ADJUSTABLE CLUTCH FOR RELATIVELY MOVING TUBULAR PARTS

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5 Claims

ABSTRACT OF THE DISCLOSURE

A clutch which is adjusted by selectively spreading fingers attached to one end of an elongated element telescoped within a tube, the adjustment being effected and maintained by a bolt whose head turns against wedge-shaped fingers and a compression spring that constantly urges the fingers outward into contact with the tube.

This invention relates to a means for controlling the relative movement between a first hollow member and a second member which telescopes within the first member.

A problem that has faced entertainers, speakers, singers, etc., for an appreciable time has been the lack of uniformity in personal preference with regard to the height at which a microphone should be adjusted when it is being used. That is, some people naturally talk and sing loudly, and therefore do not need or want a microphone to conspicuously intrude between themselves and their audience. Others talk softly and have a genuine need for a microphone to be placed rather closely to their mouth. Furthermore, in any random group of people, there are more likely to be people of diverse heights than of a uniform height. Consequently, the chances are great that a microphone which is adjusted to an optimum height for a first person will likely not be at an optimum height for a subsequent person. This chance of incompatible microphone heights is even more likely when the first person is a male, such as a master of ceremonies, and the subsequent person is, for example, a female vocalist.

The need to have a microphone placed at different heights has been generally satisfied by making microphones stands adjustable, with adjustments usually being achieved by making the stand from two tubular, upright members, one being larger than the other so that one may be telescoped within the other. With this technique there has arisen the need to provide a locking mechanism or clutch to hold the two members in place once their relative positions have been set to provide a desired overall height. Mechanical clutches of a variety of types have been made from time to time, but each has been plagued by a common problem. That is, when the upright members are once set, it is normally desired that they remain firmly in position and that they not move or creep; yet, when it is desired to change their setting, it is preferred that the clutch be sufficiently released that there is no drag which is significant enough to be offending. Accordingly, mechanical clutches have been employed which are characterized as having a so-called "positive" release and, when in the holding mode, they provide a truly positive grip. The relatively definite control that is achieved by clutches of this type is certainly beneficial in preventing creep, but it suffers from the liability of requiring two hands to effect an adjustment. That is, one hand must grip the clutch to activate the release mechanism, and the other hand must be employed to grasp the upper tube to move it to the desired position. As long as the stand is in an upright position and the release mechanism alone is activated, the upper tube is usually under no restraint; and, if it is not held up by a hand, it quickly falls or telescopes to its lowest possible position within the outer tube.

For a vocalist, the requirement that two hands be used in adjusting a microphone stand is not really an insurmountable obstacle to satisfactory use; but it is less desirable than would be one-handed adjustment. This is particularly true because vocalists so often use their hands in expressive movements that are intended to complement their singing. Hence, to observe a singer struggling with both hands to make an adjustment in microphone height during a performance is to observe a physical act which can detract from the words of the song and the atmosphere that the singer is trying to create with the song. The requirement for two-handed operation of a stand is perhaps even more of a problem to a musician who must utilize a sheet music stand with a positive lock, because he must usually lay down his instrument in order to have both hands free to change the height of the stand. Thus, it will be seen that problems faced by a photographer in adjusting a camera tripod, a musician in adjusting a music stand, etc., are very similar to the problem faced by those people who use microphone stands; hence, a solution for one problem can usually be adapted to satisfy a related need. Accordingly, broadly speaking, it is an object of this invention to provide an improved means for controlling the relative movement between a first hollow member and a second member adapted to telescope within the first member.

Another object is to provide an improved microphone stand.

A further object is to provide a substitute for the conventional clutch found in most microphone stands.

Yet another object is to provide an economical friction element which is adjustable to provide any desired degree of resistance to movement between a tubular member and the friction element enclosed thereby.

A still further object is to provide a dependable stand which is adjustable in height through the use of only one hand.

Other objects and advantages will be apparent from the specification and claims and from the accompanying drawing illustrative of the invention.

In the drawing:

FIG. 1 is a representation of a microphone stand which is adjustable in height by virtue of the telescoping action of a small diameter tube within a large diameter tube; FIG. 2 is an isometric view, partially sectioned, of the friction device which controls relative movement between an inner and outer tube such as those shown in FIG. 1; FIG. 3 is an elevation view in section of a friction element before it is installed in a device such as shown in FIG. 2; FIG. 4 is an elevation view in section of the friction device shown in FIG. 2; FIG. 5 is an elevation view in section of an alternate embodiment of a friction device; FIG. 6 is an end view of a friction device such as the one shown in FIG. 5; FIG. 7 is an elevation view in section of a still further embodiment of a friction device; and FIG. 8 is an end view of a friction device such as the one shown in FIG. 7.

With initial reference to FIG. 1, a microphone stand 10 is shown in a conventional upright position. A microphone 11 is mounted on top of the stand 10 in a routine manner, and the height of the microphone is adjusted by moving an inner tube 12 relative to an outer tube 13. As will be apparent later, it is not necessary that the inner element 12 be hollow; however, it is only necessary that it be elongated so that it will telescope within the outer tube 13.
With further reference to FIG. 2, a friction device 14 comprising a preferred embodiment is attached to one end of the tube 12 by any convenient means such as by staking. In the figure, the numeral 15 is employed to refer to a portion of the tube that has been upset to secure the device. The device 14 is preferably made from a plastic such as low-density polyethylene; thus, it readily yields during the upsetting process to achieve an effective lock between the friction device and the tube 12. The friction device 14 has a base 16 and a threaded bore extending along the longitudinal axis, which can perhaps be seen in FIG. 3. The element 14 also has a plurality of pendant fingers 18 extending from the periphery of the base, in a manner such that they are adapted to bear against an internal surface of the tube 13. Each of the fingers 18 comprises a wedge having proximal portions which are nearer the longitudinal axis of the device 14 than are the distal portions. Thus, the internal surface 19 which joins proximal and distal portions of a respective finger 18 is inclined with respect to the longitudinal axis of the device 14; for convenience, it is referred to herein merely as the inclined surface. Each finger 18 further has an internal groove 20 in its distal portion, with the plurality of grooves being aligned so as to retain a ring 21 therein.

With further reference to FIG. 4, a threaded member 22 such as a bolt is engaged in the bore 17 of the friction element 14, with its head 23 extending out of the tube 12 such that it may be rotated to affect the position of the head with respect to the fingers 18. The head 23 has a diameter which is less than the distance between diametrically opposed internal surfaces of the finger distal portions, and is greater than the distance between diametrically opposed internal surfaces of the finger proximal portions. Since an inclined surface 19 extends between distal and proximate portions of a respective finger 18, the relative position between the bolt head 23 and the fingers can be adjusted by turning the bolt 22 with respect to the friction element 14. The position of the bolt 22 can be adjusted such that the head 23 bears against the outer tube 13. Where the tube 13 is not shown in FIGS. 3 and 4, a comparison of FIG. 3 (which shows only the friction element 14) with FIG. 4 (which shows both the friction element and the bolt 22) will reveal how the bolt head 23 serves to spread the fingers into a position where they can affect the relative movement between the tube 12 and the tube 13. For purposes of illustrating the spreading action of the bolt head 23, the fingers are shown in a slightly exaggerated position.

In addition to the bolt 22 which serves to spread the fingers 18, a split ring 24 is inserted into the grooves 20 provided for this purpose. The ring 24 has a diameter which when it is in a relaxed or uncompressed state, is greater than the relaxed distance between diametrically opposed grooves 20. That is, diametrically opposed fingers 18 are initially separated by a distance which will not admit the entry of ring 24; the ring is therefore made resilient so that it may be radially compressed to present a smaller diameter, and the fingers 18 are designed to flex with respect to the base 16, so that the ring can be inserted between the grooves 20. The depth of the grooves 20 and the diameter of the ring 24 are set so that when the split ring is approximately in its position and is released from the tool used to insert it, the ring cannot expand as much as would be required to return it to its relaxed or uncompressed position kept in compression once it is in place in the grooves 20, and the distal portions of the fingers 18 therefore will continuously bear against the outer tube with a force which is substantially constant.

In operation of this preferred embodiment of the invention (shown in FIGS. 2, 3 and 4), the installed friction device 14 controls the relative movement between the inner member 12 and the outer tube 13 with a degree of certainty never before possible with such a simple and therefore economical construction. That is, the friction device 14 is adjustable to provide practically any desired amount of drag when the inner tube 12 is moved with respect to the outer tube 13. The first components of the overall drag is realized from the force which the resilient ring 24 exerts on the distal portions of the fingers 18, which force is in turn exerted on the outer tube 13. This first drag component is substantially constant since the friction device 14 is fabricated and installed. It should be apparent, however, that a force of almost any desired magnitude can be achieved by proper selection of the uncompressed diameter of the snap ring 24, the material from which the ring is made, the relative sizes of the friction element 14 and the outer tube 13, etc. As a means of keeping production costs at a modest level, however, it is preferred that conventional hardware items be employed; accordingly, a conventional spring-steel retaining or snap ring is employed rather than one which is specifically designed for a single purpose. The wide variety of sizes in snap rings which are commercially available makes a satisfactory match between snap ring 24, fingers 18 and outer tube 13 relatively easy to establish.

The second component of the total drag is adjustable, which contributes in a dominant manner to the degree of control that distinguishes this invention from prior devices. This second drag component is realized from the force which the bolt head 23 exerts on the proximal portions of the fingers 18, which force is in turn exerted on the outer tube 13. The force is adjusted by turning the bolt 23 so as to advance or withdraw it from the threaded bore 17 of the member 14. Rotating the bolt head 23 is most readily accomplished by turning a rod on its side and then telescoping the inner tube 12 within the outer tube 13 until the bolt head is reachable with a screwdriver or the like from the bottom of the stand. When the bolt 22 is advanced into the friction element 14, the head 23 eventually contacts the inclined surfaces, and thereafter turning causes the fingers 18 to spread outwardly until proximal portions of the fingers bear against the inner surface of the outer tube 13. The force transmitted to the finger proximal portions does not interfere with the force transmitted to the finger distal portions because the forces are applied in two axially spaced planes. That is, the forces applied by the snap ring 24 and the bolt head 23 are applied at positions adjacent opposite ends of the wedge-shaped fingers 18; being spaced as they are, the ring and bolt cooperate to apply an appropriate total force to the outer tube through the same friction elements or fingers 18 without interference.

With respect to principles of mechanics, the effect achieved by this construction is almost the same as if the fingers 18 were beams simply supported at their two ends, and not supported like cantilevered beams. While it is perhaps true that simply supported friction elements could somehow be made to do substantially the same thing that the pendant wedges 18 are doing, it would obviously be necessary to provide a cage or race which would be rigidly connected to the inner tube 12 so as to retain such substitute friction elements, and the advantages of a substantially unitary device would be lost. That is, the bulk of friction device 14 as shown in FIG. 2 is relatively easy and economical to mold in one piece from polyethylene or the like, and the only steps required to prepare it for final installation are the steps of adding a conventional bolt 22 and a resilient ring 24. Thus, only three components complete the device.

While it is true that in theoretical situations the friction realized between a friction device 14 and a mating tube 13 is dependent only on the amount of force transmitted from one to the other and is not dependent on the area through which the two items are in contact, in actual practice the surface imperfections inherent in most commercially available materials causes the surface area in contact to be of real significance in achieving a desired amount of friction. The original concentrated loads imposed by the two means 22, 24 on one side of the fingers
18 are realized at the other side as widely distributed loads, which insures that larger portions of the fingers are actually in contact with and not merely lying alongside the outer tube. In consequence to the spring applied force between the fingers 18 and the outer tube 13, the inner tube may be pulled as far out of the outer tube as is desired to provide the microphone height needed. A height adjustment when once made will normally be retained indefinitely in the absence of, for example, unusual temperature changes. It is true that if the outer tube 13 is made of, for example, aluminum, and the friction device is made of a different material such as polyethylene, an adjustment which is considered perfect at 65° F. may not be so at 85° F. because of the difference in thermal expansion of such materials. However, the substantially constant force exerted by the resilient ring 24 maintains contact between the fingers 18 and the outer tube 13 and therefore compensates for thermal expansion of the outer tube 13 as well as, for example, shrinkage of the polyethylene due to freezing. As indicated earlier, however, the force which is exerted by a resilient member such as snap ring 24 is effectively established at a permanent value during manufacture of the stand. Hence, the resilient member alone cannot achieve the selectivity which entertainers generally desire in microphone stands. Thus, only with the snap ring 24 in combination with the threaded member 22 can both a 100-pound soprano and a 250-pound baritone have the opportunity to use such a dependable microphone stand which is adjustable to suit their personal tastes, i.e., one that yields to the amount of force they want to apply in effecting more movement.

Probably equally as important as personal tastes in an adjustable microphone is the ability to compensate for wear of the friction fingers 18. Thus, after the stand has been employed for so many months that some wear has occurred, to the extent that the fit is not as tight as it once was, the bolt 22 can be advanced to further spread the fingers 18 and restore the amount of drag that is desired. The pitch of the threads on the bolt 22, of course, will determine exactly how fine the adjustment is that can be made in the force supplied by the bolt. If it has been determined, however, that conventional stove bolts with their relatively coarse threads provide excellent control, and for a microphone stand such bolts are more than adequate.

It should perhaps be noted that the friction element 14 is constructed so simply and is so easy to adjust that practically anyone could effect the adjustment once they were told which way to turn the bolt 22. Too, the parts that make up the device are so simple that there is essentially nothing to go wrong, break, get lost, etc. Even the possibility of backing off the bolt 22 so far that it becomes completely unthreaded is avoided by properly sizing the snap ring 24; that is, the internal diameter of the snap ring is large enough to pass the blade of a screwdriver when an adjustment is to be made, but it is not so large as to permit the passage of a bolt head. Hence, the bolt 22 will always remain in the friction device 14 except when a deliberate step is taken to remove it.

Having described the preferred embodiment of the friction device 14 and explained the manner in which its successful operation is achieved, it will no doubt be apparent to those skilled in the art that certain substitutions could perhaps be made which would result in a somewhat different configuration, but nevertheless produce nearly the same results. Example of alternate configurations that properly fall within the scope of the invention are those shown in FIGS. 5–8, which will now be described in detail.

In FIGS. 5 and 6, a friction device 14A is shown wherein pendant fingers 18A are arranged so that their wedged cross-section operates to spread the fingers when a bolt is backed off. Rather than the threaded bore, the bolt head 23A is inclined so that it is approximately tangent to the inclined surface 19A, and it has a recess which is adapted to receive the end of an Allen wrench or the like when turning is to be effected. A compression spring 25 is shown in a compressed position as if it were being restrained by an outer tube. Said spring 25, like the ring 24 previously described, urges the distal portions of a finger 18A outward such that it continuously bears against an outer tube. A hole 26 is provided in the spring 25 to permit a wrench to be inserted through the spring to effect turning of the bolt 22A.

If the base 16A and fingers 18A are to be molded or cast, the reversed slope of the wedge-shaped fingers in this embodiment might make it difficult to extract a finished unitary piece from the mold. Hence, it may be appropriate to make two identical halves and place them face-to-face at the end of the inner member, with such a construction in FIGS. 13 and 14. This construction makes it possible to utilize the same truncated cylindrical configuration in the fric tion element must be compatible with the mounting of the element. For example, in the embodiment shown in
FIG. 4, the bolt 22 is capable of exerting a greater force than is a conventional snap ring 24; accordingly, it is appropriate that the bolt means be used at the proximal end of a finger 18, because said proximal end is stiffer and less susceptible to flexing movement than the distal end. Thus, while it is deemed necessary only that a substantially constant force and an adjustable force be applied to the outer tube, with the configuration of FIG. 4 it is preferable that the bolt 22 and the snap ring 24 have the spatial relationship shown, i.e., it is preferable that their positions not be reversed.

The material from which the friction device 14 is made can of course be selected according to the use to which the product is to be put. For example, if very small adjustments in tube spacing are to be made and yet firm gripping action is desired, it will probably be appropriate to use a material whose static coefficient of friction is low. Other factors deserving consideration are the relationship between the static and the sliding coefficients of friction, the weight of the device to be supported by the stand, whether the tubes are normally used in a vertical or in a horizontal plane, the frequency of relative movement of the two elements, etc. Because of the adjustment which is made possible by this invention, however, these factors need not be as accurately determined before a stand is manufactured as is the case with many other stands. Furthermore, a retailer can stock a single stand which, with proper adjustment, can satisfy many diverse needs. Thus, the retailer is benefited because he can reduce the variety of stands he must keep in stock, and the customers are benefited because they are less likely to find that the only stand they can use is temporarily out of stock. It will be apparent, then, that the utility of the friction devices disclosed herein has been ably demonstrated.

Besides the aforementioned low-density polyethylene, there are of course other materials which might be employed for the friction device 14, including, for example, other polyethylenes, propylene, nylon, Delrin, etc. For a microphone stand, however, it has been discovered that low-density polyethylene produces the best results, said results being based upon favorable wear resistance, quietness of operation, molding qualities, flexural strength, Rockwell hardness, coefficients of friction, flexural modulus, etc.

While relatively few embodiments of the invention have been described in detail herein and shown in the accompanying drawing it will be evident that various further modifications are possible in the arrangement and construction of its components without departing from the scope of the invention.

What is claimed is:

1. Means for controlling the relative movement between a first hollow member and a second member adapted to telescope within the first member, comprising:
   a friction element secured to a first end of the second member, said element having a base with a threaded bore extending along the longitudinal axis thereof, and having at least one pendant finger extending from the periphery of the base and adapted to bear against an internal surface of the hollow member, said finger having proximal portions which are nearer the longitudinal axis of the element than are the distal portions, with an inclined surface joining the proximal and distal portions thereof, and said finger having an internal radially extending groove in its distal portion; a thread member engaged in the bore of the friction element, said member having a head adapted to be rotated to affect the position of the head with respect to a finger, said head having a radius which is less than the distance between diametrically opposed internal surfaces of the finger; and the friction element and the internal surface of a distal portion of a finger, and said radius being greater than the distance between said longitudinal axis and the internal surface of a proximal portion of a finger, whereby the position of said threaded member with respect to the friction element is adjustable as desired to cause the head to bear against a finger and in turn to cause said finger to bear against the first hollow member; and
   a radially compressible spring member positioned within said grooves to cause the distal portion of said finger to bear against the first hollow member with a substantially constant force.

2. A microphone stand having a hollow outer tube and an inner tube adapted to be selectively positioned at least partially within and extending beyond the outer tube, and further having a means for adjusting the inner tube to the outer tube, comprising:
   a friction element secured to a first end of the inner tube, said element having a base with a threaded bore extending along the longitudinal axis thereof, and having at least two diametrically opposed pendant fingers extending longitudinally from the periphery of the base, each of which fingers is adapted to bear against an internal surface of the hollow member, said fingers having proximal portions which are nearer to the longitudinal axis of the element than are the distal portions, with an inclined surface joining proximal and distal portions of respective fingers, and each finger having an internal groove in its distal portion, with said grooves being aligned so as to retain a ring therebetween;
   a bolt threadably engaged in the bore of the friction element, said bolt having a head adapted to be rotated to affect the position of the head with respect to the fingers, said head having a diameter which is less than the distance between diametrically opposed internal surfaces of the respective finger distal portions and is greater than the distance between diametrically opposed internal surfaces of the respective finger proximal portions, whereby the position of said bolt with respect to the friction element is adjustable as desired to cause the head to bear against the fingers and in turn to cause the fingers to bear against the outer tube; and
   a split ring of resilient material inserted into the grooves of the fingers, the diameter of the uncompressed ring being greater than the initial distance between diametrically opposed grooves such that the fingers are spread outwardly by the ring, the ring being of such a diameter that the ring causes the spread fingers to bear against the outer tube.

3. The microphone stand as defined in claim 2 wherein the friction element is made of low-density polyethylene.

4. Means for controlling the relative movement between a first hollow member and a second member adapted to telescope within the first member, comprising:
   a friction element secured to a first end of the second member, said element having a base with an axially extending threaded bore, and having a plurality of pendant fingers extending from the periphery of the base and adapted to bear against an internal surface of the hollow member, said fingers having proximal portions which are nearer the longitudinal axis of the element than are the distal portions, with an inclined surface joining the proximal and distal portions thereof, and said finger having an internal radially extending groove in its distal portion; a thread member engaged in the bore of the friction element, said member having a head adapted to be rotated to affect the position of the head with respect to a finger, said head having a radius which is less than the distance between diametrically opposed internal surfaces of the finger distal portions and is greater than the distance between diametrically opposed internal surfaces of the finger proximal portions, whereby the position of said thread member
with respect to the friction element is adjustable as desired to cause the head to bear against a finger and in turn to cause said finger to bear against the first hollow member; and
a radially compressible spring member positioned within said grooves to cause the distal portion of said finger to bear against the first hollow member with a substantially constant force.

5. Means for controlling the relative movement between a first hollow member and a second member adapted to telescope within the first member, comprising:
a friction element secured to a first end of the second member, said element having a base with an axially extending threaded bore and having at least two diametrically opposed pendant fingers extending longitudinally from the periphery of the base and adapted to bear against an internal surface of the hollow member, said fingers having proximal portions which are nearer the longitudinal axis of the element than are the distal portions, and each finger having an internal groove in its distal portion, said grooves being axially aligned;
a threaded member engaged in the bore of the friction element, said member having a head adapted to be rotated to affect the position of the head with respect to the fingers, said head having a diameter which is less than the distance between diametrically opposed internal surfaces of the respective finger distal por-
tions and is greater than the distance between diametrically opposed internal surfaces of the respective finger proximal portions, whereby the position of said member with respect to the friction element is adjustable as desired to cause the head to bear against the fingers and in turn to cause the fingers to bear against the outer tube; and
a radially compressed resilient member inserted into the grooves of the fingers, the uncompressed diameter of said radially compressed member being greater than the initial distance between diametrically opposed grooves such that the fingers are spread outwardly thereby into bearing contact against the outer tube.

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