

Dec. 14, 1937.

F. L. HILL

2,102,002

OVERLOAD RELEASE DEVICE

Filed Jan. 22, 1937

2 Sheets-Sheet 1

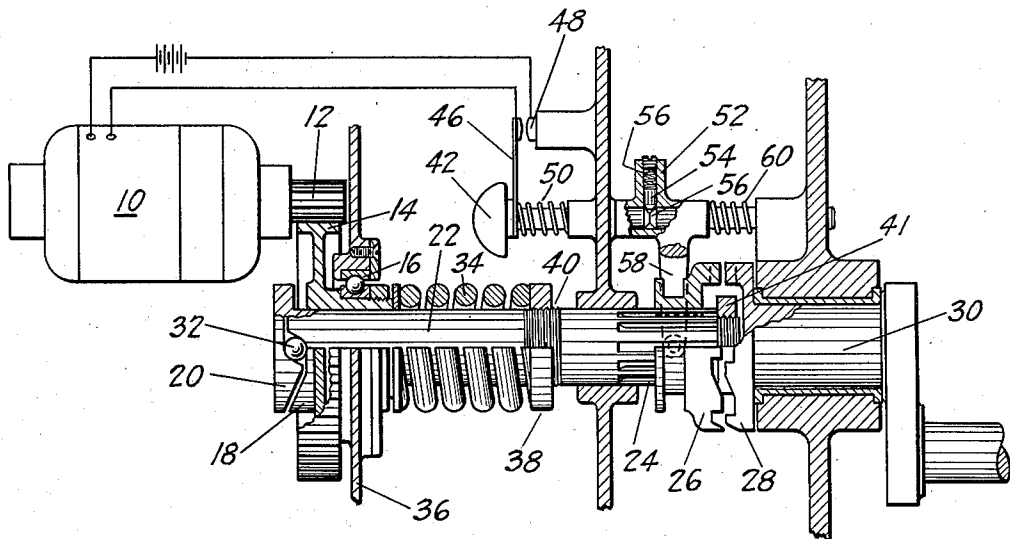


Fig. 1.

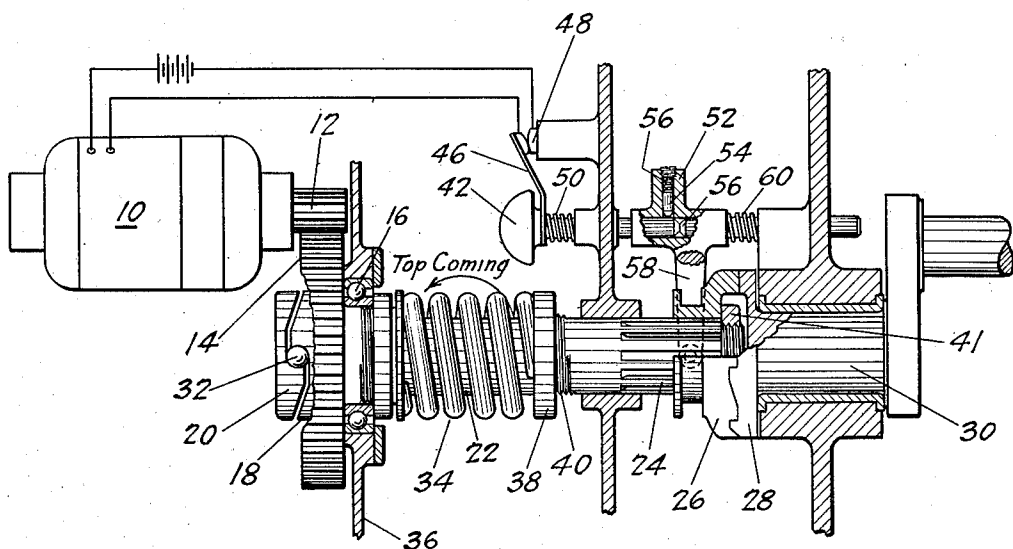


Fig. 2.

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2 Sheets-Sheet 2

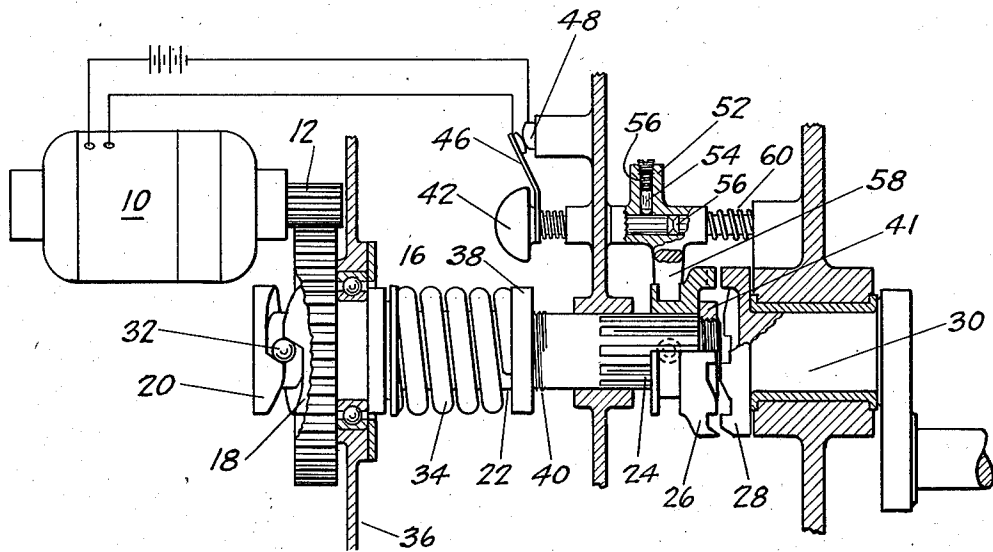


Fig. 3.

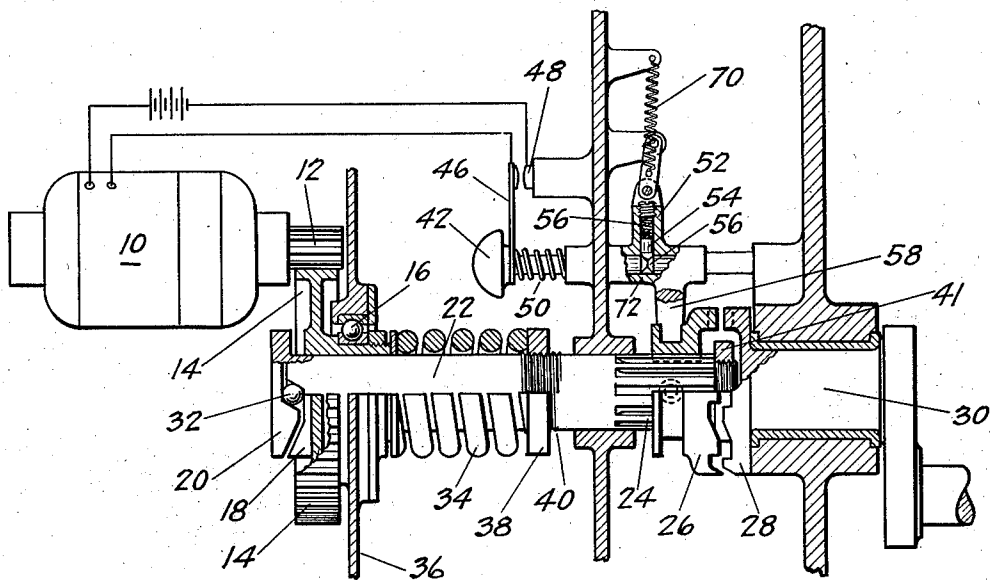


Fig. 4.

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OVERLOAD RELEASE DEVICE

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Application January 22, 1937, Serial No. 121,729-

6 Claims. (Cl. 74-6)

My invention relates to devices designed to avoid destructive stresses of torsion when transmitting power between a driving and a driven shaft. It is intended to automatically disconnect or uncouple the two shafts when the torque load on the driven shaft exceeds a predetermined value.

The device is useful in any and all organizations where an overload on the driven shaft is likely to occur. For instance, in a shear or punch press, driven by an electric motor, or in an electric engine starter organization, the device of my invention may be used to advantage. Especially is it useful in the latter organization wherein overloads due to backfire frequently occur. Regardless of its use, the invention also embodies, as an important adjunct, means or mechanism whereby the driving couple or connection may be established and disestablished as required.

In the drawings:

Fig. 1 is a semi-diagrammatic view of an electric engine starter organization having the device of my invention incorporated therein; the starter and the engine being shown disconnected as is the case where the engine is not running or is running in normal operation;

Fig. 2 is a similar view showing the relative disposition of the device parts with the starter plunger depressed;

Fig. 3 is a further similar showing with the device parts positioned as would be the case at the moment of the application of an overload on the driven shaft; and

Fig. 4 is a fragmentary view of a slight modification.

In the embodiment of the invention selected for illustration, a prime mover 10 (preferably an electric starter motor) is shown. The motor 10 is provided with a driving pinion 12 which meshes with a starter gear 14. The starter gear is mounted in a bearing 16, and has fastened thereto or formed integrally therewith a suitable member cam 18. The cam 18 is preferably of the three-lobe type and is adapted normally to engage with the correspondingly pitched follower cam 20 mounted at one end of a starter or follower shaft 22. The shaft 22 is movable axially with respect to the gear 14 and is provided at its opposite end with splines 24 over which one part 26 of a two-part clutch is fitted. The other part 28 of the clutch is fastened to the shaft 30 to be driven. In the present instance the shaft 30 is an internal combustion engine crankshaft of conventional design. Steel balls 32 may be

interposed between the lobes of the cams 18-20 to reduce friction. If desired, other means to reduce friction, such as rollers, etc., may be substituted for the balls 32.

The cams 18-20 are held in engagement by a spring 34 bearing at one end against the casing 36 within which the bearing 16 is fitted, and at its opposite end against a collar 38 fastened to the starter shaft 22. By threading the starter shaft 22, as indicated at 40, the collar 38 may be adjusted toward and from the gear 14 to vary as desired, the force required to be exerted to separate the cams. The shaft 22, it will be noted, extends not only through the gear 14, but also through the cam 18 carried by the gear, and has mounted thereon, at its inner end, a nut or collar 41. The function of this nut or collar 41 will be hereinafter more fully explained.

To manually shift the clutch part 26 axially of the shaft 22 into and out of clutching engagement with the clutch part 28, I provide a plunger 42. The plunger 42, immediately of its ends, has formed therein a notch 44. It is mounted to be depressed manually in a starting operation and has fastened thereon a spring contact member 46. Said member 46, as the plunger is depressed, makes contact with a second contact member 48 to close an electrical circuit of which the motor or prime mover 10 forms a part. As an aid in returning the plunger 42 to its extended or normal position when pressure thereon is relieved, a spring 50 is provided.

Mounted on the plunger 42 is a slide member 52 within which is fitted a pawl 54, spring-loaded as at 56, to insure its engagement in the notch 44 when the plunger 42 is fully extended. The slide 52 also carries a yoke 58 which straddles the clutch part 26 to move it into and out of clutching engagement with the clutch part 28 as the slide 52 is moved either with or with respect to the plunger. To resist inward movement of the slide 52 a spring 60 is provided. Normally, the spring 60 holds the slide 52 in that position shown in Figs. 1 and 3.

In Fig. 1, the position of the device parts, when the starter motor is disconnected from the crankshaft of the engine, is shown. In this position, it will be noted, the pawl 54 is in fitting engagement within the notch 44 of the plunger; the clutch part 26 is out of engagement with the clutch part 28; and the contacts 46-48 are out of engagement one with the other. Fig. 2 shows the position of the device parts during a starting operation. To start the engine the plunger 42 is depressed. As the plunger is depressed, the

slide 52 is correspondingly moved until the yoke 58 shall have moved the clutch part 26 into clutching engagement with the clutch part 28; movement of the plunger causing the springs 50 and 60 to be compressed. Full depression of the plunger 42 causes the pawl 54 to ride out of the notch 44 where it remains so long as the plunger is held in its fully depressed position. Depression of the plunger 42 also moves contact 46 into engagement with contact 48 to close the starter circuit. With the circuit closed torque is transmitted from the starter pinion 12 to the crankshaft 30 of the engine, the starting torque being transmitted from the gear 14 to the starter shaft 22 through the mating cams 18—20 held against separation by the spring 34. The spring 34, it should be pointed out, is strong enough to prevent separation of the cams 18—20 under normal loads, though of insufficient strength to prevent separation of said cams should the driven shaft 30 be subjected to an overload or a load exceeding a predetermined value.

Assume that no overload occurs and the engine is started. Under these circumstances, as the crankshaft begins to turn under the firing impulses of the engine, the clutch part 28 runs away or overruns the clutch part 26. In so doing, it "kicks" the clutch part 26 out of contact with the clutch part 28, and by means of the yoke connection 58, forces the slide 52 into the position shown in Fig. 3. With the engine running, the plunger 42 is released. Immediately the plunger is released, the spring 50 returns it to the position shown in Fig. 1. In this latter position the pawl 54 is again forced into fitting engagement in the notch 44 of the plunger.

Should an overload occur, as for instance an overload induced by backfire, the clutch part 26, instead of being kicked out by the overrunning clutch part 28, is immediately declutched by the action of the cams 18—20. In Fig. 3, the position of the device parts when a declutching occurs automatically, is clearly illustrated. The cam 18, as it turns in the direction of the arrow of Fig. 2, is resisted by the cam 20. The cam 20 being held against turning, causes the cam faces to separate and the shaft 22 to move axially away from the clutch part 28. As axial movement of the shaft 22 occurs, the nut or collar 41 forces the clutch part 26 away from the clutch part 28. In so moving the clutch part 26, the yoke 58 is moved and hence the slide 52. The driving couple having thus been automatically broken, it only remains to release the plunger, whereupon the device parts, under the urge of the spring 34, the spring 50 and the spring 60 return to their original position.

It may be pointed out that the pawl 54 which releasably connects the yoke 58 to the plunger 42 is necessary because of the fact that if a positive connection were provided, manual pressure on the plunger 42 could not be removed quickly enough to prevent re-engagement of the clutch parts 26—28, while backfire of the engine was still in process. A re-engagement of the clutch parts 26—28 would cause the cams 18—20 to again climb one upon the other, thereby causing axial movement of the starter shaft and repeated de-clutching. This cycle of operation, if not prevented, would take place repeatedly and would result in objectionable vibration and needless wear through repeated impact of the clutch parts one against the other.

To further clarify the operation, it should also

be pointed out that the axial movement of the follower cam 20 by reason of its contact with the cam 18 is very rapid. The cams climb one upon the other on the balls 32, declutching the parts 26—28, whereupon, the spring 34 immediately returns them to their original position. The spring 60, or other equivalent means, must be provided to maintain the clutch part 26 in its disengaged position while the starter shaft returns to its original position.

Referring to the modification of Fig. 4, a spring 70 is provided in lieu of the spring 60. The spring 70, by reason of its disposition, as shown, acts on the slide 72 very much in the manner of a toggle and tends to yieldingly hold the slide, once it is shifted to either side of a dead center position, in that position to which it is shifted. In all other respects the operation is the same as described in connection with the preferred arrangement of Figs. 1 to 3.

While I have described my invention in detail in its present preferred embodiment, it will be obvious to those skilled in the art, after understanding my invention, that various changes and modifications may be made therein without departing from the spirit or scope thereof. I aim in the appended claims to cover all such modifications and changes.

What is claimed is:

1. An overload release device adapted to be introduced between a driving and a driven shaft comprising, in combination, a two-part clutch, an axially movable shaft upon which one clutch part is mounted and with respect to which it is axially movable, a cam and cam follower normally held together by spring pressure, and means mounted on said shaft and contactable with the axially movable clutch part to axially move and hence disengage it from the other said clutch part, said shaft being urged to axial movement of said contacting cam surfaces and against the action of said spring pressure should the torque load on the driven shaft exceed a predetermined value.

2. An overload release device adapted to be introduced between a driving and a driven shaft comprising, in combination, a two-part clutch, an axially movable shaft upon which one clutch part is mounted and with respect to which it is axially movable, a cam and cam follower, the cam being in driving contact with the drive shaft and the cam follower being in driving contact with the axially movable shaft, spring means normally maintaining said cam and cam follower in driving contact one with the other, and means movable with said shaft to disengage the axially movable clutch part from the other said clutch part by moving the movable clutch part axially of the shaft, said shaft being urged to axial movement of said contacting cam and follower and against the action of said spring pressure should the torque load on the driven shaft exceed a predetermined value.

3. An overload release device adapted to be introduced between a driving and a driven shaft, in combination, a clutch, a cam and cam follower normally held together by spring pressure, means interconnecting one element of said clutch with one element of said cam and follower to axially separate the cam and follower and disengage the clutch against the action of said spring should the torque load on the driven shaft exceed a predetermined value, means responsive in its operation to disengagement of the clutch

to hold the clutch disengaged once disengagement is effected, and means to re-engage the clutch.

4. An overload release device adapted to be introduced between a driving and a driven shaft, in combination, a two-part clutch, a shaft movable axially toward and from one element of said clutch, said shaft having mounted thereon for movement both with and with respect thereto the other element of said clutch, a cam and cam follower normally held together by spring pressure, means interconnecting the movable clutch part with one element of said cam and follower to separate the cam and follower and disengage the clutch against the action of said spring should the torque load on the driven shaft exceed a predetermined value, means responsive in its operation to disengagement of the clutch to hold the movable clutch part disengaged from the other said clutch part once disengagement thereof is effected, and means to re-engage said clutch parts at will by moving said movable clutch part axially of and independently of corresponding movement of said shaft.

5. In an engine starter, a driving and a driven

shaft, a two-part clutch, an axially movable starter shaft upon which one said clutch part is mounted and with respect to which it is axially movable, means movable with the starter shaft to disengage the clutch by axially shifting the movable clutch part on the starter shaft should the torque load on the driven shaft exceed a predetermined volume, and means engaging one said clutch part and movable independently of the starter shaft to re-engage said clutch.

6. In an engine starter, a driving and a driven shaft, a two-part clutch, an axially movable starter shaft upon which one said clutch part is mounted and with respect to which it is axially movable, means movable with the starter shaft to disengage the clutch should the torque load on the driven shaft exceed a predetermined volume, a starter motor, means engaging one said clutch part and movable independently of the starter shaft to re-engage the clutch, and mechanism carried by and responsive in its movement to the movement of said last mentioned means to activate said motor.

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