

Sept. 3, 1935.

F. R. NELSON

2,013,248

STOKER

Original Filed April 18, 1931 3 Sheets-Sheet 1

Fig. 1.

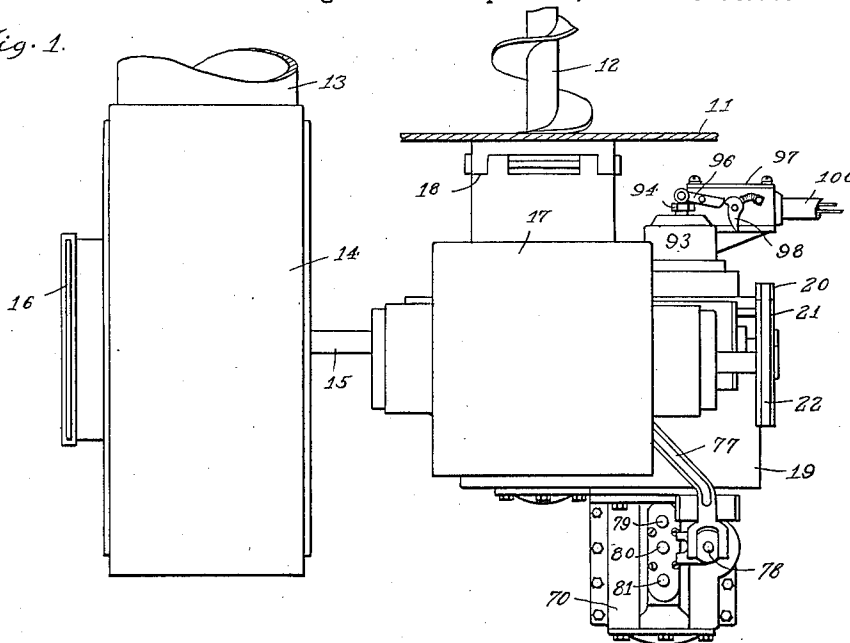


Fig. 3.

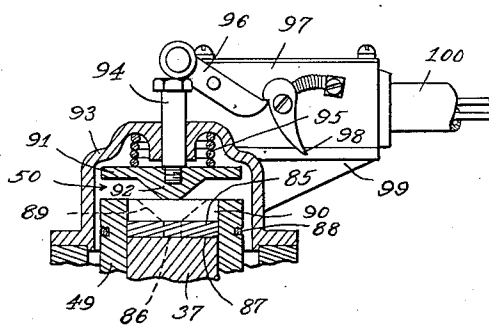


Fig. 4.

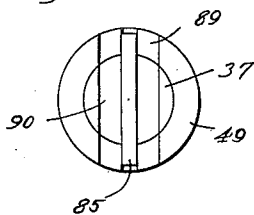
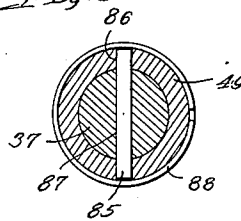


Fig. 5.



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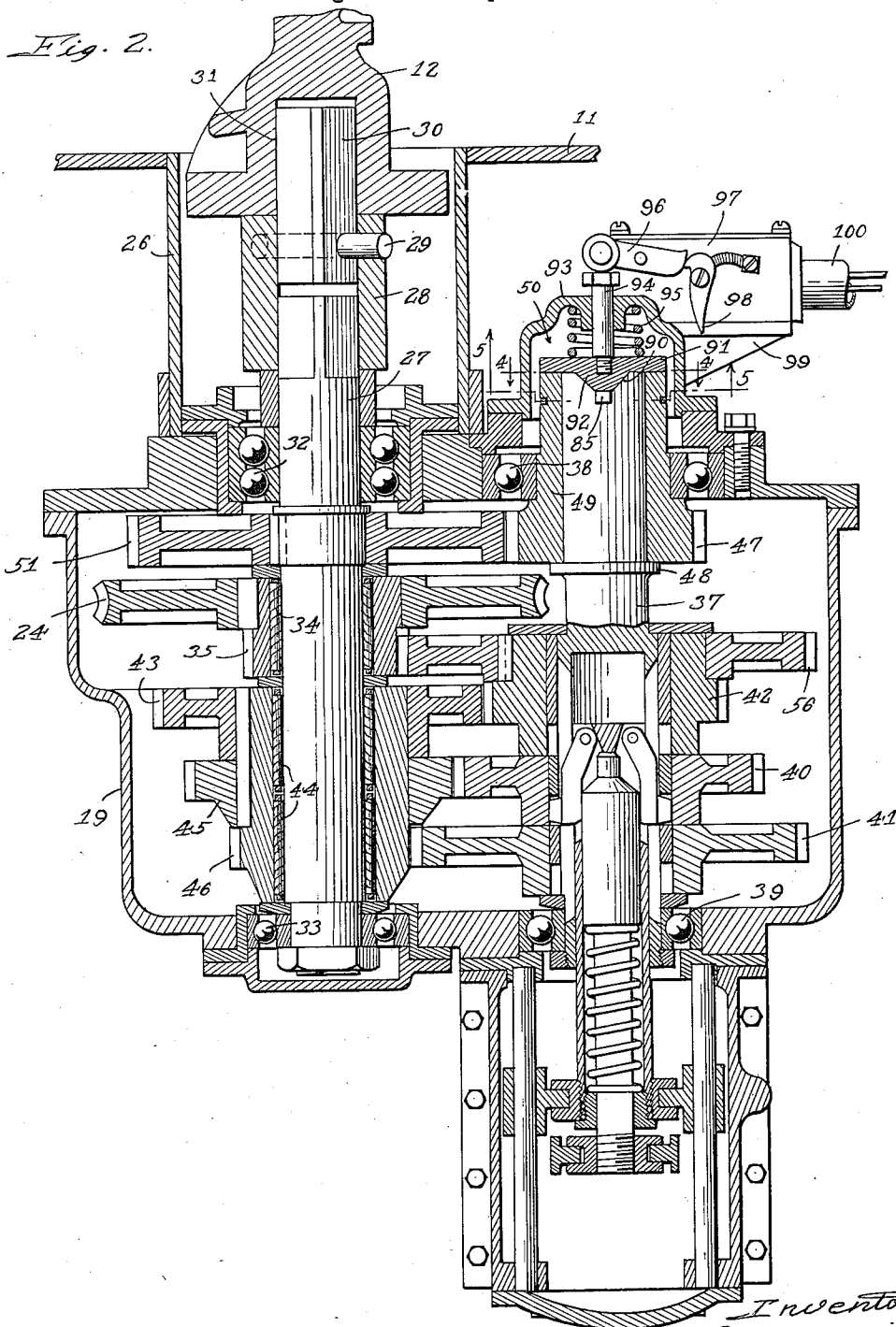
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STOKER

Original Filed April 18, 1931 3 Sheets-Sheet 2



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**Sept. 3, 1935.**

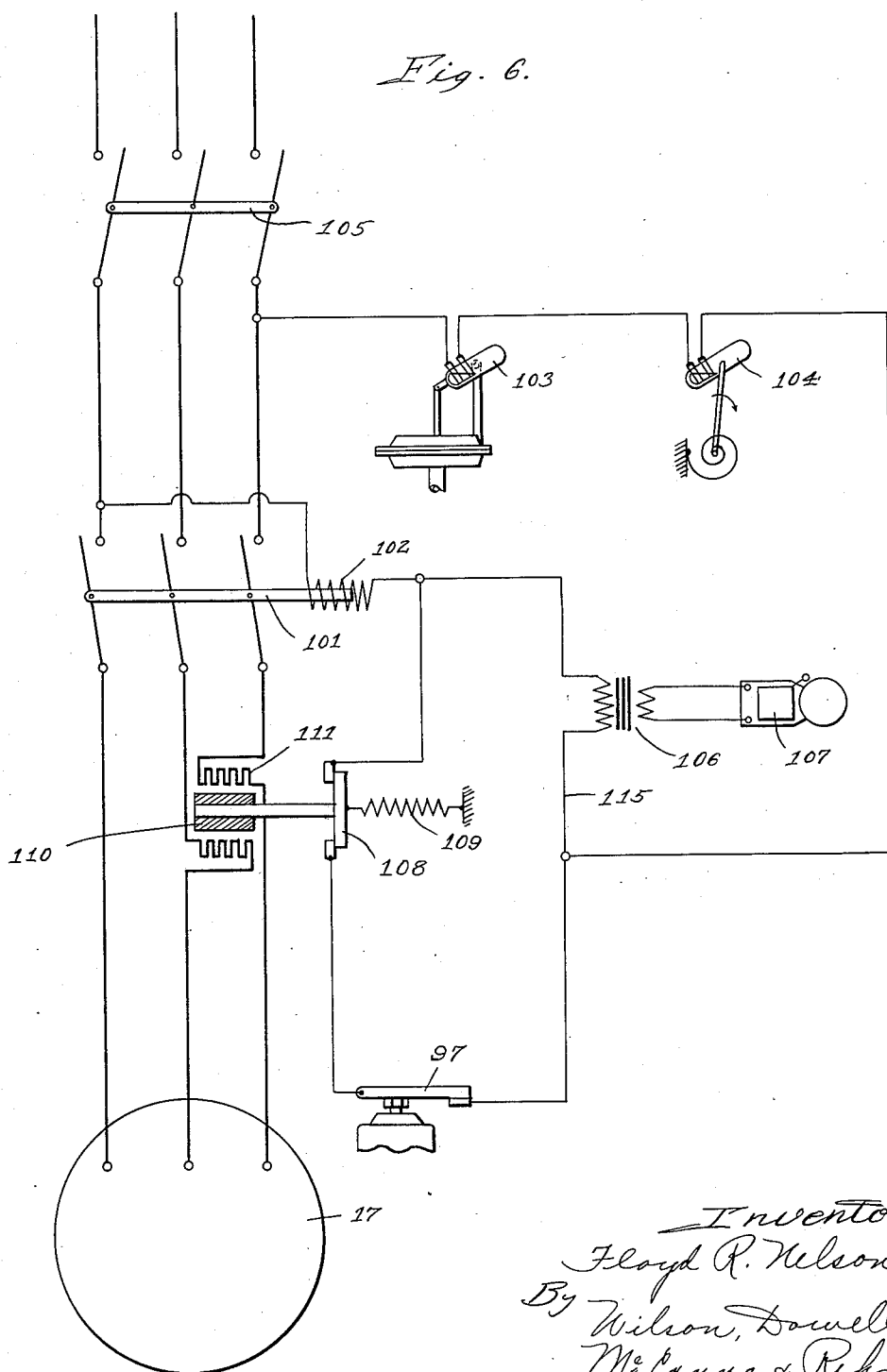
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**2,013,248**

STOKER

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Fig. 6.



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## UNITED STATES PATENT OFFICE

2,013,248

STOKER

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Original application April 18, 1931, Serial No.  
531,100. Divided and this application January  
9, 1932, Serial No. 585,739. Renewed January  
18, 1935

9 Claims. (Cl. 192—129)

This invention relates to stokers, and has for its principal object the provision of an overload release mechanism arranged in the event of excessive resistance to the turning of the stoker feed screw to operate a switch and break the circuit of the electric motor, besides disconnecting the screw from the transmission.

Another object consists in the provision of an alarm electrically connected with the motor and switch in such a way as to be thrown into operation automatically when the motor circuit is opened at the switch due to an overload.

The invention further contemplates the provision of a thermal relay in series with the aforesaid switch arranged to break the circuit in the event of an overload in the motor itself such as would be caused, for example, by failure to keep the motor properly lubricated. The alarm would also be operated automatically in the event of the motor circuit being broken in this way.

This application is a division of my application, Serial No. 531,100, filed April 18, 1931, and is in part a continuation of said application.

In the accompanying drawings illustrating the invention—

Figure 1 is a plan view of the drive end of a stoker embodying my invention;

Fig. 2 is a horizontal section through the transmission showing the overload release mechanism and its connection with the switch controlling the motor circuit;

Fig. 3 is a similar view showing the parts in released position;

Figs. 4 and 5 are sectional details on the correspondingly numbered lines of Fig. 2, and

Fig. 6 is a wiring diagram.

The same reference numerals are applied to corresponding parts throughout the views.

The invention is herein illustrated as applied to a stoker of the under-feed type utilizing a feed screw, but it will soon be evident that the invention is adaptable for use with other stokers and for that matter any machine on which similar features are desirable. Referring to Figure 1, the numeral 11 is applied to a portion of the hopper from which the coal is fed by the screw 12 through a suitable conduit extending forwardly from the hopper to a point under the grates of the furnace, hot water heater, or boiler. Air to support combustion is also delivered to the furnace through an air duct 13 extending forwardly from the blower 14. The rotor of the blower is operated by a shaft 15 at a constant speed, so that a shutter 16 has to be provided for the air inlet to regulate the delivery of air according to

the fuel delivery. A constant speed electric motor 17 furnishes the power for driving the screw 12 and blower 14, and is hingedly mounted on the base of the hopper 11, as shown at 18, above the housing 19 of the transmission. A spring (not shown) acts against the top of the housing 19 to raise the motor 17 to keep the belt 22 under proper tension. The shaft 15 previously referred to extends through suitable bearings in the housing 19 and has a pulley 20 on the projecting end thereof directly below the pulley 21 provided on the armature shaft of the motor 17, and the belt 22 provides a driving connection between these pulleys. This accounts for the constant speed drive of the blower. A worm (not shown) is provided on the shaft 15 in the housing 19 and meshes with a worm gear 24 in the housing to provide a reduction driving connection between the motor and the transmission.

The transmission is constructed to provide further reductions in speed to give three different constant speeds of operation of the screw 12. The housing 19 of the transmission is suitably supported from the base of hopper 11 on a large collar 26 which extends rearwardly from the bottom of the hopper 11 to the housing to enclose the rear end of the screw 12 and its coupling connection with the transmission. As shown in Fig. 2, the output or driven shaft 27 of the transmission is connected with the rear end of the screw 12 by means of a sleeve 28 which fits over the squared projecting end of the shaft 27 and is connected by means of a pin 29 to a square stub shaft 30 arranged to be received in a square socket 31 provided in the end of the screw. The shaft 27 is mounted in anti-friction bearings 32 and 33 in the opposite ends of the housing 19 and has the worm gear 24 mounted thereon by means of a roller bearing 34. A pinion 35, which is keyed to the worm gear 24, meshes with a gear 36 rotatably mounted on a countershaft 37 disposed in parallel relation to the shaft 27 and supported, as will soon appear, on anti-friction bearings 38 and 39 in the opposite ends of the housing 19. It is obvious that the gear 36 is driven at a much lower speed than the gear 24 by reason of the reduction drive shown. The gear 36 is arranged to be clutched to the shaft 37 for the high speed drive. The intermediate and low speed drives are provided, respectively, by means of two other gears 40 and 41 rotatably mounted on the shaft 37. The gear 40 is driven in this way: a pinion 42 is keyed to the gear 36 and drives a gear 43 mounted as by means of roller bearings 44 on the shaft 27, and a gear 45 is keyed to the gear 43 and meshes with the gear 55

40. Obviously, the gear 40 turns at a much slower speed than the gear 36 by reason of the reduction drive therebetween. There is a still further reduction between the gears 36 and 41 by reason of the fact that a pinion 46, smaller than the gear 45 previously mentioned and also keyed to the gear 43, meshes with the gear 41. Reference may be made to the parent application for an explanation as to how the gears 36, 40, and 41 are arranged to be individually clutched to the shaft 37 to provide the high, intermediate, and low speed drives, respectively. It will be observed that a pinion 47 is received on the front end of the shaft 37 in abutment with a shoulder 42 thereon and has a reduced hub portion 49 received in the bearing 38 to provide support for the front end of the shaft 37 in said bearing. The pinion 47 is normally fixed to the end of the shaft 37 by means of an overload release mechanism, indicated generally by the numeral 50 which is hereinafter described in detail. The pinion 47 meshes with a gear 51 keyed on the front end of the output or driven shaft 27 whereby to transmit drive to the screw 12 at a further reduction in speed.

25 The overload release mechanism 50 is clearly illustrated in Figs. 2-5 and, as indicated above, provides a releasable driving connection between the shaft 37 and pinion 47, the release being contingent upon excessive resistance to turning of the screw 12. Such excessive resistance may result from any one of several causes, and in the case of a stoker, the most common cause is a jam resulting from a railway spike or large stone in the coal which upon arrival at the bottom of the hopper gets stuck and prevents turning of the screw. The mechanism 50 is furthermore arranged as we shall see to break the motor circuit at the same time that the drive for the feed screw is disconnected. A shear pin 85, as best appears in Fig. 5, is entered through registering slots 86 and 87 provided in the hub 49 and shaft 37, respectively, and is held in place by a split ring 88 entered with spring action in an annular groove provided in the hub 49, the ring having engagement with the opposite ends of the pin as shown. The cross-section of the shear pin 85 is such that anything beyond a predetermined resistance to turning of the screw 12 will result in the ends of the pin shearing off and allowing the shaft 37 to turn relative to the hub 49 of the pinion 47. The shear pin is at the remote end of the reduction gearing with respect to the electric motor 17 so that when a jam occurs the motor, due to the reduction drive, will readily shear the pin and there will be no danger of the motor burning out. So much for the matter of how the screw 12 is disconnected from the transmission in the event of an overload. Registering V-shaped notches 89 and 90 are provided in the end of the hub 49 and shaft 37, respectively, as best appears in Fig. 4. A plate 91 is normally disposed in abutment with the end of these parts, as shown in Fig. 2, with the diametrically extending V-shaped projection 92 fitting snugly in the registering notches 89 and 90. A cap 93 detachably secured to the front end of the housing 19 and enclosing the mechanism 50, has a stud 94 slidably received in a hole at the center thereof and threaded into the center of the plate 91 to provide a mounting for the plate on the cap. A coiled compression spring 95 acts between the inside of the cap and the back of the plate to normally hold the same in abutment with the end of the hub 49 and shaft 37 with the projection 92 disposed in the notches in said parts. However, when the pin 85 shears off and the shaft 37 turns

with respect to the hub 49 the plate 91 is cammed away from the shaft 37, as shown in Fig. 3, by reason of the turning of the notch 90 with respect to the projection 92. This movement of the plate 91 is utilized to break the motor circuit by having the stud 94 move a trigger 96 of a switch 97. Any suitable form of switch may be used but I prefer using a limit switch similar to those used on elevators and the like and also quite extensively used in connection with automatic trip mechanisms on machine tools. The trigger 96 in moving from the position shown in Fig. 2 to that shown in Fig. 3 is arranged to break the motor circuit, and is automatically locked in open circuit position by means of a spring pressed latch 98. The switch 97 is suitably supported by means of a bracket 99 on the side of the housing 19 and has a conduit 100 extending therefrom containing the wires forming part of the motor circuit. The switch 97 is in series with the magnetic switch that is directly connected with the motor and a pressure control switch and stack temperature or low water cut-out switch associated with the boiler in connection with which the stoker is used. Thus, the pressure switch automatically breaks the motor circuit to stop the stoker when the steam pressure has been raised to a predetermined point and the switch 97 comes into play to break the motor circuit only in the event of an overload on the stoker. The throwing out of operation of the motor the instant an overload occurs sufficient to disconnect the stoker feed screw from the transmission is of advantage naturally from the standpoint of economy but also from the standpoint of letting the operator know when the stoker requires attention. Obviously, when the pin 85 shears off the thing that has caused that to occur must be remedied and then the cap 93 is removed and the shear pin replaced, after which the latch 98 can be released to throw the motor back into operation.

Referring to Fig. 6, which is a wiring diagram, the relationship of the switch 97 to the magnetic switch 101 of the motor is apparent at a glance; it is connected in series with the magnetic coil 102 of the magnetic switch so that when an overload occurs and the switch 97 is opened, the circuit through the coil 102 is broken and the magnetic switch 101 is thrown open and the motor stops. Mercoid switches are shown at 103 and 104 also in series with the coil 102. The switch 103 is the pressure control switch which breaks the motor circuit when the steam pressure has been raised to a predetermined point. The switch 104 can be either a stack temperature or a low water cut-out switch, but is shown as of the former type. When the main line switch 105 is closed to start the motor 17, the switch 101 is closed by reason of the energization of coil 102 and the motor is thrown into operation, and it is thereafter dependent for its continued operation on the switches 97, 103 and 104. Obviously, if an overload occurs and the switch 97 is opened, it is important that the operator's attention be called to it immediately. For that reason, a shunt connection 115 is made across the switch 97 for the primary winding of a transformer 106, the secondary winding of which is connected with an alarm 107. The latter is herein illustrated as a bell, but, of course, any other form of signal, such as an electric light, could be used. The resistance through the shunt connection is such that there is normally no appreciable current flowing therein; the current flows through the switch 97 as a path of least resistance. However, when the switch 97 is opened, the only path

left for the current is through the shunt connection 115 and the alarm 107 is accordingly operated. There is, therefore, no danger of the stoker being thrown out of operation for any longer period.

As a further safety feature, I provide a thermal relay 108 in series with the coil 102 and switch 97. This relay is of the well-known type which has a spring 109 normally tending to open the same when a mass of fusible metal 110 is heated to a predetermined temperature for fusion. The heating resistance for that purpose is shown at 111 and is in series with the motor. If the motor armature fails to turn for any reason, as for example, in case the bearings are not lubricated, the heating of the resistance 111 will cause fusion of the metal 110 and the relay 108 will be thrown open under the action of spring 109. As soon as that occurs, the electric current flowing through the shunt connection 115 will cause the alarm 107 to be operated, and attention will be called immediately to the fault so that it can be remedied and the stoker thrown back into operation with minimum delay.

It is believed the foregoing description conveys a good understanding of all of the objects and advantages of my invention. The appended claims have been drawn so as to cover all legitimate modifications and adaptations.

I claim:

1. In a stoker drive transmission of the type comprising a driven member such as a feed screw, an electric motor for driving the same, reduction gearing between the motor and the driven member for driving the latter from the former at a reduced speed, and a switch in the motor circuit, an overload release mechanism for disconnecting the driven member from operative relation to the motor and stopping the motor, said mechanism comprising a shear pin for interconnecting two interfitting driving and driven members of said transmission, such as a shaft and hub, said pin being arranged to shear off in the event of a predetermined excessive resistance to turning of the driven member and thus permit relative rotation between the shaft and hub, said shaft and hub having V-shaped notches provided therein held in register when the pin is intact, a plate having a V-shaped projection thereon fitting in said notches; spring means normally holding said plate in such position, said plate being movable outwardly by cam action of the projection in said notches in the event of relative rotation between the hub and shaft, and means operable upon outward movement of said plate to operate the switch to break the motor circuit.

2. An overload release mechanism adapted to be used with a shaft and a member mounted on the shaft and having a hub portion, one of the latter elements being the driver and the other the driven element, said release mechanism comprising a shear pin extending transversely through the shaft and hub portion to interconnect the same for drive purposes, said pin being arranged to shear off in the event of excessive resistance to turning of the driven element, said shaft and hub having transverse V-shaped notches provided in the end thereof normally disposed in register, a plate abutting the end of the shaft and hub having a transverse V-shaped projection fitting in said notches, said plate being movable outwardly by cam action of the projection in said notches upon relative rotation between the shaft and hub resulting from shearing of the pin, and means operable in outward

movement of the plate for operating a device to be operated.

3. A mechanism as set forth in claim 2 including a housing from which the shaft and hub project, a cap removably mounted on the housing and enclosing the projecting end of the shaft and hub, said cap being arranged to be removed to permit replacement of the shear pin, the means operable by the plate extending through said cap for operation of the device disposed outside the cover, and a coiled compression spring acting between the cover and the plate for normally urging the plate toward abutment with the shaft and hub to keep the projection thereon in the notches provided in said parts.

4. An overload release mechanism comprising a driving member, power means for driving said member, a driven member, a shear pin normally connecting said driving and driven members to rotate together, a control member normally disposed to turn with the driving and driven members, said control member having a V-shaped cam projection, and one of said driving and driven members having a V-shaped notch normally receiving said projection, said control member being normally stationary with respect to the notched member but arranged to move endwise with respect thereto by cam action of the projection in the notch upon relative rotation between the driving and driven members resulting from shearing of the shear pin, and controlling means for the power means operable upon endwise movement of said control member.

5. An overload release mechanism comprising a driving member, power means for driving said member, a driven member, a shear pin normally received in registering diametrical holes provided in the driving and driven members to cause said members to turn together, a control member normally disposed to turn with the driving and driven members, said control member having a V-shaped cam projection, and one of said driving and driven members having a V-shaped notch normally receiving said projection, said control member being normally stationary with respect to the notched member but arranged to move endwise with respect thereto by cam action of the projection in the notch upon relative rotation between the driving and driven members resulting from shearing of the shear pin, spring means for resiliently retaining the shear pin and control member in their normal positions, and controlling means for the power means operable upon endwise movement of said control member.

6. In an overload release mechanism, the combination of a first member and a second member surrounding the first member and normally arranged to turn therewith, a shearable pin interconnecting said members, and means for indicating the shearing of said pin comprising a member mounted for rotation normally with both of said members, one of said members having a V-shaped notch and said third member having a V-shaped cam projection entered in said notch, whereby upon relative rotation of said members resulting from shearing of the shear pin the third member is arranged to be moved endwise by cam action of its projection in the notch.

7. In an overload release mechanism, the combination of a first member and a second member surrounding the first member and normally arranged to turn therewith, a shearable pin interconnecting said members, means for indicating the shearing of said pin comprising a member mounted for rotation normally with both of said

members, one of said members having a V-shaped notch and said third member having a V-shaped cam projection entered in said notch, whereby upon relative rotation of said members resulting

5 from shearing of the shear pin the third member is arranged to be moved endwise by cam action of its projection in the notch, and spring means for retaining the shear pin in its operative position and resisting endwise movement of the

10 third member.  
 8. An overload release mechanism for a power transmission comprising in combination with a driving shaft and a driven sleeve on said shaft, a shear pin connecting the shaft and sleeve to rotate together, a control member mounted on said  
 15 shaft to turn therewith, said member having a V-shaped cam projection, said sleeve having a V-shaped notch normally receiving said projection, said projection being arranged in the event of rotation of the shaft and control member rela-  
 20 tive to the sleeve, resulting from shearing of the pin, to cause endwise movement of said control member by cam action of the projection in its

lateral movement relative to the notch, and means operable in endwise movement of said control member for operating a device to be operated.

9. An overload release mechanism for a power transmission comprising in combination with a driving shaft and a driven sleeve on said shaft, a shear pin connecting the shaft and sleeve to rotate together, a control member mounted on said shaft to turn therewith, said member having a  
 10 V-shaped cam projection, said sleeve having a V-shaped notch normally receiving said projection, said projection being arranged in the event of rotation of the shaft and control member rela-  
 15 tive to the sleeve, resulting from shearing of the pin, to cause endwise movement of said control member by cam action of the projection in its lateral movement relative to the notch, spring means resisting endwise movement of said control member, and means operable in endwise  
 20 movement of said control member for operating a device to be operated.

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