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- (56) Prior Art Documents  
**GB 2214582**  
**GB 2150241**  
**GB 1000059**
- (57) Claim

1. A tread-brake unit comprising, as a unitary structure, a brake shoe for engagement with the tread of a vehicle wheel, a brake actuator having an output member via which the brake shoe can, firstly, be moved into engagement with the wheel tread and, thereafter, a braking force generated by the actuator can be transmitted to the brake shoe, and a slack adjuster by which clearance between the brake shoe and the wheel tread, in the "released" condition of the unit, can be maintained substantially constant, the slack adjuster having a pair of screw-threaded nuts, each such nut being threadedly engaged with and rotatable on the output member of the actuator, wherein the actuator includes a piston of non-circular peripheral configuration that is within a cylinder of the actuator that has a complementary-shaped internal wall whereby the piston is non-rotatable with respect to but is slidable in the cylinder, a piston rod rotationally fast with the piston being of tubular form, and the slack adjuster including securing means for non-rotatably and releasably securing one of the nuts to



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the tubular piston rod thereby to prevent rotation of  
this nut relative to the output member.



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Complete Specification for the Invention entitled:

"TREAD BRAKE UNIT"

The following statement is a full description of this invention,  
including the best method of performing it known to us:-



TREAD BRAKE UNIT

This invention relates to tread-brake units for vehicles.

Tread-brake units are, of themselves, well known  
5 and comprise, as a unitary structure, a brake shoe for  
engagement with the tread of a vehicle wheel, a brake  
actuator having an output member via which the brake  
shoe can, firstly, be moved into engagement with the  
wheel tread and, thereafter, a braking force generated  
10 by the actuator can be transmitted to the brake shoe,  
and a slack adjuster by which clearance between the  
brake shoe and the wheel tread, in the "released"  
condition of the unit, can be maintained substantially  
constant.

15 The overall available envelope of tread-brake  
units is inevitably severely restricted as a result of  
their position on the vehicle and frequently the need  
for them to replace pre-existing units which may not  
incorporate slack adjusters. This restriction places  
20 considerable limitations on the space available on the  
unit to accommodate a slack adjuster and causes severe  
difficulties for designers.

One conventional and beneficial type of slack  
adjuster, as described in British Patent Specification  
25 No. 980881, includes a pair of screw-threaded nuts.  
One of these nuts is an "adjustment nut" and the other  
is "a force-transmitting nut". At various stages of  
operation of the slack adjuster these nuts are required  
to be clamped so as to be prevented from rotation on a  
30 common output member with which they are threadedly  
engaged. This is achieved with a tube encircling one  
or other or both of the nuts, which tube is held at an





appropriate stage in the operation of the slack adjuster against rotation. To provide such a tube in a tread-brake unit takes up space which, for the reasons given above, is at a premium in tread-brake units.

5        According to the present invention there is provided a tread-brake unit comprising, as a unitary structure, a brake shoe for engagement with the tread of a vehicle wheel, a brake actuator having an output member via which the brake shoe can, firstly, be moved  
10 into engagement with the wheel tread and, thereafter, a braking force generated by the actuator can be transmitted to the brake shoe, and a slack adjuster by which clearance between the brake shoe and the wheel tread, in the "released" condition of the unit, can be  
15 maintained substantially constant, the slack adjuster having a pair of screw-threaded nuts, each such nut being threadedly engaged with and rotatable on the output member of the actuator, wherein the actuator includes a piston of non-circular peripheral  
20 configuration that is within a cylinder of the actuator that has a complementary-shaped internal wall whereby the piston is non-rotatable with respect to but is slidable in the cylinder, a piston rod rotationally fast with the piston being of tubular form, and the  
25 slack adjuster including securing means for non-rotatably and releasably securing one of the nuts to the tubular piston rod thereby to prevent rotation of this nut relative to the output member. This tread-brake unit takes benefit of production techniques now  
30 available to allow for a design which obviates the necessity for a space-consuming tube encircling the pair of nuts.

For a better understanding of the invention and to show how the same may be carried into effect, reference

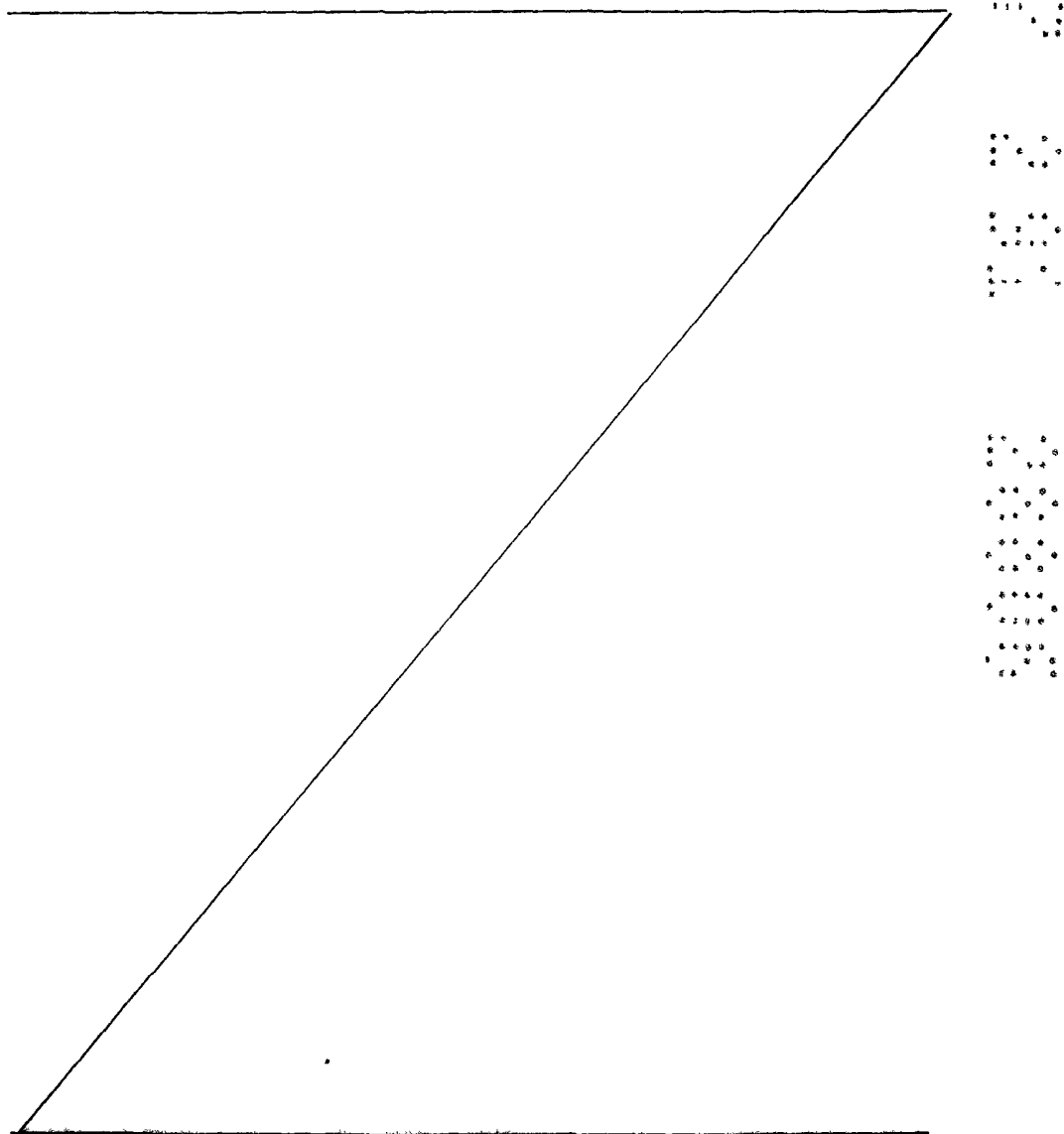




will now be made, by way of example only, to the accompanying drawings in which:-

Figure 1 is a diagrammatic cross-sectional view of a tread-brake unit shown in its "released" condition;  
5 and

Figure 2 is a similar view but with the unit in the "brake engaged" condition.





Referring to the drawings, the tread-brake unit comprises an actuator 100, a slack adjuster 200 and a brake shoe 300, as a unitary construction.

The actuator 100 has a main housing 1 that defines  
5 a pair of cylinders 2 and 3 in each of which is a piston respectively 4 and 5. One or other, or both of these pistons 4 and 5 is/are of non-circular peripheral configuration - specifically, square configuration- and the internal wall 6 or 7 of the respective cylinder  
10 2 or 3 is of complementary cross-sectional configuration to the peripheral configuration of the piston 4 or 5. The pistons 4 and 5 are interconnected by a common tubular piston rod 8 which is rotationally fast with both the pistons. Thus, by virtue of at  
15 least one of the pistons 4 and 5 being of non-circular peripheral configuration, whilst the pistons 4 and 5 are both slidable within their respective cylinders 2 and 3, the pistons 4 and 5 are non-rotatable in the cylinders 2 and 3 and, therefore, the tubular piston  
20 rod 8 is similarly slidable but non-rotatable with respect to the tread-brake unit as a whole.

The pistons 4 and 5 are resiliently urged to their left-hand positions as shown in Figure 1 by a piston return spring 9.

25 The pistons 4 and 5 define, together with walls 10 and 11 which, as shown in Figure 1, the pistons abut in their left-hand positions, chambers 12 and 13 which, via respective conduits 14 and 15, connect to an inlet port 16.

30 The actuator 100 also includes an output member 19 mounted in the main housing 1 so as to be non-rotational.

As thus far described, it will be seen that





pressurisation of the chambers 12 and 13 via the inlet port 16 and the conduits 14 and 15 will move the pistons 4 and 5 to the right (as viewed in Figure 1) against the action of the spring 9.

5       The slack adjuster 200 comprises a pair of nuts 20 and 21 of which the nut 20 is a force-transmitting nut and the nut 21 is an adjustment nut. Both of these nuts 20 and 21, which are fast-threaded, are threadedly engaged with the output member 19 of the actuator 100 and they are housed in the piston rod 8 which, for the nuts 20 and 21, constitutes a sub-housing, within the main housing 1, which is non-rotatable but axially movable with respect to the output member 19.

15       The force-transmitting nut 20 is resiliently loaded leftwards as viewed in the Figures by a spring 22 which loads the nut 20 via a thrust bearing 23. The nut 20 is urged by the spring 22 leftward so as to "make" a clutch provided by a clutch face 24 on the nut 20 and a clutch face 25 on a tubular thrust member 26 resiliently urged in a rightward direction as viewed in the Figures by a spring 27 to engage a spline 28 into an appropriately-shaped slot in the tubular piston rod 8. The spring 27, to achieve this, is of course stronger than the spring 22. At the left-hand (as viewed in the Figures) end of the tubular thrust member 26 an abutment member in the form of a ring 30 is splined at 31 to the nut 21. In the condition of the tread-brake unit shown in Figure 1, the ring 30 is spaced from the lefthand end of the tubular thrust





member 26 by a distance "Z".

The adjustment nut 21 of the slack adjuster has, adjacent its leftward end as viewed in the Figures, a circlip 40 which is spaced a distance "X" from a clutch element 41. The clutch element 41 is resiliently loaded by a spring 42 rotatably supported by a thrust bearing 43 and having a clutch face 44 engageable (and, in fact, engaged as shown in Figure 1) with a clutch face 45 on an end-plug 46 of the unit constituting the other clutch element of the clutch 44/45. The clutch element 41 is also splined to the nut 21 at 47 with a clearance "W" between the splines and the nut 21.

The output member 19 is operatively connected at its right-hand (as viewed in the Figures) end to the brake shoe 300 by connection means 50 which will be described in more detail hereafter.

The tread-brake unit, as so far described, operates as follows:-

#### BRAKE "RELEASED" CONDITION

This is the condition of the unit in which it is shown in Figure 1.

#### MOVE TO "BRAKE ENGAGED" CONDITION

Upon pressurisation of the chambers 12 and 13 sufficient to overcome the piston return spring 9, the pistons 4 and 5 move to the right. This movement (and the consequent rightward movement of the tubular piston rod 8) carries the nut 20 to the right by virtue of the spring 27 continuing to overcome the spring 22 (and, consequently, holding the clutch 24/25 "made") thus





preventing the nut 20 from spinning along the output member 19. The nut 20 thus being unable to rotate, the output member 19 is also carried to the right by the nut 20, there being, at this stage, a relatively low resistance to the movement of the output member 19.

During this rightward movement the output member 19 also carries with it the nut 21 for, by virtue of the splined connection 47 of this nut 21 with the clutch element 41 and the clutch 44/45 being "made", the nut 21 cannot spin on the output member 19.

The pistons 4 and 5 cannot, of course, rotate to allow the whole structure to rotate and spin down the output member 19 by reason of one (or both) of the pistons 4 and 5 being of a non-circular peripheral configuration complemented by the internal wall 6 or 7 of the respective cylinder 2 or 3 and, therefore, non-rotatable in the cylinder. Thus, in this stage of the operation, the pistons 4 and 5, the nuts 20 and 21 and the output member 19 all move axially together in a rightward direction. This movement continues until the circlip 40 engages the clutch element 41.

#### "NORMAL" CLEARANCE

If the clearance is "normal", the circlip 40 engages the clutch element 41 at the same instant that the brake shoe 300 engages the wheel tread.

#### "EXCESSIVE CLEARANCE"

If the clearance is "excessive", the circlip 40 engages the clutch element 41 before the brake shoe 300 engages the wheel, allowing further rightward movement of the output member 19 against continuing relatively





low resistance. During this further movement, the clutch 24/25 continues to be "made" by the spring 27 thus allowing the pistons 4 and 5 via the tubular piston rod 8, spring 27, tubular member 26, clutch 5 24/25 and the nut 20 to continue the rightward movement of the output member 19. However, the circlip 40, now abutting the clutch element 41, causes the clutch 44/45 to disengage. The load in the spring 42 is then transmitted via the circlip 40 to the nut 21 which is 10 now free to rotate. Further movement of the output member 19 to the right consequently causes nut 21, clutch ring 45 and spring 42 to rotate against the bearing 43. Consequently, the output member 19 is pulled through the nut 21 spinning it on its bearing 15 43.

Thus, whilst the nut 20 continues to move with the output member 19, the nut 21 remains in its usual position with its circlip 40 bearing against the clutch element 41. It will therefore be seen that a gap opens 20 up between the adjacent ends of the nut 20 and 21.

#### "BRAKE ENGAGED" CONDITION

In this condition the brake shoe 300 has just engaged the wheel tread, the output member 19 has thus met a substantially increased resistance to further 25 rightward movement and the nuts 20 and 21 are either abutting one another, if the clearance is "normal", or are spaced from one another by the amount by which the clearance is "excessive". This latter condition is that shown in Figure 2 in which the degree of "excess" 30 of clearance is the gap "V" between the two nuts 20 and 21.





BRAKE APPLICATION

Continued rightward movement of the output member 19 takes place with the member 19 now meeting substantially increased resistance as the brake shoe 5 200 has engaged the wheel tread. This increased resistance is transmitted to the nut 20. Further increase of pressure in the chambers 12 and 13 transmitted via the tubular piston rod 8 thus causes the spring 27 to collapse. This does not allow the 10 clutch 24/25 to be "broken" for this clutch remains "made" under the action of the spring 22. However, the collapse of the spring 27 causes the abutment member that is the ring 30 to abut the tubular element 26 and become clamped between the tubular piston rod 8 and the 15 tubular element 26. Such clamping of the ring 30 now prevents the nut 21 from any further rotation by virtue of the splined connection 31 of the ring 30 with the nut 21 and hence the ring 30 and the splined connection 31 constitute a releasable coupling between the piston 20 rod 8 and the nut 21 which is only operative when a braking force transmitted to the output member 19 is sufficient to overcome the spring 27, the coupling when operative preventing the nut 21 spinning on the output member 19.

25 Braking force generated by the pistons 4 and 5 is now transmitted via the tubular piston rod 8, ring 30, tubular member 26, clutch 24/25, nut 20, output member 19 and connection means 50 to the brake shoe 300. As the braking force thus generated rises, the system may 30 "stretch". Should it do so, the output member 19 moves slightly further rightward as do all the other parts now secured thereto. These parts include the nuts 20 and 21 whose relative axial positions on the output member 19 are preserved with the engagement of the 35 circlip 40 with the clutch element 41 causing the



clutch faces 44 and 45 to be further separated.

RETURN TO "BRAKE RELEASED" CONDITION

As pressure is dropped in the chambers 12 and 13 to release the brakes, such "stretch" as may have occurred is first recovered. During this stage, the relatively high forces still in the unit hold the nuts 20 and 21 locked on the output member 19. Thus, the nuts 20 and 21 return leftward with the output member 19 whilst being maintained in their same relative positions on the member 19. However, once the "stretch" has been fully recovered, the spring 27 is freed to re-expand and release the ring 30 from being clamped between the tubular piston rod 8 and the tubular member 26.

If the slack clearance was previously "normal", the "stretch" is fully recovered (i.e. the brake shoe 300 is just about to leave the wheel tread) and the ring 30 is released at the same instant that the clutch 44/45 is "re-made" and the circlip 40 is just about to part from the clutch element 41. Thus, at the moment that the nut 21 is freed to spin by the unclamping of the ring 30, the nut 21 is re-clutched by the clutch 44/45. The nut 21 is, therefore, in this condition of "normal" clearance, held against rotation in the output member 19 at all times of the "release" movement.

Equally the nut 20 is at all these times held in axial position on the output member 19.

There therefore being no axial displacement of the nuts 20 and 21 relative to each other on the output member 19, there is no unwanted adjustment of slack clearance.





The two nuts 20 and 21 both still being prevented from rotation, they both continue to move bodily together on the output member 19 with the circlip 40 separating from the clutch element 41 until the distance "X" is restored and the pistons 4 and 5 are back in abutment with the walls 10 and 11 of the chambers 12 and 13. The tread brake unit is now back in its "released" condition.

If the slack has previously been "excessive", recovery of "stretch" proceeds as above described with the relative positions of the nuts 20 and 21 on the output member 19 being preserved. However, upon the full recovery of "stretch" and at the point at which the brake shoe is just about to leave the wheel tread, the nut 21 is prevented from any further leftward movement by the splined connection 47. The nut 21 is also prevented from rotating, as above described, by the clutch 44/45 having been "made". Thus, the output member 19 can no longer partake in any further leftward movement and it is held in this position (in which it is more extended than it previously was) by a distance equal to the amount by which the slack was "excessive". The slack is, therefore, restored to "normal".

However, the pistons 4 and 5 have not yet returned into abutment with the walls 10 and 11 and, as they continue their leftward movement under the influence of the spring 9, they carry with them (via the tubular piston rod 8) the tubular member 26. As this member 26 continues to return leftward the clutch 24/25 is eased and the nut 20 is allowed to "chase" the tubular member 26 under the influence of the spring 22, the nut 20 spinning on the output member 19. This continues until the pistons 4 and 5 are fully returned whereat the





tread-brake unit is once again in its "released" condition with, as observed before, the slack set at "normal".

Turning now to the connection means 50, the output member 19 terminates in a cross-head 51 slidable in a vertical slot 52 in a thrust member 53. The termination of the output member 19 and the thrust member 53 are housed in a part 54 mounted on the brake shoe 300 for pivotal movement relative to both the output member 19 and the brake shoe 300 about an axis 55 extending transversely of both of these parts.

The part 54 has an internal concave face 56 centered in the axis 55 and the thrust member 53 has a complementary-shaped face 57 engaged with face 56.

The two faces 56 and 57 are forced into engagement one with the other by one or more dished spring(s) 58 operative between a back wall 59 of the part 54 and a thrust washer 60, the front face 61 of which is curved and bears against the rear face 62 of the cross-head 51.

This construction of the connection means 50 permits the brake shoe 300 to take up any pivoted position of the brake shoe 300 within its range of pivotal movement and, by virtue of the dished spring(s) 58 permits the brake shoe 300 to be held in any such position.

If the load of the vehicle is changed, this will result in consequential vertical displacement of the tread-brake unit relative to the axis of the wheel tread thereby bringing the top or bottom end (as the case may be) of the brake shoe 300 closer to the wheel





When the next brake application is made, the end of the brake shoe closer to the wheel tread first engages the tread and subsequent rightward movement of the output member 19 first pivots the brake shoe 300 about the  
5 axis 55 to engage the brake shoe along its whole length with the wheel tread against the resistance to movement offered by the dished spring(s) 58. When, after such a brake application has subsequently been released, the brake shoe 300 is moved bodily away from  
10 the wheel tread, it is held by the dished spring(s) 58 in a new pivoted position in which the brake shoe face 301 is now parallel to the wheel tread and, therefore, equidistantly spaced from it along the whole length of the brake shoe 300.

15 The above described tread-brake unit is provided with a "normal re-set" feature 70.

The re-set feature 70 includes a re-set member 71 rotatably mounted in the end-plug 46. At its outer end the member 71 has a square 72 engageable with a  
20 spanner. Along its length, the member 71 has a cam feature 73 engaged with a corresponding internal surface 74 at the inner end of a boss 75 of the end-plug 46. At its inner end face 76 the member 71 abuts a plunger 77.

25 To effect, manual re-setting (as is required, for example, on replacement of the friction material conventionally constituting the brake shoe 300), the member 71 is rotated as shown by arrow 78 in Figure 1 with a spanner. This rotation, by virtue of the inter-  
30 engaged cam surfaces 73 and 74 drives the member 71 to the right (as viewed in the Figures) which, in turn, drives the plunger 77 to the right. It will be seen that the plunger 77 abuts the splines 47. Thus,





that the plunger 77 abuts the splines 47. Thus, movement of the plunger 77, firstly, disengages the clutch 44/45 and, thereafter, by engagement of the nut 21 with the nut 20, disengages the clutch 24/25. The  
5 clutches for both nuts 20 and 21 now being "broken" these nuts 20 and 21 are now freed for rotation. Under the influence of a brake release torsion spring (not shown) encircling a trunnion 80 and operative between two arms 81 and 82 of the tread-brake unit, the arm 82  
10 is pivoted clockwise to push the output member 19 through the nuts 20 and 21. The brake shoe is thus moved clear of the wheel tread to allow replacement of the brake shoe.

To permit the fitting of the spring-applied brake  
15 actuator of British Patent Application No. 2 214 583 A as a "parking brake" facility, the tread-brake unit is further provided with a lever 90 pivotal about an axis 91. This lever 90 has an arm 92 (shown in dotted lines) engageable with the left-hand end face of the  
20 tubular piston rod 8. Thus, anti-clockwise pivoting of the lever 90 effects a brake application. The lever 90 is connectable to the output member of the spring-applied brake actuator of the application just mentioned and that actuator accepts the trunnion 80.

25 A brake actuator as included in the tread brake unit described above is also described and claimed in British Patent Application No. 2 214 582 A to which reference is accordingly directed.





THE CLAIMS DEFINING THE INVENTION ARE AS FOLLOWS:

1. A tread-brake unit comprising, as a unitary structure, a brake shoe for engagement with the tread of a vehicle wheel, a brake actuator having an output  
5 member via which the brake shoe can, firstly, be moved into engagement with the wheel tread and, thereafter, a braking force generated by the actuator can be transmitted to the brake shoe, and a slack adjuster by which clearance between the brake shoe and the wheel  
10 tread, in the "released" condition of the unit, can be maintained substantially constant, the slack adjuster having a pair of screw-threaded nuts, each such nut being threadedly engaged with and rotatable on the  
15 output member of the actuator, wherein the actuator includes a piston of non-circular peripheral configuration that is within a cylinder of the actuator that has a complementary-shaped internal wall whereby the piston is non-rotatable with respect to but is  
20 slidable in the cylinder, a piston rod rotationally fast with the piston being of tubular form, and the slack adjuster including securing means for non-rotatably and releasably securing one of the nuts to the tubular piston rod thereby to prevent rotation of this nut relative to the output member.
- 25 2. A tread-brake unit as claimed in claim 1, wherein said securing means comprises a spring-biased-to-engage clutch between said one nut and a thrust member that is spring biased into splined engagement with the tubular piston rod.
- 30 3. A tread-brake unit as claimed in claim 2, wherein said securing means is also for non-rotatably and releasably securing the other of the nuts to the tubular piston rod, the securing means further





comprising an abutment member in splined engagement with said other nut, there being a clearance between the abutment member and the thrust member of the securing means in the "released" condition of the unit;  
5 the brake actuator serving upon operation to generate said braking force to move the abutment member into abutment with the thrust member thereby to secure said other nut to the tubular piston rod.

4. A tread-brake unit as claimed in claim 3, wherein  
10 the other of the nuts is in splined engagement with one clutch element of a clutch associated with this nut, the other clutch element of which is fast in a housing of the unit whereby with this clutch engaged this other nut is held against rotation, there being rotatably  
15 mounted in said other clutch element a re-set member that can be manually rotated such that a cam surface thereof in co-operation with a corresponding cam surface of the other clutch element drives the re-set member to disengage both the clutch associated with  
20 said other nut and also the clutch between said one nut and the thrust member whereby movement of the output member for effecting brake shoe replacement is permitted.

5. A tread-brake unit as claimed in claim 4, wherein  
25 the re-set member when driven first moves said other nut to disengage the clutch associated therewith, and then, via further movement of said other nut, moves said one nut to disengage the clutch associated with said one nut.

30 6. A tread-brake unit is claimed in claim 1, 2, 3, 4 or 5, wherein the piston is one of two pistons that are both rotationally fast with the piston rod, the other of the two pistons also being of non-circular





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configuration and being within a cylinder of the actuator that has a complementary shaped internal wall whereby this piston is non-rotatable with respect to but is slidable in its cylinder.

- 5 7. A tread-brake unit substantially as hereinbefore described with reference to the accompanying drawings.

DATED this 26th day of FEBRUARY, 1991.

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FIG.1.

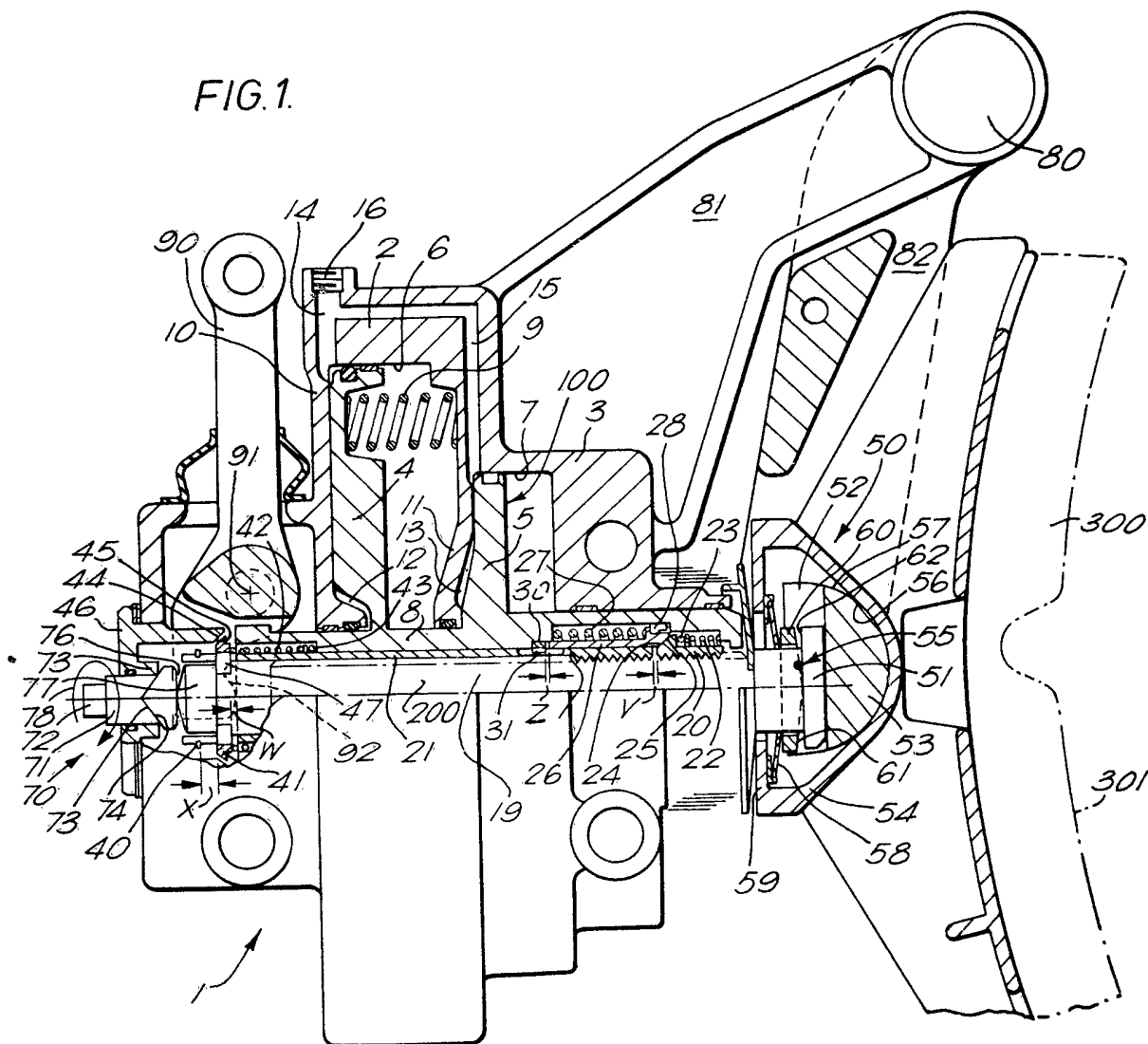




FIG. 2.

