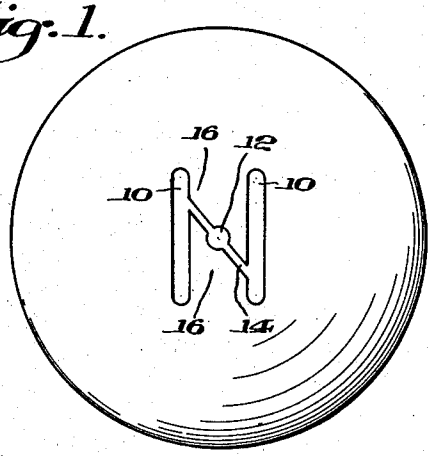
March 1, 1955 T. T. RYDE 2,703,231

SNAP ACTION DEVICE

Filed April 5, 1951

Fig. 1.



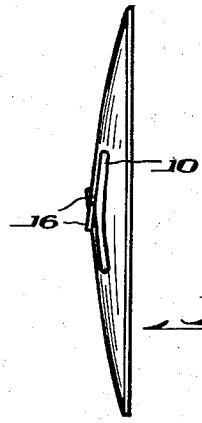
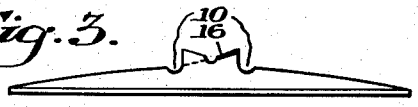


Fig. 2.

Fig. 3.



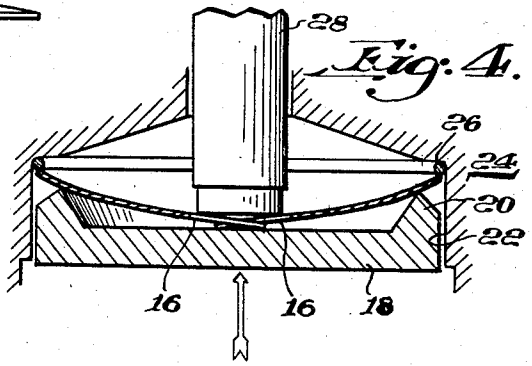


Fig. 4.

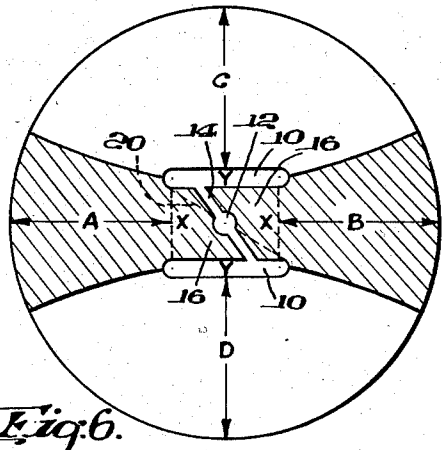


Fig. 6.

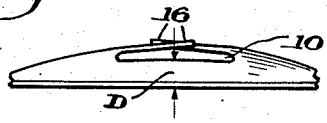


Fig. 7.

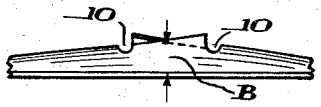


Fig. 8.

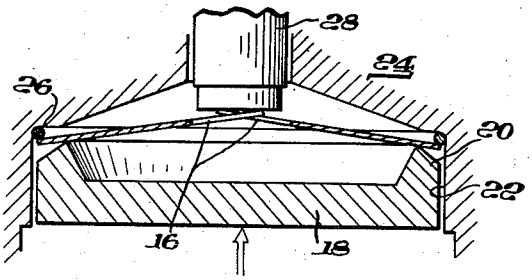


Fig. 5.

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SNAP-ACTION DEVICE

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Application April 5, 1951, Serial No. 219,489

4 Claims. (Cl. 267—1)

This invention relates to snap-action devices and more particularly to clicker disks such as are used for operating valves or switches with snap-action.

An object of the present invention is to obtain a larger movement of lift without increasing the proportions of the disk.

Another object of the invention is to increase the force exerted by the disk to obtain more efficient clicker action and ability to operate against greater pressures.

Another object of the invention is to reduce stress concentration in the disk and distribute the forces over a wide area for increasing the safety factor.

Another object of the invention is to reduce the temperature differential in thermostatic devices utilizing the improved clicker disk as an operating element.

Another object of the invention is to render the processing of the disks more uniform and reduce scrap losses and resulting cost of manufacture.

Another object of the invention is to eliminate the expense of the range measurement operation customarily employed in production of clicker disks.

With these and other objects and advantages in view, the invention takes the form of a substantially circular disk of thin sheet material, such as spring steel, having a spherically curved surface. The disk is provided with a pair of substantially parallel slots each of uniform width and having a length of approximately one-third the diameter of the disk. This length can be varied if desired, depending on the material used to form the disk. These parallel slots are positioned one on either side of the center of the disk with the outer walls of each slot being chordal to the periphery of the disk for concentrating the snap and return forces within oppositely disposed ring sectors. The aforesaid slots are connected by a transverse slot extending through the disk center at an angle of approximately 30 to 45 degrees relative to the first named slots. The transverse slot defines a pair of oppositely disposed spring arms at the inner ends of the ring sectors respectively and each extending in a plane tangential to the spherically curved surface.

In the drawings,

Fig. 1 is a plan view of the improved clicker disk,

Fig. 2 is a side elevation thereof,

Fig. 3 is a front elevation thereof,

Fig. 4 is a schematic view partly in section showing the disk in one position of operation,

Fig. 5 is a view similar to Fig. 4 showing the disk in another position of operation,

Fig. 6 is a schematic plan view illustrating the forces employed in the operation of the disk,

Fig. 7 is a front elevation corresponding to Fig. 6, and

Fig. 8 is a side elevation corresponding to Fig. 6.

Referring more particularly to the drawings, the clicker disk is substantially circular and formed of thin sheet material having suitable spring characteristics, such as stainless steel. The disk is formed with a slightly curved surface by the use of dies of uniform spherical radius to produce the desired concavo-convex form customary in these devices.

In this embodiment, however, the center portion of the disk is provided with a pair of substantially parallel slots **10, 10** each being of uniform width and having a length approximately one-third the diameter of the disk. It should be particularly noted that the outer walls of each slot **10** are chordal to the periphery of the disk for reasons which will be apparent hereinafter. An axial aperture **12** is provided in the disk, although this aperture **12** is not essential. The parallel slots **10, 10** are connected by a transverse slot **14** which is preferably of less width than the parallel slots **10, 10** and extends through the aperture **12** in angular relation to the parallel slots **10, 10**. Preferably, an acute angle is employed in forming the transverse slot **14** and, specifically, an angle of approximately 45 degrees relative to the parallel slots **10, 10**. As will hereinafter be apparent, this angular relation between the transverse slot **14** and the parallel slots **10, 10** may be varied if desired.

In the clicker disk so constructed a pair of oppositely disposed spring arms **16, 16** are defined by the transverse slot **14** having their inner ends at a 45 degree angle relative to the parallel slots **10, 10** and being capable of moving independently of each other. In the normal or unoperated condition of the disk, the arms **16, 16** extend in a plane tangential to the spherically curved surface of the disk as shown more clearly in Fig. 2.

Referring now more particularly to Figs. 6 to 8 inclusive it will be apparent that unequal radii are produced in portions of the disk due to the position of the parallel slots **10, 10**. This condition is indicated on the drawing by the unequal dish heights of the points *xx*, on radii A and B compared to points Y, Y on radii C and D. The distance of the points *x, x* and Y, Y from the clicker periphery are substantially equal. Thus, measurements of the dish height at D (Fig. 7) and at B (Fig. 8) indicate that B may be approximately equal to 2D. The sectors of greater dish height, e. g. on radii AB, are indicated on Fig. 6 by shadow lines. Hence, it will be observed that a pair of oppositely disposed ring sectors are formed about the radii AB and that the oppositely disposed spring arms **16, 16** are positioned at the inner ends of the sectors so formed.

Referring now to Figs. 4 and 5, the disk is shown as positioned on a thrust element **18** having the usual annular knife edge **20** which contacts the disk adjacent its periphery. The thrust element **18** is adapted for reciprocation in a recess **22** formed in this instance in a valve body portion **24**. Positioned at the bottom of the recess is a ring member **26** which engages the clicker disk adjacent its periphery on the opposite side to the knife edge **20**. A valve stem **28** is positioned for reciprocation in the valve body **24** and has its inner end seated upon the spring arms **16, 16** of the clicker disk.

Since the spring arms **16, 16** are formed tangential to the spherical contour of the clicker disk it is apparent that the valve stem **28** resting on these arms will occur a lower position in the assembly then would be the case when using arms of spherical contour. In the reverse or snap-over-center position shown in Fig. 5, the valve stem **28** is supported by the extreme ends of the spring arms **16, 16**. Since these extreme ends of the spring arms **16, 16** are beyond the approximate center of the clicker due to the 45 degree angular arrangement previously described it is evident that the distance the valve stem **28** is lifted is correspondingly increased. If the length of the spring arms **16, 16** is increased by changing the angle of the diagonal slot **14**, then the angular movement of the arms will be increased, but the output force will be decreased. This decrease in output force could be compensated for by increasing the thickness of the clicker disk, the depth of the disk or decreasing the length of the parallel slots **10, 10** should it be desirable to utilize the full capabilities of the increased angular movement. As indicated on Fig. 6 by the broken line **20** extending diagonally between the extreme ends of the parallel slots **10, 10** the angular relation could be approximately 30 degrees instead of the less acute angle of the preferred form.

The increase in energy during the snap-over movement of the disk will be apparent from the description of Figs. 6 to 8 inclusive previously given. Thus, as pressure is applied to the thrust element **18** in the direction indicated by the arrow in Fig. 4, then the sectors on CD of less dish height having less distance to travel than the sectors on AB of greater dish height will snap-over-center prior to the latter. The stored energy in the sectors shown shaded in Fig. 6 on the radii A and B approaching the snap-over-center point is thus increased and, as the

thrust element **18** is advanced to the snap-over-center point, this energy is released, causing a large deflection of the spring arms **16, 16**. It should be understood that the snap-over-center of the clicker disks sections on radii A, B, C and D occurs at practically the same time instant and does not produce a discernable intermittent movement of the spring arms **16, 16**.

The invention removes tension compression stresses from the center of the clicker during operation and the available force exerted by the clicker movable arms is greatly increased resulting in more efficient clicker action and the ability to work against greater gas or valve spring pressures. Moreover, the reduction of stress concentration at the clicker center serves to distribute the involved forces over a greater area and the clicker safety factor is consequently increased. The novel clicker disk can be used with amplifying devices if so desired as is well-known to workers in the art.

Various changes and modifications may be made in the details of construction and arrangement of parts without departure from the scope of the invention as defined in the appended claims.

I claim:

1. A snap action device comprising a substantially circular disk having a spherically curved surface, said disk having a pair of substantially parallel slots positioned one on either side of the center thereof, the outer walls of each slot being chordal to the periphery of said disk for concentrating snap and return forces within oppositely disposed ring sectors, said slots being connected by a transverse slot extending through the center and angular relative to the first named slots.

2. A snap action device comprising a substantially circular disk having a spherically curved surface, said disk having a pair of substantially parallel slots positioned one on either side of the center thereof, the outer walls of each slot being chordal to the periphery of said disk for concentrating snap and return forces within oppositely disposed ring sectors, said slots being connected by a transverse slot extending through the center and at an acute angle relative to the first named slots.

3. A snap action device as claimed in claim 2 wherein said acute angle is from approximately thirty to forty-five degrees.

4. A snap action device comprising a substantially circular disk of thin sheet material having a spherically curved surface, said disk having a pair of substantially parallel slots each of uniform width and a length approximately one-third of the diameter of said disk positioned one on either side of the center thereof, the outer walls of each slot being chordal to the periphery of said disk for concentrating snap and return forces within oppositely disposed ring sectors, said slots being connected by a transverse slot extending through the center at an angle of approximately forty-five degrees relative to the first named slots, said transverse slot defining a pair of oppositely disposed spring arms at the inner ends of said ring sectors respectively and each extending in a plane tangential to said spherically curved surface.

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