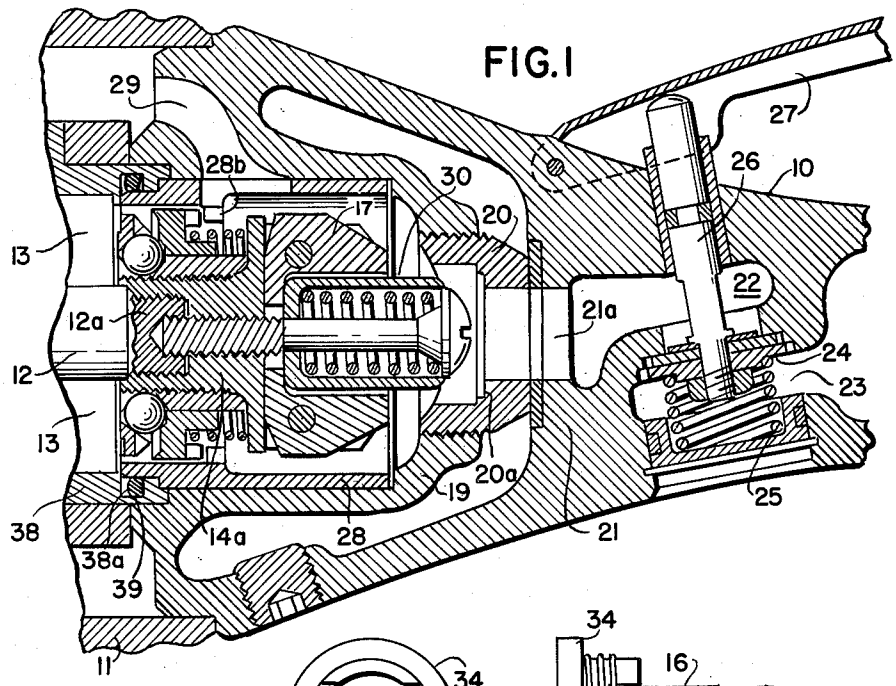
April 4, 1961 D. E. SCHOTT 2,977,931

OVERSPEED SAFETY DEVICES

Filed Aug. 18, 1960

FIG. 1



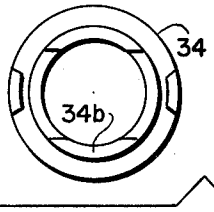


FIG. 2

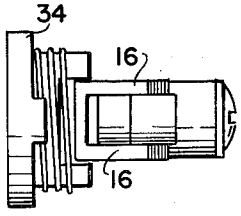
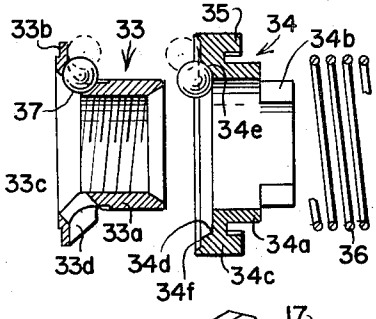


FIG. 3



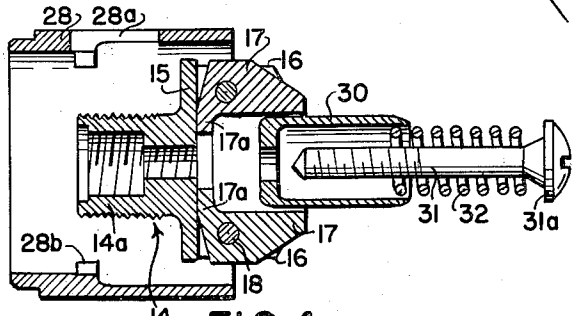


FIG. 4

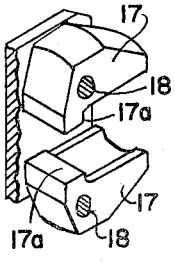


FIG. 5

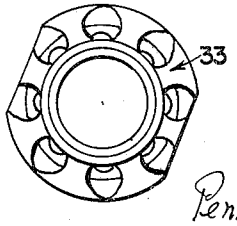


FIG. 6

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OVERSPEED SAFETY DEVICES

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6 Claims. (Cl. 121—33)

This invention relates to safety devices and is concerned more particularly with a safety device for use with a pneumatic motor to keep it from operating at excessive speeds. The new device is simple and inexpensive and, since it functions only when the rated motor speed is exceeded, it is subject to little wear. The device is reliable in operation and it is so made that, once it has operated, the motor cannot be restarted except after the device has been reset. As a result, the device is effective at all times and its purpose cannot be defeated by carelessness on the part of the operator. While the new device may be employed with pneumatic motors for various purposes, all its advantages are realized in its use in pneumatically driven hand-held grinders and an embodiment of the invention for that application will accordingly be illustrated and described in detail for purposes of explanation.

Grinders of the hand-held type, which include a grinding wheel rotated by an air motor, are commonly provided with a governor operating as a selected speed is approached to reduce the air supply. While such governors, when in good operating condition, serve their intended purpose, they sometimes become ineffective either because they are out of adjustment or because they have become jammed by dirt carried in by the compressed air being supplied to the motor. The disabling of such a governor is likely to result in the development of excessive motor speed with possible bursting of the grinding wheel and injury to property or personnel.

The overspeed safety device of the invention functions at speeds in excess of the rated speed of the motor and thus operates only when the governor is ineffective. The device comprises a retainer mounted to rotate with the motor shaft and having seats for a plurality of balls and radial guideways leading outwardly from the seats. A shut-off jaw also rotates with the shaft and is urged against the balls by a spring to hold the balls in their seats. A shut-off sleeve is mounted in the housing for the governor and is provided with a port normally registering with an opening in the housing wall, through which air passes to the motor. As long as the motor does not exceed its rated speed, the balls remain in their seats but, if excessive motor speed develops, the balls are moved outwardly along the guideways by centrifugal force and such movement forces the shut-off jaw away from the retainer and into engagement with the shut-off sleeve. As a result, the sleeve is caused to rotate with the jaw and the rotation of the sleeve cuts off the air supply to the motor except during the short periods when the port in the sleeve is passing across the opening in the housing wall. The cutting off of the air supply stops the motor and it cannot be started again until the balls have been restored to their seats and the jaw and the sleeve have been returned to their initial positions with the port in the sleeve registering with the port in the housing wall.

For a better understanding of the invention, reference may be made to the accompanying drawing, in which

Fig. 1 is a view of the longitudinal cross-sectional view through a portion of a pneumatic grinder provided with a governor and the safety device of the invention;

Fig. 2 is a view in end elevation of the shut-off jaw of the device;

Fig. 3 is a view in side elevation showing the jaw mounted on the body of the governor;

Fig. 4 is an exploded longitudinal sectional view of the safety device and governor;

Fig. 5 is a view in perspective showing the pivoted weights of the governor; and

Fig. 6 is an end view of the retainer.

The pneumatic hand-held grinder, of which part is illustrated in Fig. 1, comprises a handle **10** secured by bolts to a casing **11** enclosing the pneumatic motor, which has a shaft **12** mounted for rotation in a ball bearing indicated diagrammatically at **13**. The shaft has an end section **12***a* of reduced diameter and the hub **14***a* of the body **14** of a governor is threaded on the section. The body has a diametrical flange **15** at the end of the hub remote from the motor shaft and a pair of wings **16** project from the flange on opposite sides of and parallel to the axis of the motor shaft. A pair of weights **17** are pivotally mounted on respective pins **18** having their ends in openings in the wings and each weight has an ear **17***a* extending radially and lying adjacent to the flange **15**.

The handle **10** contains an internal partition **19** forming a chamber serving as a housing for the governor and a bushing **20** is threaded in an opening in the housing wall concentric with the motor shaft and is formed with an internal seat **20***a*. The outer end of the bushing lies close to a part of the handle **10** which defines an opening **21***a* leading from a chamber **22** in the handle to the passage through the bushing. Air is supplied to the chamber **22** through a passage **23** in the handle containing a valve which has a valve member **24** normally held by a spring **25** against a seat surrounding the passage to prevent the flow of air therethrough. A stem **26** attached to the valve member extends through the chamber **22** and a passage in the handle **10** and is movable against the resistance of the spring **25** to open the valve by a hand lever **27** pivoted on the handle.

The air from chamber **22** passes through the bushing **20** and enters the interior of a cut-off sleeve **28** of tubular form which is mounted with a snug fit against the inner surface of the housing defined by the partition **19**. The sleeve has a port **28***a* through its cylindrical wall and, when the sleeve is in proper angular position, the port registers with a passage **29** leading through the wall of the housing to the interior of the motor casing **11**. The sleeve is also provided with a pair of diametrically disposed internal lugs **28***b*.

The flow of air from the chamber **22** through the bushing **20**, the sleeve **28**, and the passage **29** is controlled by the action of the governor. For this purpose, the governor is provided with a cylindrical valve member **30** having a closed end with a central opening, through which a bolt **31** loosely extends. The bolt is threaded into the body **14** of the governor and into the end of the motor shaft and its head **31***a* is of a diameter slightly less than the internally diameter of the valve member **30**. A spring **32** encircling the bolt bears at one end against the under side of the head and, at the other, against the end of the valve member **30**.

In the operation of the device, the governor body rotates with the motor shaft and, as the motor speed increases, the weights **17** are swung by centrifugal force, so that their ears **17***a* engage the end of the valve member **30** and move the member toward the seat **20***a* encircling the opening through bushing **20**. As the valve member approaches the seat, the cross-sectional area of

the passage for air through the bushing is reduced and the motor speed is correspondingly reduced.

The overspeed device of the invention includes the shut-off sleeve 28, a retainer 33, and a shut-off jaw 34. The retainer includes a sleeve 33*a* threaded on the hub 14*a* of the body of the governor and lying at the side of the flange 15 facing the end of the motor shaft. The retainer also includes a radial flange 33*b* at its inner end and a plurality of seats for balls are provided by openings 33*c* partly in the sleeve 33*a* and partly in the flange 33*b*. A radial guideway 33*d* extends outwardly from each seat.

The cut-off jaw 34 includes a ring 34*a* which encloses and is slidable on the sleeve 33*a* of the retainer, and a pair of arcuate extensions 34*b* from one end of the ring, which are spaced sufficiently to receive the flange 15 of the governor body between them. At its opposite end, the ring is formed with flange 34*c*, the outer face of which is formed with an annular radial seat 34*d* connected by a conical surface 34*e* to an annular radial surface 34*f*. A pair of lugs 35 are formed on the flange and extend parallel to the axis of the ring 34*a*.

A spring 36 encircles the ring 34*a* of the shut-off jaw and bears at one end against the flange 34*c* and, at the other, against the flange 15 on the governor body. The spring urges the shut-off jaw toward the flange 33*b* of the retainer so that balls 37 lying in the seats 33*c* of the retainer are held in their seats by contact with the annular seat 34*d* and the conical surface 34*e* on the shut-off jaw.

The housing 38 in the motor casing for the ball bearing 13 has an end section overlying the adjacent end of the shut-off sleeve 28 and the end section is formed with an internal annular channel 38*a*. A rubber O-ring 39 is mounted in the channel to bear against the surface of the sleeve 28 and normally holds the sleeve against rotation.

During normal operation of the grinder equipped with the safety device, the balls 37 of the device lie in their seats 33*c* in the retainer 33 and the annular seat 34*d* and the conical surface 34*e* on the shut-off jaw 34 are held in contact with the balls by the spring 36. The shut-off sleeve 28 is initially adjusted with its port 28*a* in register with the air passage 29 and the sleeve is held in this position by the O-ring. When the motor is operating, the retainer rotates with the governor body and, although the shut-off jaw is mounted loosely on the retainer sleeve, the jaw also rotates with the governor body because its extensions 34*b* lie on opposite sides of the flange 15 on the governor body. The shut-off sleeve is at rest. If the rated motor speed is exceeded, centrifugal force moves the balls out of their seats and they roll outwardly in their guideways and on the radial surface 34*f* on the shut-off sleeve. In such outward movement, the balls cause the jaw to move along the sleeve section 33*a* of the retainer until the lugs 35 on the jaw engage the lugs 28*b* on the shut-off sleeve. The sleeve then rotates with the jaw and, in such rotation, the port 28*a* on the sleeve registers with the air passage 29 only for a brief period during each rotation of the sleeve with the result that the air supplied to the motor is so greatly reduced that the motor stops.

When the motor comes to rest, the balls remain in their outward positions, since they lie between opposed radial surfaces 33*b* and 34*e* on the retainer and shut-off jaw, respectively, and there is no force tending to move them inwardly toward their seats. The resetting of the device, accordingly, requires that the balls be returned to their seats and that the shut-off sleeve be adjusted to place its port in registry with the air passage 29. In order to reset the device, the handle 10 of the grinder is detached from the motor housing and, as the handle is removed, it takes the shut-off sleeve with it. The governor is then exposed, so that it can be restored to proper operating condition, and the balls of the safety device can also be reseated. Finally, the shut-off sleeve is adjusted angularly to proper position and, when the handle 10 is again attached to the motor housing 11, the grinder is ready for further operation.

I claim:

1. An overspeed safety device for use with an air motor having a housing with openings for inlet and outlet of air, a valve member within the housing for controlling the flow of air through the housing, a motor shaft entering the housing, and a governor driven by the shaft and operating the valve member, the governor having a body with a hub encircling and fast on the shaft, which comprises a retainer mounted to rotate with the shaft and having circumferentially spaced ball seats and guideways with radial surfaces leading from the seats, balls in respective seats, a shut-off jaw mounted for rotation with and movement axially relative to the shaft and having an annular seat opposed to the retainer seats and a radial surface opposed to the guideways, means urging the jaw toward the radial surfaces of the guideways and against the balls, means operable on rotation to reduce the flow of air through the housing, and co-operating parts on the jaw and reducing means for connecting them for rotation in unison upon movement of the jaw axially of the shaft away from the radial surfaces of the guideways.

2. The device of claim 1, in which the reducing means is a sleeve mounted in the housing against the inner surface thereof for rotation about the axis of the shaft and having a port registering with one of the housing openings in one angular position of the sleeve.

3. The device of claim 1, in which the retainer is mounted to encircle the governor body hub and is fast thereon.

4. The device of claim 3, in which the shut-off jaw is mounted to encircle the governor body hub and is movable endwise thereon and connected to the governor body for rotation therewith.

5. The device of claim 4, in which the reducing means is a sleeve mounted in the housing against the inner surface thereof for rotation about the axis of the shaft and having a port registering with one of the housing openings in one angular position of the sleeve, the sleeve at least partially enclosing the jaw.

6. The device of claim 5, in which the sleeve has internal lugs and the jaw has lugs engageable with the sleeve lugs for connecting the sleeve and jaw for rotation in unison.

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