M. P. WINTHER 2,637,415

BAND BRAKE

Filed Dec. 13, 1949

FIG. 1.

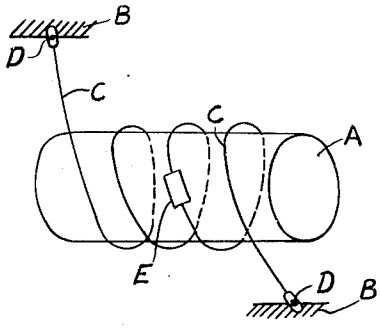



FIG. 2.

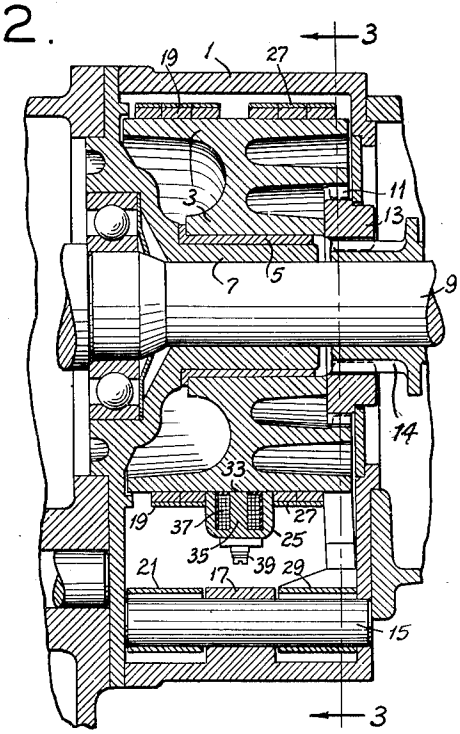



FIG 3

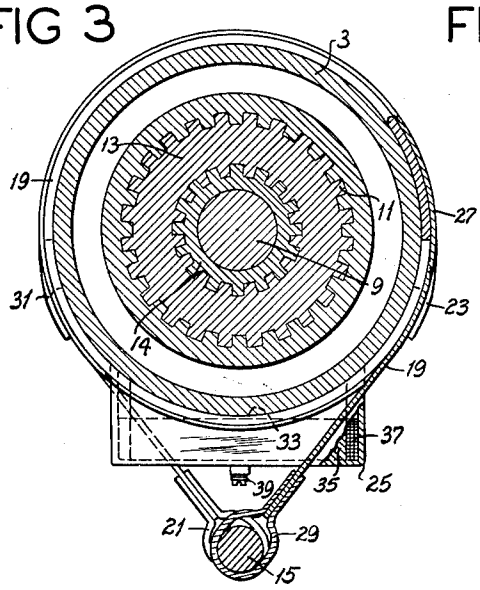
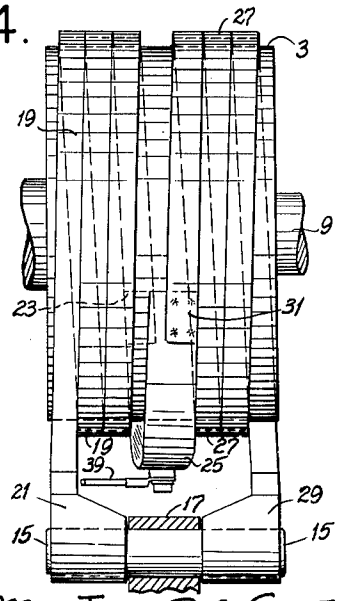



FIG. 4.




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# UNITED STATES PATENT OFFICE

2,637,415

## BAND BRAKE

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Application December 13, 1949, Serial No. 132,763

4 Claims. (Cl. 188—137)

1

This invention relates to band brakes and more particularly to two-way band brakes.

This invention is an improvement upon the band brake shown in the application of Jerrold B. Winther for Brake, Serial No. 91,985, filed May 7, 1949, issued as Patent 2,605,862, August 5, 1952. In said patent there is disclosed a brake comprising a magnetic brake drum and a brake band coiled around the drum. One end of the band is anchored. Attached to the other end of the band is a magnetic shoe provided with means for magnetizing it when desired. The arrangement is such that when the shoe is magnetized it is attracted to the surface of the brake drum, whereupon the shoe rotates with the drum. The brake band then tightens by coiling with servo action thereby braking the drum.

The brake disclosed in the said patent of Jerrold B. Winther is unidirectional, i. e., it acts only upon rotation of the brake drum in one specific direction, this being the direction in which the brake band is coiled around the drum from the anchor. It is the purpose of this invention to provide a two-way band brake which is adapted to brake the drum in either direction of rotation of the drum. In general, this is accomplished by providing a drum and a band coiled around the drum with both ends of the band anchored. A shoe is attached to the band at an intermediate point along its length, preferably the center. The brake includes means whereby the shoe may be caused controllably to cling to the drum. In particular, this is accomplished by making the drum magnetic, and by employing an electromagnetic shoe adapted magnetically to attract itself to the drum. With this arrangement, that part of the length of the band extending from one anchor to the shoe is effective for braking upon rotation in one direction, and that part of the length of the band extending from the other anchor to the shoe is effective for braking upon rotation in the opposite direction. 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 drawing, in which one of various possible embodiments of the invention is illustrated.

Fig. 1 is a diagrammatic view illustrating the basic principles of the invention;

2

Fig. 2 is a longitudinal section through a practical embodiment of the invention;

Fig. 3 is a transverse section on line 3—3 of Fig. 2, with a brake housing omitted; and,

Fig. 4 is a side elevation of the operating parts of the brake removed from other parts.

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

Fig. 1 diagrammatically illustrates the basic features of the invention. A drum member is shown at A and a band anchoring member is shown at B. These are relatively rotary. Usually, the drum member A is rotary and the band anchoring member B is stationary. A friction strap or band C is loosely coiled around the drum and has both its ends anchored with lost motion to the anchoring member at D. At E is shown a shoe attached to the band at a point intermediate its length. Means is provided whereby the shoe may be caused to engage and cling to the drum. For example, the drum may be made of magnetic material and the shoe an electromagnet adapted magnetically to cling to the drum upon being energized. With this arrangement, assuming the drum to be rotary and the band anchoring member stationary, that part of the length of the band extending from one anchor D to the shoe is effective for braking upon rotation of the drum in one direction, and that part of the length of the band extending from the other anchor D to the shoe is effective for braking upon rotation of the drum in the opposite direction.

Figs. 2–4 illustrate the invention in an application for locking the sun gear of a planetary gear train of an automatic transmission. The transmission is completely disclosed in the copending application of myself and Howard J. Findley for Power Transmission, Serial No. 125,854, filed November 7, 1949, issued as Patent 2,605,650, August 5, 1952. It will be understood that the invention has many other applications.

Referring to Figs. 2–4, there is shown at 1 a casing constituting a brake housing. Rotary in the housing is a brake drum 3, which is made of magnetic material such as iron or soft steel, and which has a smooth cylindric periphery. The drum is rotary on a sleeve bearing 5 located on a fixed sleeve 7 formed as an extending part of one end wall of the housing. At 9 is shown a shaft which extends through the sleeve 7. The brake drum is shown to have a splined connection at 11 with a drive ring 13. Ring 13 is splined to a sleeve 14 which is independent of shaft 9 and which is attached to the parts to be braked. The

shaft 9, splined connection 11, drive ring 13 and sleeve 14 are elements of the aforementioned transmission and are not essential as regards the brake of this invention per se.

At 15 is shown an anchoring member consisting of a pin which extends longitudinally in the housing located outward of the periphery of the brake drum, being fixed at its center in a boss 17 formed on the interior of the wall of the housing. A lined brake band element 19 is loosely anchored at one end to one end of the pin by means of a connector 21 formed to allow some lost motion or play. The brake band element 19 is helically coiled around the brake drum in clockwise direction from its anchored end, as viewed in Fig. 3, which is to say, like a left-handed screw (Fig. 4); and its other end is attached at 23 to one end of a box-like electromagnetic shoe 25. A second lined brake band element 27 is loosely anchored at one end to the other end of the pin by means of a connector 29 like connector 21 formed to allow some lost motion or play. The brake band element 27 is helically coiled around the brake drum in counterclockwise direction from its anchored end, as viewed in Fig. 3, and its other end is attached at 31 to the other end of the shoe 25. It also is therefore of the character of a left-handed screw.

The shoe 25, which is made of magnetic material such as iron or soft steel, has a curved open face 33 shaped to fit the cylindrical periphery of the brake drum and is skew formed so as to follow the helix of the brake band elements. In the shoe is a magnetic pole piece 35, of magnetic material, such as iron or soft steel, around which is fitted a magnetizing coil 37. The pole piece is shaped to fit the cylindrical periphery of the drum. The coil 37 may be energized through leads 39.

Since the two brake band elements 19 and 27 are connected through the shoe, in effect they constitute a continuous brake band extending from the anchor at 21 to the anchor at 29 with the shoe 25 at an intermediate point along the length of the band. The band is wrapped around the drum loosely, so that the friction between the band and the drum is not sufficient to initiate any servo braking action as long as the magnetizing coil 37 is deenergized. Thus, with the coil 37 deenergized, the drum may rotate in either direction without effective frictional restraint within the loose brake band.

Assuming that the drum is rotating clockwise as viewed in Fig. 3, and it is desired to stop the drum, the coil 37 is energized. This causes the shoe 25 magnetically to cling to the brake drum and to be carried around with the drum clockwise as viewed in Fig. 3. This initiates tightening of the brake band element 19, which is coiled around the drum in clockwise direction from its anchored end as viewed in Fig. 3, and is followed by a frictional servo action occasioned by the friction between the brake band element and the drum which causes the brake band element tightly to grip and lock the drum against rotation. Thus, it will be seen that the final locking action of the brake band element is not dependent upon the magnetic clinging of the shoe 25 to the brake drum, this magnetic clinging only initiating the tightening of the brake band element. When the brake band element 19 tightens around the brake drum, the action is to loosen the other brake band element 27. The play at the anchor 29 for the brake band element 27 permits this loosening action. When the coil 37 is subsequently deenergized, since the brake drum is stopped, and no forces are present tending to keep the brake band element 19 tight, the brake band element is released.

Assuming that the drum is rotating counterclockwise as viewed in Fig. 3, and it is desired to stop the drum, the coil 37 is energized. This causes the shoe 25 magnetically to cling to the brake drum and to be carried around with the drum counterclockwise as viewed in Fig. 3. This initiates tightening of the brake band element 27, which is coiled around the drum in counterclockwise direction from its anchored end as viewed in Fig. 3, and is followed by a frictional servo action occasioned by the friction between the brake band element 27 and the drum which causes the brake band element tightly to grip and lock the drum against rotation. The final locking action of the brake band element again is not dependent upon the magnetic clinging of the shoe 25 to the brake drum, the magnetic clinging only initiating the tightening of the brake band element 27. When the brake band element 27 tightens around the brake drum, the action is to loosen the other brake band element 19. The play at anchor 21 for element 19 permits this loosening action. When the coil is subsequently deenergized, the brake band element 27 is released.

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 shoe 25 is 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. The term clutch and brake are to be considered herein as synonymous.

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 drawing shall be interpreted as illustrative and not in a limiting sense.

I claim:

1. A brake comprising a magnetic brake drum and a band anchoring member, one of which is rotary and the other stationary, a brake band loosely coiled around the drum and having both its ends anchored to the anchoring member, and an electromagnetic shoe attached to the band at an intermediate point along its length adapted magnetically to cling to the drum upon being energized, the shoe, when energized being rotatable with the drum relative to the band anchoring member to tighten the band on either side of the shoe.

2. A brake comprising a rotary magnetic brake drum, a brake band loosely coiled around the drum with both of its ends anchored with respect to the drum, and an electromagnetic shoe attached to the band at an intermediate point along

its length adapted magnetically to cling to and rotate with the drum upon being energized, whereby that portion of the length of the band extending from one anchor to the shoe is effective for braking upon rotation of the drum in one direction and that portion of the length of the band extending from the other anchor to the shoe is effective for braking upon rotation of the drum in the opposite direction, the ends of the band being anchored by means affording some play.

3. A brake comprising a housing, a magnetic brake drum rotary in the housing, an anchor pin fixed in the housing extending longitudinally and located outward of the periphery of the drum, a lined brake band element loosely anchored at one end to one end of the pin and coiled in a helix around the drum, an electromagnetic shoe attached to the other end of the brake band element adapted to cling to and rotate with the drum upon being energized, and a second lined brake band element loosely anchored at one end to the other end of the pin, coiled in a helix around the drum, and attached at its other end to the shoe, the first band element extending in one direction from its anchor to the shoe for braking upon rotation of the drum in said one direction, the second band element extending in the opposite direction from its anchor to the shoe for braking upon rotation of the drum in said opposite direction, the shoe comprising a box-



like magnetic member having a curved open face shaped to fit the periphery of the drum and having a magnetizing coil around a pole therein, and being skewed to follow the helix of the brake band elements.

4. In combination, a magnetic drum and a band anchoring member, said drum and member being relatively rotary, a brake band loosely coiled around the drum and having both its ends anchored to the anchoring member, and an electromagnetic shoe attached to the band at an intermediate point along its length adapted magnetically to cling to the drum upon being energized, the shoe, when energized, being rotatable with the drum relative to the band anchoring member to tighten the band on either side of the shoe.

MARTIN P. WINTHER.

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