July 8, 1952 M. M. MATCHETT 2,602,664

SAFETY DEVICE FOR DOOR OPERATING MECHANISM

Filed Feb. 24, 1947 2 SHEETS—SHEET 1

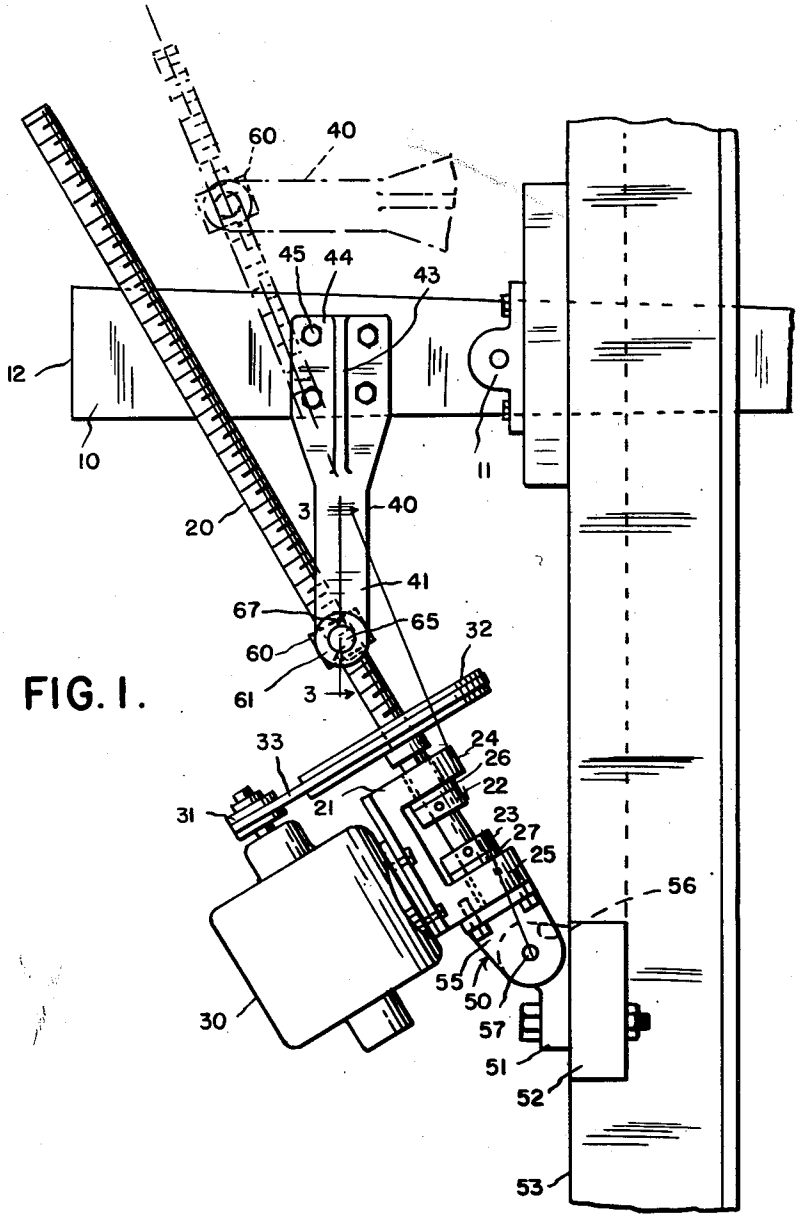


FIG. 1.

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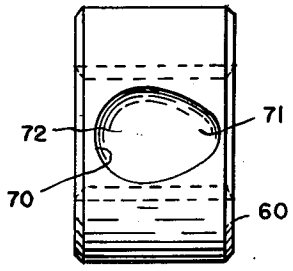


FIG. 4.

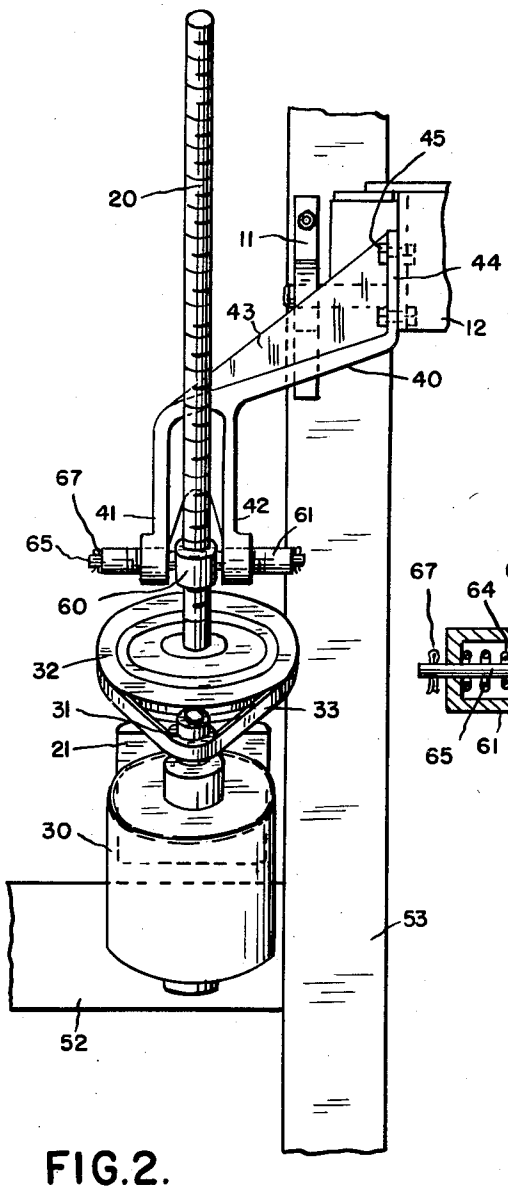


FIG. 2.

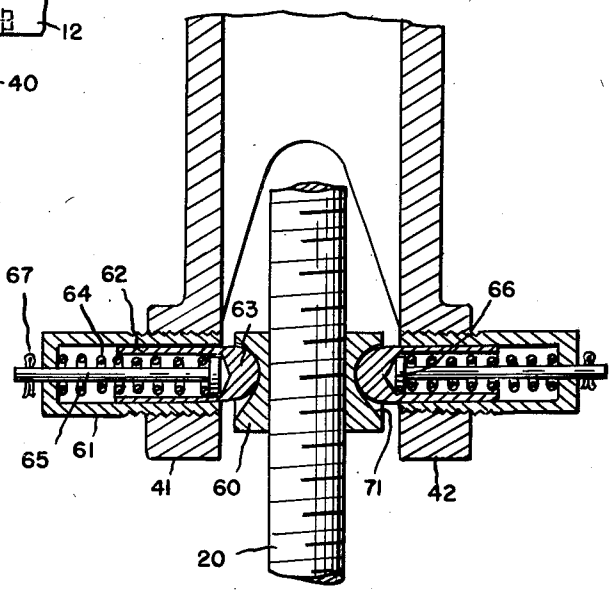


FIG. 3.

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SAFETY DEVICE FOR DOOR OPERATING MECHANISM

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The present invention relates to door operating mechanism and more particularly to a safety device associated therewith adapted to prevent injury and to improve the operation of power actuated garage doors and more particularly those of the overhead tilting type.

In accordance with the present invention, actuating means for the door comprise a feed screw and a traveling nut associated between a fixed portion of the building and a movable portion of the door. Motor means are provided for rotating the feed screw and thus effecting travel of the nut so as to move the door in opening or closing relation.

It is desirable for a variety of reasons to provide means which permit disassociation between the driving connections or between the mounting of one of the driving connections and its associated part of the building structure. Thus, for example, in the case of an overhead tilting door on a garage it is in many cases the only source of ingress or egress to the building. If, for example, there is a failure of the motor means, or if a fuse or circuit breaker disconnects the power circuit to the motor, it has in the past been extremely difficult if not impossible to effect entry into the garage without at the same time damaging the power mechanism. In other cases, movement of the garage door has brought it into contact with the operator or other person. While normally the power effective to move the door is such that no injury to the person thus engaged by the moving door results, nevertheless, it has in the past been possible for such person to be trapped or firmly held even though the motor or driving actuating mechanism is stalled.

In accordance with the present invention, means are provided so that whenever the forces acting on the door exceed a predetermined minimum amount, separation or disassociation of elements of the power mechanism occurs so that the door may be freely swung toward open or closing position. Thus, for example, if due to failure of the motor it is desired to enter the garage it is necessary only to grasp the usual operating handle provided on the door and by the application of a relatively small force, the door may be opened without injury to the power mechanism. Correspondingly, if the door in its closing movement encounters a person standing in the path thereof in such a manner as to effectively trap or imprison him, it is an easy matter to release such person by applying a relatively small force to the door in a door opening direction. The release mechanism may be provided of such effectiveness that the power of the motor is effective to release the driving mechanism if the door encounters an

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immovable object or an object offering a predetermined resistance to further movement of the door.

With the foregoing general remarks in mind, it is an object of the present invention to provide safety mechanism for preventing accidents or injury to persons in connection with power actuated door operating mechanism.

It is a further object of the present invention to provide door operating mechanism having associated therewith means for disconnecting the driving connections for the door upon the application of a relatively small force directly to the door.

More specifically, it is an object of the present invention to provide for disassociation of elements of the driving connection whenever the forces acting on the door exceed a predetermined amount.

More specifically, it is an object of the present invention to provide means for effecting automatic opening and closing movement of a garage door which comprises a power driven feed screw, a traveling nut, means for mounting the screw and nut between a fixed portion of the building and a movable portion of the door, and combination with releasable means for supporting one of the elements of the power driven mechanism whereby its disengagement may be effected whenever the forces acting on the door exceed a predetermined amount.

It is a feature of the present invention to provide spring pressed fingers engageable with opposite sides of a traveling nut whereby application of force between the nut and spring pressed fingers will effect disengagement thereof.

Other objects and features of the invention will become apparent as the description proceeds, especially when considered in connection with the accompanying drawings, wherein:

Figure 1 is a fragmentary side elevation of the door operating mechanism;

Figure 2 is a fragmentary front elevation of the mechanism shown in Figure 1;

Figure 3 is an enlarged sectional view taken substantially on the line 3—3 of Figure 1; and

Figure 4 is a front elevation of the traveling nut employed.

For purposes of illustration, the present invention is illustrated as embodied in an overhead tilting garage door. It will be appreciated, however, that the invention is not so limited and may be usefully employed in other types of power door operating mechanisms.

However, for a specific illustration and description of a preferred embodiment of the present invention, reference is now made to the figures.

An overhead tilting garage door 10 is mounted for tilting movement about the horizontal axis of a hinge support 11. The upper edge of the door, when the door is in closed position, is indicated at 12 and it will be observed that the lower portion of the door swings outwardly, and since the door is pivoted intermediate its top and bottom edges, the upper edge 12 of the door swings inwardly.

Operating mechanism for the door 10 comprises a feed screw 20 rotatably supported in a housing or mounting 21, the screw 20 having thrust collars 22 and 23 mounted between arms 24 and 25 of the support 21. Thrust washers 26 and 27 are provided between the thrust collars 22 and 23 and the cooperating arms 24 and 25, respectively. Mounted on the screw housing or support 21 is an electric motor 30 which drives a small pulley 31. Rigidly connected to the screw 21 is a large pulley 32 which is adapted to be driven from the motor pulley 31 by a V-belt or the like 33.

Extending laterally from the door 10 and above the hinge 11 when the door is in closed position is an actuating arm 40.

As best seen in Figure 2, the arm 40 is bifurcated at its free end to provide two arms 41 and 42. The arm or bracket 40 includes a reinforcing web portion 43 and an attaching flange 44 which is secured to the side edge of the door by suitable fastening elements indicated at 45.

The screw housing or support 21 is mounted for swinging movement in a vertical plane by a pivotal housing support 50 which is carried by a pivot bracket 51. The bracket 51 is rigidly secured to a suitable rigid part of the garage structure adjacent the side of the door. In the present instance the bracket is illustrated as secured to a 2 x 6 spacer 52 extending between upright studdings 53. It will be appreciated, however, that any suitable rigid support may be provided for the bracket 51. Preferably the housing support 50 is provided with a pair of arms 55 which span an outwardly projecting portion 56 of the bracket 51, and is pivotally connected thereto by a pivot pin 57.

In order to transmit motion to the door 10, a traveling nut 60 (Figure 3) is mounted between the arms 41 and 42 of the bracket 40. The nut 60 is internally threaded so as to have traveling threaded engagement with the feed screw 20 and as will be apparent from Figure 1, rotation of the feed screw will result in motion of the nut along the feed screw accompanied by a relatively slight rotation of the feed screw about the axis of the pivot pin 57 and this will be effective to swing the door from the open position indicated in full lines in Figure 1 to closed position, at which time the arm or bracket 40 occupies the position indicated in dotted lines in this figure.

In order to provide for separation between the arm or bracket 40 and the nut 60, releasable means for engaging opposite sides of the nut 60 are provided. As best seen in Figure 3, each of the arms 41 and 42 is provided with a threaded opening in which is received an externally threaded cup 61. A hollow plunger 62 is slidably received within the cup 61 and is provided with an outer rounded or spheroidal end 63. The plunger 62 is urged outwardly by a compression spring 64 retained within the cup and a headed rod 65 is provided which extends through the spring 64, the head 66 of which engages the bottom of the spring receiving recess formed in the plunger 62. Movement of the rod 65 out of the cup 61 is prevented by suitable means such as the cotter pin indicated at 67. The structure at opposite sides of the nut 60 is identical, and accordingly only one is described in detail.

The nut 60 may be of generally cylindrical shape and at opposite sides thereof there are formed recesses 70 for the reception of the rounded or spheroidal ends 63 of the plungers 62. As best seen in Figure 4, the recesses 70 include a gradually sloped side wall portion indicated at 71, the balance of the recess as indicated generally at 72 being spheroidal. The recesses 70 may conveniently be formed at opposite sides of the nut 60 by an end mill having a hemispherical end portion which is fed into the sides of the nut at an angle equal to the inclination of the sloped side wall portion 71.

Inasmuch as the ends 63 of the plungers 62 which engage in the recesses 70 are hemispherical or spheroidal, it will be apparent that the nut 60, being engaged by plungers 62 at opposite sides thereof, is held thereby against displacement but is permitted rotation about an axis established by the axes of the plungers 62. Furthermore, motion of the nut 60 downwardly as seen in Figure 3 is effective to apply a very strong force between members connected to the feed screw and nut supporting bracket 40, inasmuch as the outermost portion of the recesses 70 engage portions of the rounded ends 63 of the plungers throughout zones which approach parallelism to the direction of thrust. On the other hand, a relatively slight force applied in a direction to cause the nut 60 to move upwardly as seen in Figure 3 relative to the rounded ends 63 of the plungers will be effective to separate the nut from the plungers. In this case the sloped surfaces 71 of the recesses 70 act as camming surfaces, with the result that the plungers 62 are forced outwardly into the cup member 61 against the resistance of the springs 64.

In the illustrated embodiment of the nut, it will be observed that the camming surfaces 71 are provided at one side only of the recesses 70 so that the release mechanism is effective primarily in response to forces acting in a single direction, such for example as forces applied manually to the door independent of the power mechanism in a direction tending to open the door. However, it is within the purview of the present invention to provide corresponding camming surfaces at opposite sides of the recess so that the driving connections may be disassociated in response to a predetermined force applied directly to the door independently of the power mechanism operating in either door opening or door closing direction. Further, it should be noted that this permits an arrangement in which the power mechanism may be effective to separate the driving connections in the event that movement of the door is arrested intermediate its open or closed position by an object, such for example as an automobile parked too close to the door, or an individual standing in the path of movement thereof.

Therefore, if the tilting door is the only means of access to the interior of the garage, and if for any reason such as power failure it is impossible to effect power actuated opening of the door, it is possible to disengage the operating elements of the power driven door actuating mechanism by applying an opening force directly to the door. This will have the effect of forcing the rounded ends 63 of the plungers against the camming surfaces 71 of the nuts and thus will cause the bracket 40 to become separated from

the nut 60. At this time the cotter pins which prevent movement of the rod 65 completely out of the recesses of the cups 61 will also prevent complete separation of the plungers 62 therefrom. In order to reengage the plungers with the nut it is necessary only to bring the plungers into juxtaposition to the nut and thereafter by appropriate movement of the pivoted feed screw 20, to force the nut into position between the plungers where they will automatically engage into the recesses 70. The same operation may of course be effected in case a person is accidentally within the garage when the door is closed. Substantially the same operation may be carried out if the door accidentally closes upon a person in a manner to require reverse movement of the door to extricate the individual. As previously stated, the motor is of such power that normally injury to a person in the path of the door will not result, but even a slight force may of course be effective to prevent removal of the person caught between a fixed portion of a building and a movable portion of the door. In such case a relatively slight force applied directly to the door in a door opening direction will cause separation of the spring pressed plungers 62 and the nut 60.

Briefly reviewed, the safety mechanism, comprising the means for separating the driving connections and more specifically for releasing the traveling nut from the normal support therefor, is effective under a variety of conditions. In the first place, it may be effective to release the nut if motion of the door is arrested in either opening or closing movement, in which case the power of the motor is effective to apply forces sufficient to cam the rounded ends 63 of the plungers out of the recesses 70. In the second place, the strength of the springs 64 and the shape of the camming surface or surfaces may be such that if the door's motion is arrested, the motor will stall, the power of the motor being such that the forces applied by the door are insufficient to cause injury to a person. In this case, with the motor stalled the individual may release the driving connections by applying a force to the door in either a door opening or door closing direction. In a specific case the camming surfaces which would be effective to release the driving connections upon forces applied independently of the driving mechanism to the door in a door closing direction may be such as to require substantially greater forces to effect separation of the driving mechanism than is required in the opposite direction.

While there is illustrated and described in considerable detail the structure and application of a safety device to a particular door actuating mechanism, it will be appreciated that this full exposition has been given merely to enable those skilled in the art to practice the invention, the scope of which is indicated by the appended claims.

What I claim as my invention is:

1. In mechanism for operating the door of a building, a power driven screw and a traveling nut adapted to be interconnected between a movable part of the door and a fixed part of the building, means for supporting said nut against rotation comprising a bracket having a bifurcated portion for receiving said nut, and spring pressed nut engaging elements resiliently engaging opposite sides of said nut and normally retaining said nut against rotation but effective upon application of a predetermined force to said door to release said nut.

2. In mechanism for operating the door of a building, a power driven screw and a traveling nut adapted to be interconnected between a movable part of the door and a fixed part of the building, means for supporting said nut against rotation comprising a bracket having a bifurcated portion for receiving said nut, and spring pressed nut engaging elements, said nut having recesses therein for receiving the ends of said elements.

3. In mechanism for operating the door of a building, a power driven screw and a traveling nut adapted to be interconnected between a movable part of the door and a fixed part of the building, means for supporting said nut against rotation comprising a bracket having a bifurcated portion for receiving said nut, and spring pressed nut engaging elements, said nut having recesses therein for receiving the ends of said elements, the ends of said elements and said recesses being shaped to provide a camming action effective to move said elements out of said recesses upon application of a predetermined force to said door.

4. In mechanism for operating the door of a building, a power driven screw and a traveling nut adapted to be interconnected between a movable part of the door and a fixed part of the building, means for supporting said nut against rotation comprising a bracket having a bifurcated portion for receiving said nut, and spring pressed nut engaging elements, said nut having recesses therein for receiving the ends of said elements, the ends of said elements being rounded, the recesses in said nut being generally rounded but having gradually inclined camming side walls at one side effective to force retraction of said spring pressed elements upon application of a predetermined force to said door in a predetermined direction.

5. In mechanism for operating the door of a building, a power driven screw and a traveling nut adapted to be interconnected between a movable part of the door and a fixed part of the building, means for supporting said nut against rotation comprising a bracket having a bifurcated portion for receiving said nut, and spring pressed nut engaging elements, said nut having recesses therein for receiving the ends of said elements, the ends of said elements being rounded, the recesses in said nut being generally rounded but having gradually inclined camming side walls at opposite sides effective to force retraction of said spring pressed elements upon application of a predetermined force to said door in either door opening or door closing direction.

6. In a building having a door mounted for swinging about a horizontal axis between open and closed position, door operating mechanism comprising a power driven screw adapted to be pivoted to a fixed portion of the building, a traveling nut on said screw, a nut-supporting bracket adapted to be carried by a movable portion of the door, said bracket having releasable means for retaining said nut against axial rotation while providing for pivotal movement about a transverse axis, said releasable means comprising means engaging opposite sides of said nut including a spring pressed plunger, and said nut having a plunger receiving recess in a side thereof.

7. In a building having a door mounted for swinging about a horizontal axis between open and closed position, door operating mechanism comprising a power driven screw adapted to be

pivoted to a fixed portion of the building, a traveling nut on said screw, a nut-supporting bracket adapted to be carried by a movable portion of the door, said bracket having a pair of spaced arms, spring pressed plungers carried by said arms, said nut having lateral recesses for receiving said plungers.

8. In a building having a door mounted for swinging about a horizontal axis between open and closed position, door operating mechanism comprising a power driven screw adapted to be pivoted to a fixed portion of the building, a traveling nut on said screw, a nut-supporting bracket adapted to be carried by a movable portion of the door, said bracket having a pair of spaced arms, spring pressed plungers carried by said arms, said nut having lateral recesses for receiving said plungers, the ends of said plungers and said recesses being shaped to provide for pivotal movement of said nut about a transverse axis while retaining said nut against axial rotation.

9. In a building having a door mounted for swinging about a horizontal axis between open and closed position, door operating mechanism comprising a power driven screw adapted to be pivoted to a fixed portion of the building, a traveling nut on said screw, a nut-supporting bracket adapted to be carried by a movable portion of the door, said bracket having a pair of spaced arms, spring pressed plungers carried by said arms, said nut having lateral recesses for receiving said plungers, the ends of said plungers and said recesses being shaped to provide for pivotal movement of said nut about a transverse axis while retaining said nut against axial rotation and further shaped to provide camming surfaces to effect separation between said nut and plungers upon application of a predetermined force to said door.

10. In a building having a door mounted for swinging about a horizontal axis between open and closed position, door operating mechanism comprising a power driven screw adapted to be pivoted to a fixed portion of the building, a traveling nut on said screw, a nut-supporting bracket adapted to be carried by a movable portion of the door, said bracket having a pair of spaced arms, spring pressed plungers carried by said arms, said nut having lateral recesses for receiving said plungers, the ends of said plungers and said recesses being shaped to provide for pivotal movement of said nut about a transverse axis while retaining said nut against axial rotation and further shaped to provide camming surfaces to effect separation between said nut and plungers upon application of a predetermined force to said door in either door opening or door closing direction.

11. Safety release means for a nut associated with a power driven screw comprising a bracket having spaced arms for receiving a nut therebetween, a nut located between said arms and having recesses in its sides adjacent said arms, elements carried by said arms seated in said recesses comprising at least one spring pressed element, said elements and recesses comprising a pivot support for said nut.

12. Safety release means for a nut associated with a power driven screw comprising a bracket having spaced arms for receiving a nut therebetween, a nut located between said arms and having recesses in its sides adjacent said arms, elements carried by said arms seated in said recesses comprising at least one spring pressed element, said elements and recesses comprising a pivot support for said nut, the sides of said recesses being inclined to provide camming surfaces for effecting release of said nut by force applied laterally thereto.

13. Safety release means for a nut associated with a power driven screw, comprising a bracket having spaced arm members for receiving a nut member therebetween, a nut member located between said arm members, means between said nut member and arm members providing for rocking movement of said nut member about an axis extending between said arm members and effective to retain said nut member against rotation about its axis, said means comprising at least one pivot element carried by one of said members, a shallow recess on the adjacent member adapted to receive said element, yieldable means resiliently urging said element into said recess, said recess having gradually tapered edges operable as camming surfaces to effect release of said nut member upon application of force in a direction transverse to the axis of said nut member.

14. Safety release means for a nut associated with a power driven screw, comprising a bracket having spaced arm members for receiving a nut member therebetween, a nut member located between said arm members, means between said nut member and arm members providing for rocking movement of said nut member about an axis extending between said arm members and effective to retain said nut member against rotation about its axis, said means comprising at least one pivot element carried by one of said members, a shallow recess on the adjacent member adapted to receive said element, yieldable means resiliently urging said element into said recess, said recess having a gradually tapered edge portion at one side thereof operable as a camming surface to effect release of said element upon application of force in a direction transverse to the axis of said nut member, said recess having a second more steeply inclined edge portion angularly spaced from said gradually tapered edge portion effective to retain said nut against torque imparted thereto by rotation of a feed screw associated therewith.

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