Sept. 6, 1927. 1,641,506

S. P. SMURR

FIRE DOOR

Filed Nov. 14, 1923

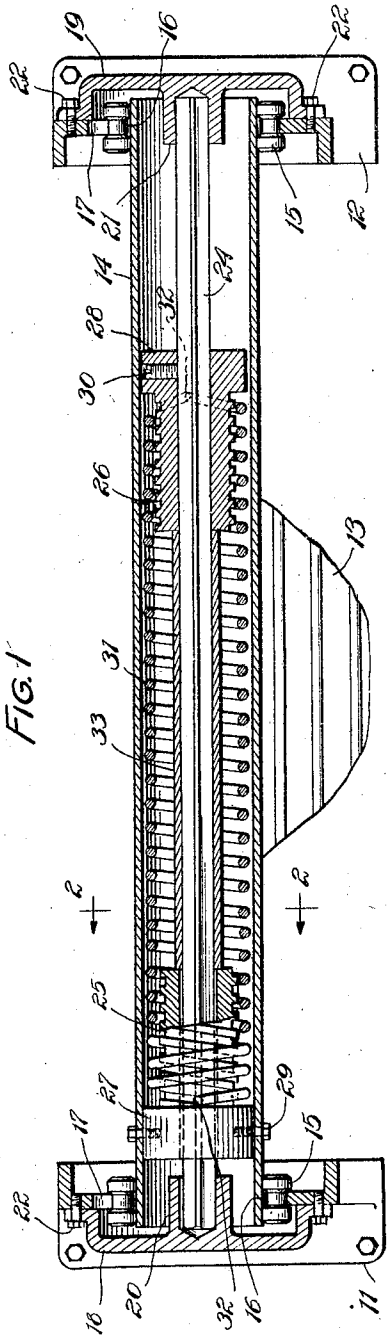


FIG. 1

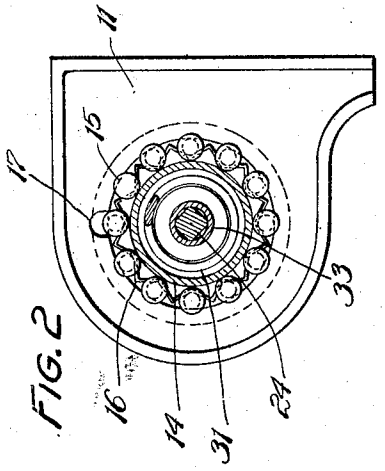


FIG. 2

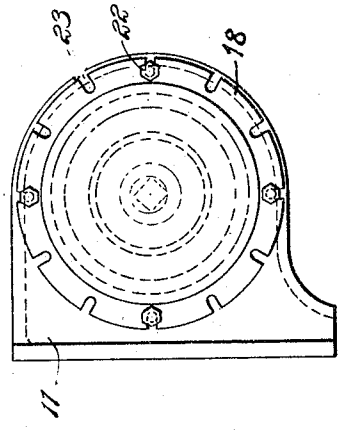


FIG. 3

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UNITED STATES PATENT OFFICE.

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FIRE DOOR.

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My invention relates to fire doors of the rolling shutter type, and has for its objects improvements in devices of that kind.

The shutter or curtain of this type of device is composed of a plurality of metal slats connected together and wound upon a barrel or drum. It is the ordinary practice to mount the barrel on a shaft, which in turn is mounted in bearings in brackets secured to the wall of the building on each side of the opening which is to be closed by the door. The weight of the curtain is practically balanced by a spring which has one end secured to the shaft and the other end secured to the barrel, the barrel in turn being secured to the upper end of the curtain. As the shaft of such construction must be turned in its bearings to wind the spring, and as the barrel must turn on the shaft to raise and lower the door or curtain, it is evident that the shaft must be round. As such supporting shaft must be drilled for the attachment of the spring, and for connections by which to turn it in winding the spring, it is evident that the shaft is considerably weakened. In the case of doors twelve to twenty feet wide, the great weight of the barrel and metal slats on this weakened shaft bends or distorts it so as to cause it to be out of alignment, and this in turn causes undue friction in the bearings and impairs the operation of the device. The main object of the present invention is to overcome the troubles and difficulties which arise directly or indirectly from the use of structures such as that above indicated.

In the accompanying drawings—

Fig. 1 is a longitudinal section thru the barrel;

Fig. 2 is a section on line 2—2 of Fig. 1; and

Fig. 3 is an end elevation.

The brackets 11 and 12 are secured to the wall of the building at the sides of the doorway which is to be closed by the curtain or shutter 13 secured in the ordinary way to the barrel 14. The barrel extends thru the brackets and has bearings therein. These bearings are roller bearings, the rollers 15 of which are of dumbbell shape. The construction is such that the barrel rides on the heads of the dumbbells, and these in turn ride with their necks on the edges of the openings in the brackets 11 and 12. Owing to the short necks of the dumbbells, and consequently to the narrow bearing surface in the brackets 11 and 12, the bearings of the barrel may be materially out of line without affecting the operation of the device.

This is an advantage in erection as it does not make necessary great care in bringing the bearings into exact line. It is also of advantage in wide doors, the heavy curtains of which cause the barrel to sag in the center. The dumbbell shape of the rollers 15 also provides means for applying the roller spacing strips 16. These are metal strips of a width a trifle less than the length of the neck between the heads of the dumbbells, and are crimped as shown in Fig. 2. One strip for each bearing lies between the barrel and the necks of the rollers.

As a convenient means for inserting and withdrawing the rollers, there is provided a small opening 17 in the web of the brackets just above the bearings therein. As the weight is on the lower part of the bearings, the rollers will not get out of themselves, but may be readily removed by lifting them manually one at a time and moving them axially. It is also to be observed that when these rollers are in position in a bearing, they are restrained from axial displacement by the heads which are on opposite sides of the bearing in the bracket.

It will thus be seen that the dumbbell shape here serves three purposes. One is providing for ordinary displacement of the barrel from alignment without causing friction, a second is providing room for a spacer 16, and the third is providing means for retaining the rollers from axial displacement without providing closers or keepers for that purpose.

Secured to the outer faces of the brackets 11 and 12 are covers 18 and 19 which are provided with hubs 20 and 21. These hubs may, and preferably do, extend into the ends of the barrel as shown in Fig. 1. These covers are secured to the brackets by bolts 22 which pass thru slots 23. These covers are alike except that hub 21 has a square hole to fit the square shaft 24, and hub 20 has a round hole in which the shaft may be turned. Or hub 20 may be reduced to a simple boss against which the end of the shaft abuts.

Within the barrel 14 and on the shaft 24 are screws 25 and 26 provided with heads 27 and 28. The screw 25 has a round axial

opening large enough to permit it to turn freely on the square shaft, and a head which fits the interior of the barrel 14. It is secured to the barrel by cap screws 29. The screw 26 has a square axial opening to fit the shaft 24 and a head of slightly less diameter than the interior of the barrel. It is secured to the shaft by means of the set screw 30.

Mounted upon screws 25 and 26 is a helical spring 31 having inturned ends 32 which project into the threads of the screws. These parts are so arranged that for a right hand spring the screws have left hand threads, and for a left hand spring the screws have right hand threads. These screws are inserted in the ends of the spring by simply screwing them in until the inturned ends come to the ends of the threads adjacent to the heads 27 and 28.

In a device of this kind in which the spring 31 must be wound up to support a long heavy curtain, the said spring must be given a pre-stretch (shown exaggerated in the drawings) to accommodate the extra number of turns given to the spring in the winding operation. This pre-stretch is determined by a piece of tubing 33 mounted on the shaft between the screws 25 and 26.

It will be assumed that the parts are erected as shown in Fig. 1, and that the curtain 13 hangs down to cover the doorway. The next step is to remove the screws 22 of cover 19, and apply a spanner to the slots 23 for the purpose of turning the shaft 24 to wind spring 31. When the spring has been wound enough to practically balance the weight of the curtain, screws 22 are returned to place and the cover thus secured in position.

Returning now to the matter before mentioned, if the weight and length of the curtain are known, a proper size and length of spring may be determined by calculation. Also, there may be calculated in advance the number of turns which it will be necessary to give the spring in balancing the weight of the curtain in the operation previously described. In this position, with the curtain down, the adjacent coils of the spring should be close together but not quite touching. Under the tension which winds the spring, the inturned ends 32 are close to the heads 27 and 28, and remain permanently in that position. As the desired length of the wound spring is determined by calculation, and the length of the screws 25 and 26 are known, it is a simple matter to determine the proper length of the spacing tube 33 which will give the least practicable pre-stretch to the spring 31. In ordinary fire doors there is no special device for fixing the desired pre-stretch, and the amount used is usually determined by estimate. If there is too much pre-stretch, there is axial strain which produces an undue amount of friction. If there is not enough pre-stretch, then the coils rub on each other and the spring buckles and binds. The spacing tube 33 furnishes a means for determining this so that workmen are never at a loss in getting the proper adjustment, and in shipping and erecting there is no possibility of displacement.

The barrel 14 and shaft 24 are shown of equal length, and it will be convenient to make them that way. Then if the holes in the hubs 20 and 21 are of less depth than the inner faces of the covers 18 and 19, the shaft will position the barrel with respect to the brackets 11 and 12. This will be evident from the fact that screw 26 is secured to the shaft and screw 25 is secured to the barrel, and that the stretched spring 31 holds these screws into engagement with the spacer 33. With the square shaft here shown, the only purpose of the screw 30 is to position the shaft longitudinally with respect to the barrel so that contact between the ends of the shaft and the covers 18 and 19 will position the barrel with respect to the brackets.

It is to be observed that the shaft 24 is a square shaft, has no holes drilled in it, and has to carry practically no load beyond its own weight. Its function is to furnish winding tension for the spring 31, the axial tension being furnished by the spacer 33. As the hole in the screw 26 is a square hole to match the shape of the shaft, the set screw 30 has nothing to do other than prevent accidental longitudinal displacement.

In ordinary devices of this kind, the barrel lies between the brackets which carry it, and is mounted on a shaft which has bearings in the brackets. This shaft is necessarily of small diameter as compared to that of the barrel, and has to carry the entire load in addition to the torsional strain of winding the spring. It is to be observed that I run the barrel itself thru the brackets and have the load carrying bearings on the large barrel and not on a small shaft. This adds much to the substantial nature of the structure.

When the barrel itself has its bearings in the supporting brackets, it may be removed from the brackets by simply removing one of the covers 18 or 19, and drawing the barrel out longitudinally. Or when the barrel has roller bearings of the kind shown, it may be removed between the brackets. This may be accomplished by removing one cover, slipping the barrel longitudinally far enough to release the other end, and then lowering the released end and drawing the other end inward. There are no such conveniences in removing a barrel which is mounted upon a shaft which is itself carried in bearings. The roller bearings in the present case do something more than produce a bearing of small friction. They make it practicable to

use the entire diameter of the barrel in the bearings and thus provide a better load carrier, they provide accommodation for variations from accurate alignment without the production of undue friction, and they make it easier to erect the device and to take it down for repairs.

What I claim is:

1. In a device of the class described, brackets at opposite sides of a doorway, a curtain-carrying barrel having bearings in said brackets, a spring for balancing the weight of the curtain, and a central shaft serving as a means for applying tension to said spring, the weight of said parts being carried by the barrel resting on its bearings.

2. In a device of the class described, brackets at opposite sides of a doorway, a barrel having bearings in said brackets, a spring within the barrel, and a central shaft manually adjustable to apply tension to said spring and serving to position said barrel in its bearings.

3. In a device of the class described, brackets located at opposite sides of a doorway, a curtain-carrying barrel extending thru openings in said brackets, roller bearings located in said openings and serving to support the ends of the barrel, and removable stops secured to the bearings adjacent to the ends of the barrel and serving as means for determining the position longitudinally of the barrel in its bearings.

4. In a device of the class described, bearings located at opposite sides of a doorway, a curtain-carrying barrel extending thru said bearings and supported therein, a spring within the barrel for balancing the weight of a curtain carried thereby, and means for adjusting the tension of said spring.

5. In a device of the class described, brackets, a barrel having bearings in said brackets, covers on the outer faces of the brackets and provided with inwardly projecting hubs, a shaft extending thru the barrel and having its ends projecting into said hubs, and a spring having one end secured to the shaft and the other end secured to the barrel.

6. In a device of the class described, brackets, a barrel having bearings in the brackets, a square shaft extending thru the barrel, covers on the outer faces of the brackets and having parts engaging the ends of the shaft, one of said parts having a square hole to receive and match the square shaft, and a spring having one end secured to the shaft and the other end secured to the barrel.

7. In a device of the class described, brackets, a barrel having bearings in the brackets, a square shaft extending thru the barrel, a spring within the barrel and around the shaft, devices mounted upon the shaft and connected to the ends of the spring, one of said devices having a square hole to fit the shaft and being clear of the barrel and the other of said devices being secured to the barrel and having a hole which clears the shaft, and means carried by one bracket for turning the shaft to give tension to the spring.

8. In a device of the class described, the combination with a barrel and bearings in which the barrel turns, of a centrally supported shaft within said barrel, stops connected to the bearings and engaging the ends of the shaft to hold it from axial movement, and an adjustable connection between shaft and barrel so that said stops may serve to hold said barrel at a desired axial position in its bearings.

9. In a device of the class described, a barrel, a shaft therein, a screw connected to the barrel, a second screw connected to the shaft, and a spring mounted upon said screws and having its ends turned in to engage the threads of the screws.

10. In a device of the class described, a barrel, a square shaft extending therethru, a screw connected to the barrel and free from the shaft, a second screw having a square hole to fit the shaft, and a spring mounted upon said screws and having its ends inturned to engage the threads of the screws.

11. In a device of the class described, a barrel, a central shaft therein, a device connected to the barrel but free from the shaft, a second device connected to the shaft but free from the barrel, a spring having its ends connected to said devices respectively, and a spacing tube between said devices and arranged to give a pre-stretch to the spring.

12. In a device of the class described, a helical spring, heads connected to the ends of the spring, and a spacing tube between said heads and serving to give a pre-stretch to said spring, said parts being so constructed that one head may be connected to a barrel and the other head may be connected to a shaft.

13. In a device of the class described, a horizontal shaft, a bracket having a vertical web thru which the shaft extends, and rollers confined between the shaft and the bracket so as to form a roller bearing for the shaft, the web of the bracket having a small opening over the center of the shaft thru which opening the rollers are inserted in the bearing.

14. In a device of the class described, brackets at opposite sides of a doorway, a curtain-carrying barrel having its ends extending thru openings in said brackets, and roller bearings carried in the openings in said brackets and supporting the ends of the barrel.

15. In a device of the class described, brackets at opposite sides of a doorway, a curtain-carrying barrel having its ends extending thru openings in said brackets, and

roller bearings for said barrel formed by dumbbell shaped rollers having their heads engaging the barrel and their necks riding on edges of the openings in the brackets.

16. In a device of the class described, bearings located on opposite sides of a doorway, and a curtain-carrying barrel having its ends within said bearings, said bearings being so constructed that the barrel may be removed from the bearings at the place between them while said bearings remain in fixed position.

SAMUEL P. SMURR.