Nov. 5, 1946. O. RASMUSSEN ET AL 2,410,680

SNAP ACTION MECHANISM

Filed June 2, 1943

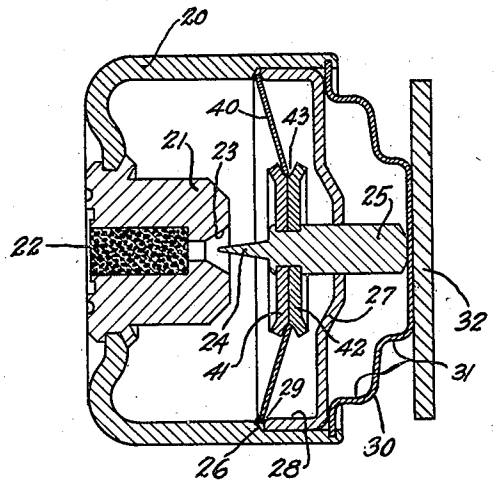


Fig. 1.

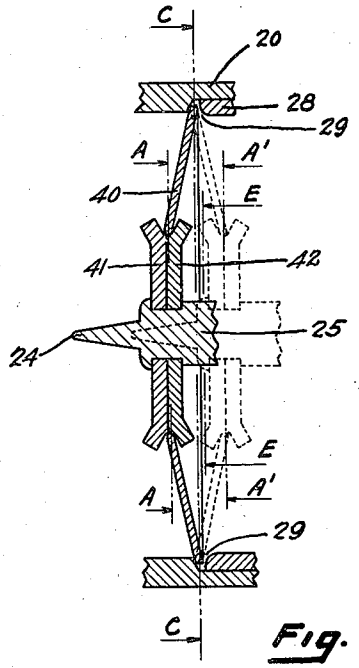


Fig. 2.

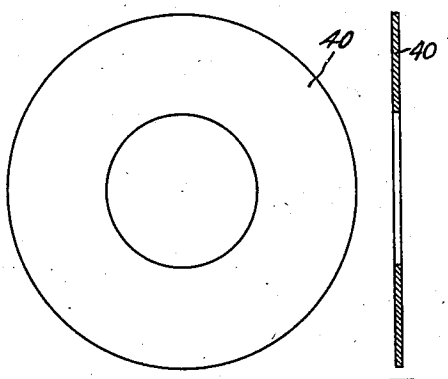


Fig. 3A.

Fig. 3.

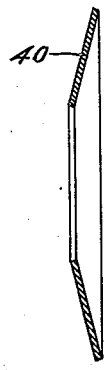


Fig. 4.

INVENTORS
OLAF RASMUSSEN AND
RICHARD C. RIKE
BY Spencer, Hardesan and Fisher
THEIR ATTORNEYS.

Patented Nov. 5, 1946 2,410,680

UNITED STATES PATENT OFFICE

2,410,680

SNAP ACTION MECHANISM

Olaf Rasmussen and Richard C. Rike, Dayton, Ohio, assignors to General Motors Corporation, Detroit, Mich., a corporation of Delaware

Application June 2, 1943, Serial No. 489,395

3 Claims. (Cl. 74—100)

1

This invention relates to a snap action mechanism.

It is among the objects of the present invention to provide a snap action mechanism capable of thrusting a member, being otherwise moved from its normal position toward its active position, into said active position with a quick, and powerful snap action, the snap action mechanism becoming effective only after the member has been moved to a predetermined point approaching its active position.

Another object of the present invention is to preset the power element of the snap action mechanism so that latent forces therein will become effective to increase the force with which said element moves into its normal state or position.

Further objects and advantages of the present invention will be apparent from the following description, reference being had to the accompanying drawing wherein a preferred embodiment of the present invention is clearly shown.

In the drawing:

Fig. 1 is a cross-sectional view of a mine fuse showing the snap action mechanism applied thereto.

Fig. 2 is an enlarged diagrammatic view illustrating the disc spring of the present invention in its two extreme positions namely, the inactive or normally formed position and the flexed or pre-active position.

Fig. 3 illustrates the flat, spring metal disc to be formed, by pressing, into its final shape.

Fig. 3A is a cross section of the ring disk shown in Fig. 3.

Fig. 4 shows the same spring metal disc pressed into its final, frusto-conical formation.

Although the snap action spring disc may be used in any device in which one member is to be moved from its inactive into its active position with a quick and powerful snap action, the present drawing shows said spring disc installed in a mine fuse the firing pin of which is thrust into contact with the primer charge of the fuse with sufficient force to explode it.

Referring to the Fig. 1 of the drawing the mine fuse is shown as comprising a housing 20 which is cup-shaped, the bottom wall of which has a central aperture in which the plug member 21 is secured. This plug has a central passage the larger diameter portion of which contains the primer charge 22. The smaller diameter, inner end of this passage is flared as at 23 and provides an entrance for the pointed end 24 of the firing pin 25. An alternate construction would

2

be to make the housing 20 and plug 21 an integral casting.

The housing 20 is interiorly recessed to provide an annular shoulder 26. A disc-guide 27 has an annular flange 28 which is press-fitted into the housing so that the inner edge of said flange cooperates with the shoulder 26 to form an annular groove 29. The firing pin 25 is slidably supported in a central opening provided in the disc-guide 27. A housing cover 30 is secured to the housing in any suitable manner this cover being cup-shaped and provided with corrugations or stepped annular portions 31 to strengthen it so that predetermined loads are required to crush it for the purpose of moving the firing pin 25 toward the primer charge 22. A platform disc 32 is secured to said cover.

The snap-action mechanism designed to thrust the firing pin end 24 into sudden contact with the primer charge 22 to explode it, comprises a ring shaped, disc spring 40. A groved disc is secured to the firing pin 25. This disc comprises two disc members 41 and 42 the two engaging peripheral edges of which are recessed to provide an annular groove 43 substantially V shaped in cross section. The ring-shaped, disc-spring 40 is placed in this annular groove 43 at the time the members 41 and 42 are assembled on the firing pin. The outer peripheral edge of the disc-spring is placed against the shoulder 26 in housing 20 and then the guide member 27 is pressed into the housing. This hingedly secures the spring disc 40 in the annular groove 29 and thus the firing pin 25 is supported in axial alignment with the flared opening 23 leading to the primer charge 22.

The disc-spring 40 is made in the following manner. First a ring-disc as shown in Figs. 3 and 3A is cut or punched from a flat piece of spring sheet metal. This flat ring-disc is then pressed into frusto-conical formation as shown in Fig. 4.

If, as shown in Fig. 2, this frusto-conical spring is properly supported and then pressure is exerted thereon centrally so as to flex it from the full line or normally formed position into the dotted line or flexed position, this pressure must be maintained to move the disc until its normal plane marked A—A overrides or passes the central plane marked C—C at which time the over center action or force will cause the disc to move into the dotted line position with a snap action and a certain force. The exterior force to reverse the contour of the disc spring, from the full to the dotted line positions as shown in Fig. 2,

must be applied substantially through the field of movement between the planes marked A—A and slightly beyond that one marked C—C. When passing beyond the center C—C, the disc spring will flip into the dotted line position.

To return the disc spring to its normal, full line position, pressure must again be applied centrally of the disc. Now, as soon as the plane A'—A' reaches substantially the plane E, the disc-spring will flip into its normal or full line position. It will be noticed, and experiments have clearly proven, that the exterior flexing pressure or force need be applied only while plane A'—A' is moving to the plane E and that this field of exterior force application is substantially less than the field A—A to C—C as is necessary when moving the spring disc into the dotted line position as previously described. Thus instead of flipping after an overcenter position has been reached, the disc spring flips before the center has been reached when flexed toward normally formed position or full line position as regards Fig. 2. As the disc-spring is flipped into its full line or normally formed position it exerts a greater power thrust than when flipping from the plane C—C into its dotted line or flexed position.

When the flat ring disc as of Fig. 3 is pressed into its frusto-conical shape as of Fig. 4, the fibres thereof are made to flow into "set" positions in which they are substantially dormant, exerting no appreciable force in any direction. As soon as a formed disc-spring is flexed from said formed position (full line Fig. 2) toward its reverse shape (dotted line Fig. 2), these fibers are stressed. This stressing of the fibers continues until the disc-spring reaches its fully flexed position (dotted lines Fig. 2). Thus as the spring disc flips from its center plane position C—C into its fully flexed reverse position A'—A', it is exerting work to stress its fibers which are resisting such stressing and consequently the spring disc moves into its flexed position with a certain force. Now when the spring disc is urged toward its normally formed position, the latent forces of the flexed fibers become effective to assist in this movement of the spring disc inasmuch as it is the tendency of the fibers to return to their normal or unstressed positions. Thus the disc spring will flip before center is reached or approximately at the plane E, Fig. 2. During its return flipping, the stressed fibers of the spring disc in returning to their unstressed positions or conditions will cause the spring disc to assume its normal position with a greater force than the force at which it moves into its flexed position (dotted lines Fig. 2).

This is of particular advantage especially in installations as shown, for the primer charge to be exploded must be struck with a powerful, sharp blow. Disc springs acting from flexed into normally formed positions provide longer and more powerful flipper movement than springs acting from manually formed position into the flexed position.

In the present installation the cover is constructed to withstand a load of from 350–401 pounds or any other desirable weight before being crushed. As soon as a crushing load is applied to the platform **22**, the cover, in crushing, will move the firing pin **25** toward the primer charge **22**. In so doing, the disc spring **40** is moved from its flexed position toward the normally formed position. Before reaching its center plane the disc spring **40** will flip, thrusting the pointed end **24** of the firing pin through the flared opening **23** and into engagement with the primer charge with a sudden, powerful thrust, thereby exploding it.

The disc-spring **40** is reversed, that is, it is moved from its normal pressed shape into its reversed, flexed shape after it is assembled upon the firing pin. The machine or fixture for flexing the disc springs, also measures the force required to flex the disc spring so that with this operation inspection is obtained by which the springs finally used may be held within consistent limits and uniformity is thus attained.

Overcenter disc springs for moving members with a snap action are well known but in no instance has the knowledge of taking advantage of the stressed fibers in a disc flexed from normally formed into reverse shape to obtain increased striking power and lengthened stroke been disclosed.

While the embodiment of the present invention as herein disclosed, constitutes a preferred form, it is to be understood that other forms might be adopted, all coming within the scope of the claims which follow.

What is claimed is as follows:

1. In combination with a member to be actuated out of normal rest position into its active position with a forcible, snap action; of means for engaging and moving said member out of its normal toward its active position, said means comprising, a resilient element secured to said member and capable of being flexed out of its normal, inert formation into another shape in which static energy is stored therein, said element when flexed into said other shape, holding the member in its normal rest position and being effective to move said member into its active position when said resilient element is actuated to assume its normally inert formation.

2. In combination with a member to be actuated out of normal rest position into its active position with a forcible, snap action; of means for engaging and moving said member out of its normal toward its active position, said means comprising, a frusto-conically shaped, resilient annular spring having one peripheral edge axially immovable, the other, axially movable edge being attached to said member, said spring being fully flexed out of its normally stable formation into another shape and thereby storing energy therein and in which it holds the said member in its normal rest position, said spring being effective to move said member into its active position when said spring is actuated to assume its normal stable formation.

3. In combination with a member to be actuated out of normal rest position into its active position with a forcible, snap action; of means for engaging and moving said member out of its normal toward its active position, said means comprising, a resilient element attached to said member and capable of being flexed out of its normal, inert formation into a shape in which it is statically loaded and holds the said member in its normal rest position, said element when moved a predetermined distance out of its statically loaded position, moving said member into its active position with a forcible snap action.

OLAF RASMUSSEN.
RICHARD C. RIKE.