

June 18, 1940.

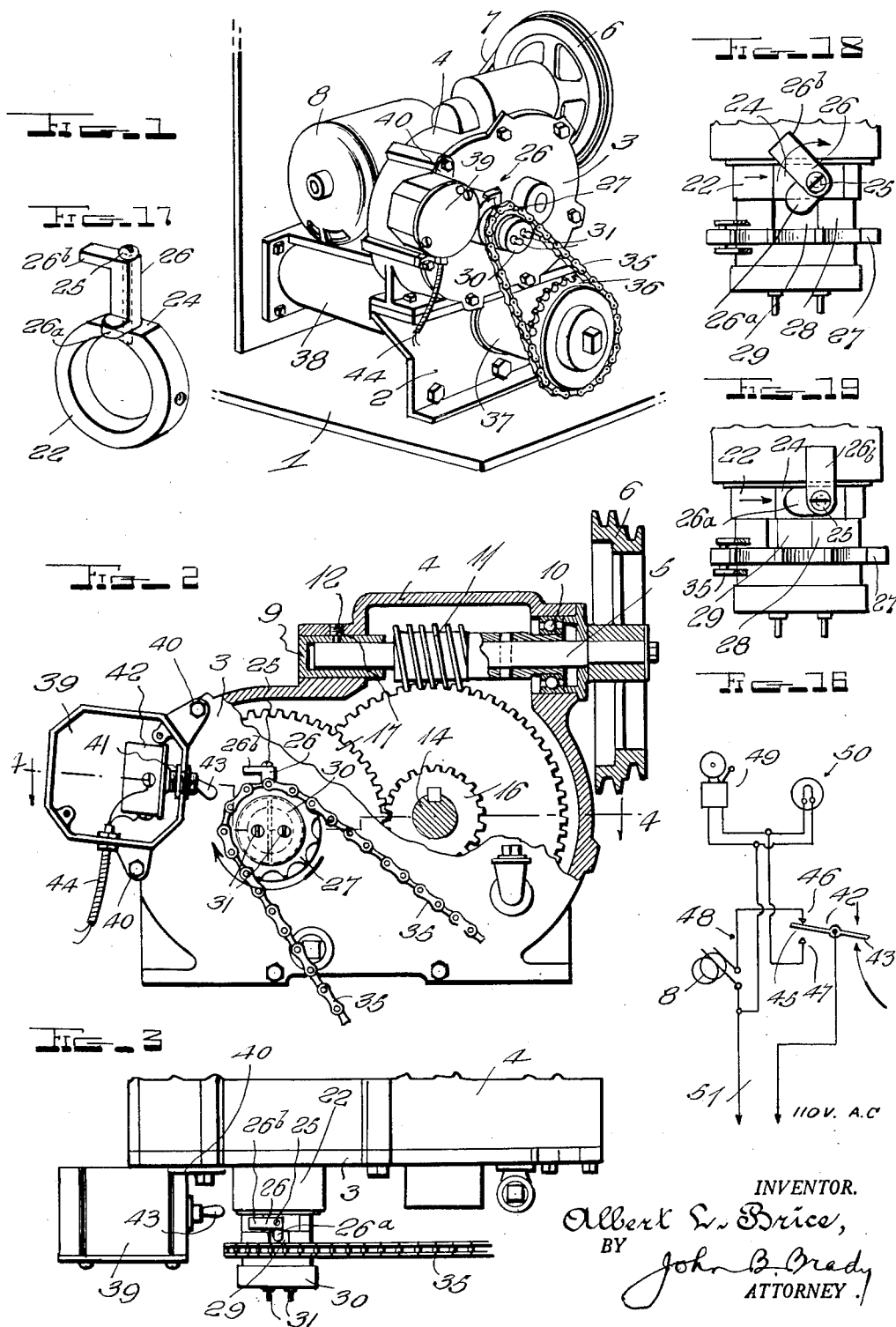
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2,205,370

SHEAR PIN ALARM FOR STOKERS

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2 Sheets-Sheet 1



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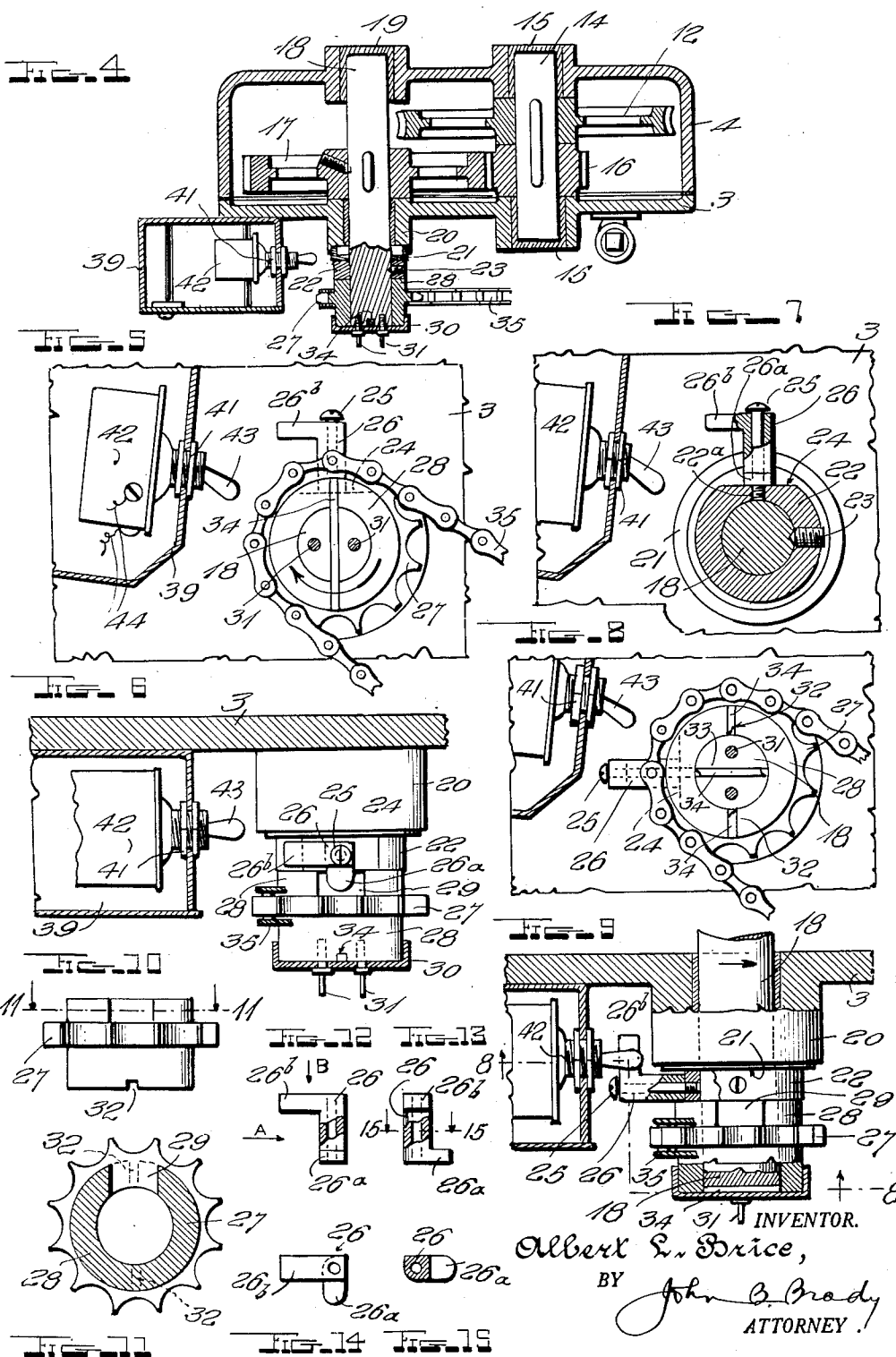
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2 Sheets-Sheet 2



UNITED STATES PATENT OFFICE

2,205,370

SHEAR PIN ALARM FOR STOKERS

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15 Claims. (Cl. 192—150)

My invention relates broadly to stokers and more particularly to a shear pin alarm and control system whereby the driving motor of the stoker may be shut down and a warning alarm sounded upon the breaking of the shear pin in the stoker drive resulting from clogging of the screw conveyor in the coal feeding mechanism of the stoker.

One of the objects of my invention is to provide a protective means for stoker operating mechanism whereby the resistance resulting from undue strain placed on the stoker operating mechanism by obstructions in the path of the stoker coal feeding mechanism will not be transmitted back to the driving motor so that injury to the gears may be avoided.

Another object of my invention is to provide a construction of frangible coupling device normally serving as a coupling between a driving means and a driven means and operating under all normal conditions of load for transmitting required driving forces the device being severed under conditions of excessive strain and abnormal load for shutting down the driving means and sounding an alarm.

A further object of my invention is to provide a simplified construction of protective device which may be readily installed on existing stoker installations for eliminating injury to the gears of the stoker operating mechanism when the coal feeding mechanism becomes jammed and sounding an alarm until the abnormal condition is corrected.

A still further object of my invention is to provide an arrangement of driving and driven members in which the driving member rotates a lever member which under all normal conditions of operation moves in a path adjacent to, but out of alignment with, an electric circuit controller but in which the lever member upon stoppage of the driven member due to excessive load is moved to a position in the path of the electric circuit controller, thereby actuating the electric circuit controller for cutting off the application of rotative force to the driving member and sounding an alarm until the abnormal condition is corrected.

Another object of my invention is to provide a construction of coupling means between a driving member and a driven member with a lever actuating mechanism and electric circuit controller associated therewith and wherein under normal conditions of operation, the lever mechanism is rotated out of the path of the actuator for the electric circuit controller, but under abnormal conditions is shifted to a position in alignment with the actuator of the electric circuit controller whereby said actuator may be functioned to cut off the driving force to the driven member and sound an alarm.

Other and further objects of my invention re-

side in the construction of a frangible pin device for controlling the actuation of an electric switch according to the condition of operation of driving and driven members as set forth more fully in the specification hereinafter following by reference to the accompanying drawings, in which:

Figure 1 is a perspective view showing the driving mechanism of a stoker embodying the protective means of my invention; Fig. 2 is a front elevational view of the gear box of the driving mechanism illustrated in Fig. 1 and illustrating the actuator of the electric circuit controller and the coacting lever mechanism operated by the driving and driven members of the stoker operating mechanism in which the gear box is partially broken away to show the gears interiorly of the gear box and illustrating certain of the parts in cross section; Fig. 3 is a fragmentary plan view of the driving and driven members and showing the coordination of the lever mechanism and the actuator of the electric circuit controller under normal conditions of operation; Fig. 4 is a horizontal sectional view through the gear box of the stoker operating mechanism, electric circuit controller mounting means and coupling means between the driving and driven members, certain of the parts being illustrated in elevation; Fig. 5 is a fragmentary front elevational view showing the association of the coupling means, the lever mechanism and the electric switch actuator in position for normal conditions of operation; Fig. 6 is a top plan view of the assembly illustrated in Fig. 5 with certain of the parts shown in cross section, the coupling means, the lever mechanism and actuator for the electric circuit controller all being shown in position for normal condition of operation; Fig. 7 is a vertical sectional view taken substantially on line 7—7 of Fig. 6 and illustrating the lever mechanism carried by the driving member and the normal position thereof with respect to the actuator of the electric circuit controller when the driving member is operating under safe condition of load; Fig. 8 is an end view taken substantially on line 8—8 of Fig. 9 and showing the lever mechanism shifted to a position in which the lever mechanism is about to engage the actuator of the electric circuit controller for cutting off a driving mechanism and sounding an alarm after the driven member has become jammed by excessive loading; Fig. 9 is a plan view of the arrangement shown in Fig. 8 with certain of the parts broken away and illustrated in section and showing the lever mechanism about to engage the actuator of the electric circuit controller; Fig. 10 is a plan view of the driven member showing the sprocket teeth thereon and illustrating the recess in one end thereof which normally receives one end of the lever

mechanism and serves as an abutment when the driven member is jammed for angularly shifting the position of the lever mechanism; Fig. 11 is transverse sectional view of the driven member taken on line 11—11 of Fig. 10; Fig. 12 is a side elevational view of the lever mechanism partially broken away and shown in cross section, the view showing in side elevation the longer arm of the lever mechanism; Fig. 13 is an elevational view of the lever mechanism partially broken away and shown in cross section, the view showing in side elevation the shorter arm of the lever mechanism, looking in the direction of arrow A in Fig. 12; Fig. 14 is a plan view of the lever mechanism, looking in the direction of arrow B in Fig. 12; Fig. 15 is a transverse sectional view through the lever mechanism on line 15—15 of Fig. 13; Fig. 16 schematically illustrates the electrical circuit arrangement of the circuit controller, the electric motor for imparting the driving force to the driving member and the visual and aural alarms which are sounded when the motor is shut down under abnormal conditions of load; Fig. 17 is a perspective view showing the mounting of the lever mechanism with respect to the driving member; Fig. 18 is a theoretical view showing the manner in which the driven member functions as an abutment for shifting the lever mechanism carried by the driving member when the coupling means between the driving and driven members has been severed under conditions of abnormal load; and Fig. 19 illustrates the manner in which the lever mechanism is maintained in a path aligned with the actuator of the electric circuit controller until the fault which brought about the severance of the frangible coupling means has been corrected and the coupling repaired.

I have illustrated my invention in connection with the gear box of a stoker particularly adapted for domestic installation where clogging of the coal feeding mechanism may often bring about wreckage of the gears and result in the continuous running of the driving motor which operates the stoker over a relatively long period of time without being observed. I desire that it be understood however that my invention is applicable generally to all classes of driving and driven mechanisms where it is desirable to shut off the driving force to the driving mechanism under conditions of jamming of the driven mechanism and to sound an alarm which will call attention to the defect.

In servicing great numbers of stokers over a considerable period of time, I have found that one of the chief sources of destruction and damage of stoker mechanism is the occasional but unavoidable presence of unyielding obstructions encountered by the coal feeding mechanism of the stoker and the undue strains to which the driving and driven members of the stoker mechanism are thereby subjected. The packing of the coal in the coal feeding tube or the presence of hard foreign objects may subject the screw conveyor to such retarded action or even force the screw conveyor to virtual stoppage. This abnormal load introduces such a strain on the driving gears, bearings, the several shaft members, and all parts of the driving motor that failure may occur which may require extensive shut-down of the stoker and substantial expense in repair or replacement of parts. Failure of any portion of the stoker mechanism at a time when heat is essential may prove very disastrous. My invention provides a safety or protective

means adaptable to stokers for localizing any failure which may occur due to excessive strains or abnormal loads in such manner that the protective means may be very readily and quickly replaced with negligible expenditure of time, effort, and expense. I provide a coupling means between the driving means and the driven means in the form of a frangible pin designed to shear below a limit resistance at which forces to be transferred from the driving means to the driven means would otherwise become destructive. The shear strength of the frangible pin is so selected or predetermined that under conditions of abnormal loads or excessive strains imposed upon the driven member, such strains or stresses will not be reflected into the driving means or cause destructive results in the driven means because the frangible pin will shear and allow the driving means to run idle. I mount upon the driven member a ring-like carrier on which there is radially supported a lever mechanism which is adapted to be angularly shifted in position. The lever mechanism rotates in a path which is immediately adjacent the actuator of an electric circuit controller but which under normal conditions is free to revolve without engaging the actuator. The driven member is so shaped that the lever mechanism supported on the driving mechanism is partially housed in a recess in the driven member under normal conditions. However, upon stoppage of the driven member, the recess therein becomes an abutment against which the lever mechanism is moved by virtue of the mounting thereof on the driving member. Thus the lever mechanism is shifted into a path aligned with the actuator of the electric circuit controller. The actuator is functioned, opening the electric circuit to the driving motor and closing the circuit to an aural and visual alarm which attracts attention to the defective condition. The cause of the obstruction may then be determined, the condition corrected, and the protective device renewed by merely withdrawing the cap, removing the sheared pin, and substituting a renewal pin, whereupon the mechanism is again in condition for operation. The actuator of the electric circuit controller is manually restored to normal position preparatory to the next automatic actuation due to a faulty or dangerous condition. It will be appreciated that the replacement thus made may be effected at almost negligible cost and may be accomplished quickly and easily with, at most, an ordinary screw driver and without the exercise of any particular skill. The costly mechanism is thus protected and inconvenient shut-downs of the stoker eliminated.

Referring to the drawings in detail, reference character 1 designates a base or support on which the apparatus embodying my invention is mounted. A suitable supporting bracket 2 carries the gear case, driving motor, pulley mechanism and parts associated with the screw conveyor of the stoker as shown. The gear case is constituted by a gear box 4 having a removable front plate 3. A driving shaft 5 is journaled in ball bearing 10 at one end and sleeve bearing 9 at the opposite end carried by gear box 4. The driving shaft 5 has drive pulley 6 secured thereon which is driven by belt 7 operated by drive motor 8 supported by an auxiliary plate supported from bracket 2. The drive shaft 5 carries worm gear 11 which meshes with gear 12 carried by a shaft 14. Shaft 14 is journaled in bearings 15, Fig. 4, one of which is supported in gear box 4 and

the other of which is mounted in front plate 3. Pinion 16 is keyed to shaft 14 and meshes with gear 17 carried by shaft 18. Shaft 18 is journaled in sleeve bearing 19 supported in gear box 4 and open end bearing 20 supported in front plate 3. An oil seal 21 is mounted in front plate 3 around shaft 18.

A ring member 22 is fixed to shaft 18 by means of set screw 23, Fig. 7. The ring member 22 is flattened at one side thereof as indicated at 24. The flattened portion 24 is substantially chordal with respect to the periphery of the ring member 22 and provides a flattened area over which the crank lever 26 may be angularly shifted. The chordal portion of ring member 22 as shown at 24 is screw threaded at 22a to receive the end of screw member 25 which passes through the crank lever 26 and about which the crank lever 26 is free to angularly shift. The crank lever 26, Figs. 12-15, includes a pair of projecting arms which extend at 90° spaced relation to each other. A short arm 26a is provided on one end of crank lever 26 and a long arm 26b is provided on the other end of crank lever 26. The short arm 26a is provided on the end of crank lever 26 which is adjacent the chordal portion 24 of ring member 22. Immediately adjacent the ring member 22 on shaft 18, I locate the gear box sprocket 27 having a hub portion 28. The hub portion 28 projects further on one side of gear box sprocket 27 than it does on the opposite side thereof. The shorter projection of hub 28 with respect to gear box sprocket 27 is at the side of the hub that directly abuts the ring member 22. The hub 28 on the side adjacent ring member 22 is recessed as indicated at 29. The short arm 26a of crank lever 26 normally projects into the recess 29 and the recess 29 is but slightly deeper than the length of the short arm 26a and has a width somewhat greater than the width of short arm 26a which permits some lost motion of crank lever 26. Displacement of sprocket 27 relative to ring member 22 causes the angular shifting of crank lever 26.

The opposite projecting portion 28 of the hub receives a cap member 30 which is adapted to fit over the projecting end of hub 28 and extend laterally across the end of shaft 18 and to be secured thereto by means of removable manually actuable wing screws 31. The longer projecting end of the hub 28 is provided with diametrically aligned grooves 32. The grooves 32 in the hub 28 are adapted to be aligned with groove 33 in the end of the shaft 18. A shear pin 34 is adapted to fit within grooves 32 and groove 33 and provide an interlock therebetween under all conditions of normal operation. The gear box sprocket 27 intermeshes with sprocket chain 35 for driving sprocket 36, Fig. 1, which is secured to the main shaft which passes through the housing 37 and through the aligned housing 38 to the screw conveyor that operates the stoker.

A switch housing 39, Fig. 2, is mounted by means of securing screws 40 which pass through the front plate 3 of gear box 4. The switch housing 39 is provided with mounting means 41 for the two-position snap switch 42 which is actuated by the two-position toggle member 43 disposed in the path of the long arm 26b of the crank lever 26 when the shear pin 34 has been severed and when shaft 18 is running idle. The two-position snap switch 42 includes the switch arm 45 indicated schematically in Fig. 16 controlled by the toggle actuator 43. Opposite contacts 46 and 47 are provided within the two-position

snap switch 42 and switch arm 45 is adapted to make contact with either of said contacts according to the movement of the toggle actuator 43. The circuit from the two-position snap switch 42 extends through conduit 44 to the circuit 48 of motor 8, to the alarm circuit constituted by either the visual indicator 50, such as incandescent light 50 and/or the aural alarm circuit, such as annunciator 49 for completing circuits from the source of potential connected to leads 51. With the switch arm 45 moved to a position in which the motor circuit 48 is energized from the power supply source 51, normal operation of the stoker takes place because the long arm 26b of the crank lever 26 rotates out of the path of the toggle 43. If, however, an obstruction occurs in the screw conveyor which is so severe as to enable the driving shaft 18 to exert excessive strain on the shear pin 34, shear pin 34 breaks and sprocket chain 35 engaged with sprocket 27 merely maintains the sprocket in fixed position, allowing shaft 18 to idle within the hub 28.

Figs. 17, 18 and 19 show more clearly the mechanical movement of crank lever 26 under normal conditions and under conditions of excessive strain when shear pin 34 has been severed. In Fig. 17 I have shown the mounting means for crank lever 26 with respect to the flat chordal portion 24 of ring member 22. In the position illustrated in Fig. 19, the long arm 26b of crank lever 26 operates to engage the toggle actuator 43 for shutting down motor 8 and operating the alarm 49 and/or signal 50.

In Fig. 18 I have shown the relative position of crank lever 26 when shear pin 34 has just severed. Under this condition, the driven sprocket 36 which has become obstructed in its movement serves as a drag on sprocket chain 35. The driven shaft 18 in continuing to drive in a clockwise direction drags the short arm 26a of crank lever 26 against the abutment offered by one side of the recess 29 in hub 28, as a result of which the short arm 26a of crank lever 26 can no longer remain within the protection of the recess 29 but is angularly shifted to swing arm 26b of crank lever 26 in a clockwise direction as illustrated in Fig. 18.

In Fig. 19 I have shown the hub 28 entirely at rest and maintained stationary by the drag of sprocket chain 35 on gear box sprocket 27 while crank lever 26 is driven by shaft 18 through ring member 22 which supports the crank lever 26. The short arm 26a of crank lever 26 is confined between the hub 28 and the peripheral wall of the oil seal 21. In this position the long arm 26b of crank lever 26 is directly in the path of the toggle actuator 43 and serves to trip the toggle actuator 43 to move the switch arm 45 (Fig. 16) from the running position for motor 8 through contact 46 to the alarm position in connection with contact 47 at which time visual signal 50 is energized and/or aural alarm 49 is sounded, thus attracting attention to the defect.

Upon discovery of the defective condition, the repair and reconditioning of the protective mechanism is very simple for it is only necessary to remove thumb screws 31 to allow removal of cap member 30 and withdrawal of the sheared pin 34 and replacement of a whole pin and the subsequent replacement of the cap member 30 by means of screws 31. It will be seen that the replacement operation can be performed without the exercise of any considerable skill and merely by use of the fingers grasping thumb screws 41

without even a screw driver as a tool. The protection afforded by the arrangement of shear pin 34 is very substantial as the necessity for extensive shutdown may be eliminated and injury to costly mechanism and other inconveniences and loss is avoided.

While I have described my invention in one of its preferred embodiments, I desire that it be understood that modifications may be made and I intend no limitations upon my invention other than may be imposed by the scope of the appended claims.

What I claim as new and desire to secure by Letters Patent of the United States is as follows:

1. In an overload safety release employing a frangible key between concentric driving and driven shafts for power transmission, said key being disposed in aligned recesses in the ends of said shafts, means for confining the key, whole and severed, comprising a member of cup-shaped cross-section having an inner diameter equal to the diameter of the outer one of said concentric shafts and an inner depth at least equal to the depth of said recesses for enclosing the said recesses with said frangible key disposed therein, an electric circuit controller, an actuator for said electric circuit controller, and a member whose position is determined by relative movement between said driving and driven shafts engageable with said actuator for tripping said actuator when said driving shaft moves independently of said driven shaft.

2. In an overload safety release as set forth in claim 1, in combination with the said confining means, means for securing said confining means to the inner one of said shaft.

3. In an overload safety release as set forth in claim 1, in combination with the said confining means, means for securing said confining means to the inner one of said shafts, comprising bolt means connected with the base portion of said cup-shaped member and engageable with the inner one of said shafts on opposite sides of the recess therein.

4. In a power transmission system, comprising driving and driven members, an overload release device including a frangible key serving as a coupling between said driving and driven members, means for mounting said key in readily accessible position for manual replacement; said means comprising exposed end portions of said members concentrically arranged one within the other and having diametrical recesses in the ends thereof to receive said frangible key sidewise, unitary cup-shaped cover means having a flanged peripheral portion for embracing said key endwise and a base portion for abutting said key sidewise, and screw means connected with said base portion and engaged with the recessed end of the inner one of said members on opposite sides of the recess therein for securing the said cover means to the inner one of said members for retaining the outer one of said members in position and the respective portions of said key in the recesses in said members, said screw means being exposed and readily accessible and removable whereby said cover means may be removed, said key replaced and said cover and said screw means remounted for restoring said power transmission to operative condition, an electric circuit controller; an actuator for said circuit controller, and a member operative under conditions of relative movement of said driving and driven members and whose position is determined by said

relative movement, said member being operated in the path of said actuator when said driving member moves relatively to said driven member.

5. In a power transmission, a driving member and a driven member mounted for rotation about a common axis and having adjacent end faces provided with registrable recesses, a frangible element disposed in said recesses to establish a normal driving connection between the members but adapted to be severed by such members when the driven member is subjected to abnormal resistance, means secured to the inner one of said members for releasably retaining the frangible element whole and severed in said recesses, an electric circuit controller, an actuator for said controller, and a crank device whose position is determined by relative movement between said driving member and said driven member, said crank device being shiftable into the path of said actuator under conditions of relative movement between said driving member and said driven member for operating said actuator.

6. In a power transmission, concentrically disposed driving and driven members having adjacent recessed surfaces disposed at right angles to the common axis of rotation, a replaceable frangible member arranged in said recesses to operatively connect the driving and driven members, an electric circuit controller, an actuator for said circuit controller, and a crank device whose position is determined by relative movement between said driving and driven members, said crank device being shiftable into the path of said actuator under conditions of relative movement of said driving and driven members and being rotatable under control of said driving members for tripping said actuator.

7. In a power transmission, concentrically disposed driving and driven members having adjacent end surfaces provided with registrable recesses, a key lying in said recesses to normally form a driving connection between the members, said key being designed for severance by the members when subjected to a predetermined resistance which is less than the operating force that can be transmitted without breakage to any other part of the transmission, an electric circuit controller, an actuator for said controller, and a crank device carried by said driving member in a position normally out of the path of said actuator, the position of said crank device being determined by relative movement between said driving and driven members, said crank device being shiftable into the path of said actuator under conditions of relative movement between said driving and driven members for tripping said actuator.

8. In a power transmission, rotatable driving and driven members arranged one within the other and having recesses in adjacent end faces thereof, a frangible connecting key, said recesses being in the form of exposed channels whereby the key may be readily inserted and removed endwise of the members, means secured to the inner one of said members for embracing said key at opposite ends thereof and for releasably securing the key in the channels, an electric circuit controller, an actuator for said electric circuit controller, and a crank device carried by said rotatable driving member and normally moving in a path displaced from the position of said actuator and being shiftable into a position engageable with said actuator under conditions of relative movement between said driving and driven members for tripping said actuator.

9. In a power transmission, rotatable driving and driven members arranged one within the other, recesses in the ends of said members to receive a connecting key, said recesses being in the form of exposed channels whereby the key may be readily inserted and removed endwise of the members, a cap releasably secured to one of the members over said recesses to retain the key therein, an electric circuit controller, an actuator for said electric circuit controller, and a crank device carried by said rotatable driving member in a position for rotation in a path normally displaced from said actuator, said crank device being shiftable in position under conditions of relative movement between said driving and driven members for rotation in a path in which the crank device is engageable with said actuator for tripping said actuator.

10. In a power transmission, rotatable driving and driven members arranged one within the other and having recesses in adjacent end faces thereof, a frangible connecting key, said recesses being in the form of exposed channels whereby the key may be readily inserted and removed endwise of the members, a cap member releasably secured to the inner one of the members over said recesses to retain the key therein, said plate having an annular flange overlying the outer ends of the channels in the outer member and embracing said key at opposite ends thereof to prevent endwise displacement of the key and severed parts thereof, an electric circuit controller, an actuator for said controller, and a crank device carried by said rotatable driving member, said crank device being shiftable under conditions of relative movement between said rotatable driving and driven members to a position for tripping said actuator.

11. An overload safety release for the power transmission of a stoker, including an electric motor, a motor operated driving member, a driven member for operating the fuel conveyor of the stoker, said members being concentrically arranged, one around the other and having end surfaces channeled to receive a frangible power transmitting key, an electric circuit controller for said electric motor, an actuator for said controller, and a crank device carried by said driving member and movable thereby in a path normally displaced from said actuator, said crank device being shiftable under conditions of relative movement of said driving and driven member to a position for tripping said actuator and opening the circuit to said electric motor.

12. An overload safety release for the power transmission of a stoker, including an electric motor, a motor operated driving member, a positive gear driven member for operating the fuel conveyor of the stoker, said members being concentrically arranged, one around the other and having channeled end surfaces, a frangible power transmitting key, means secured to the inner one of said members for releasably securing the key and severed parts thereof in the channels, an electric motor circuit controller, and an actuator for said controller, a crank carried by said driving member and normally rotatable in a path displaced from said actuator, said crank device being shiftable in position under conditions of relative movement between said driven and driving members for tripping said actuator and opening the circuit to said electric motor.

13. An overload safety release for the power transmission of a stoker, including an electric

motor, a motor operated driving member, a positive gear driven member for operating the fuel conveyor of the stoker, said members being concentrically arranged, one around the other, and having channeled end surfaces, a frangible power transmitting key, means for releasably securing the key in the channels, said means comprising a keeper secured to the inner one of the aforesaid members and engageable with the key to restrain both lateral and longitudinal displacement thereof, an electric motor circuit controller, an actuator for said controller, and a crank device carried by said driving member and normally rotatable in a path displaced from said actuator, said crank device being shiftable in position under conditions of relative movement between said driving and driven members for engaging and tripping said actuator and opening the circuit to said electric motor.

14. An overload safety release for the power transmission of a stoker, including an electric motor, a motor operated driving member, a positive gear driven member for operating the fuel conveyor of the stoker, said members being concentrically arranged, one around the other and having channeled end surfaces, a frangible power transmitting key, a flanged plate secured to the inner one of the aforesaid members in a position overlying both the open side and ends of the channels in said member surfaces to retain the key in operative position, an electric motor circuit controller, an actuator for said controller, and a crank device operated by said driving member in a position normally out of the path of said actuator, said crank device being shiftable under conditions of relative movement between said driving and driven members for engaging and tripping said actuator for opening the circuit to said electric motor.

15. An overload safety release for power transmission systems comprising an electric motor, a driving member, an outer concentric driven member including a hub portion, replaceable frangible means for normally transmitting power from said driving member through said driven member, an electric motor circuit controller, an actuator for said electric circuit controller, a ring device secured to said driving member adjacent the hub portion of said driven member and having a flattened chordal portion and a diameter substantially equal to the hub diameter of said driven member, the hub portion of said driven member having a recess normally disposed opposite the flattened chordal portion of said ring device, and a crank device pivotally mounted on the chordal portion of said ring device and having an angular projection engaged in the recess in said driven member, said crank device being normally maintained by said projection in a path of movement displaced from said actuator, said projection being expelled from said recess under abnormal conditions of relative movement between said driving and driven members and operative to move said crank device into a path of movement aligned with said actuator, said crank device being carried by said driving member into engagement with said actuator and maintained in engagement therewith by coaction of said projection with the lateral surface of the adjacent hub portion of said driven member for tripping said actuator and opening the circuit to said electric motor.

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