Aug. 9, 1949. A. V. MASKET ET AL 2,478,663

PROJECTILE TESTING MACHINE

Filed March 29, 1946 2 Sheets-Sheet 1

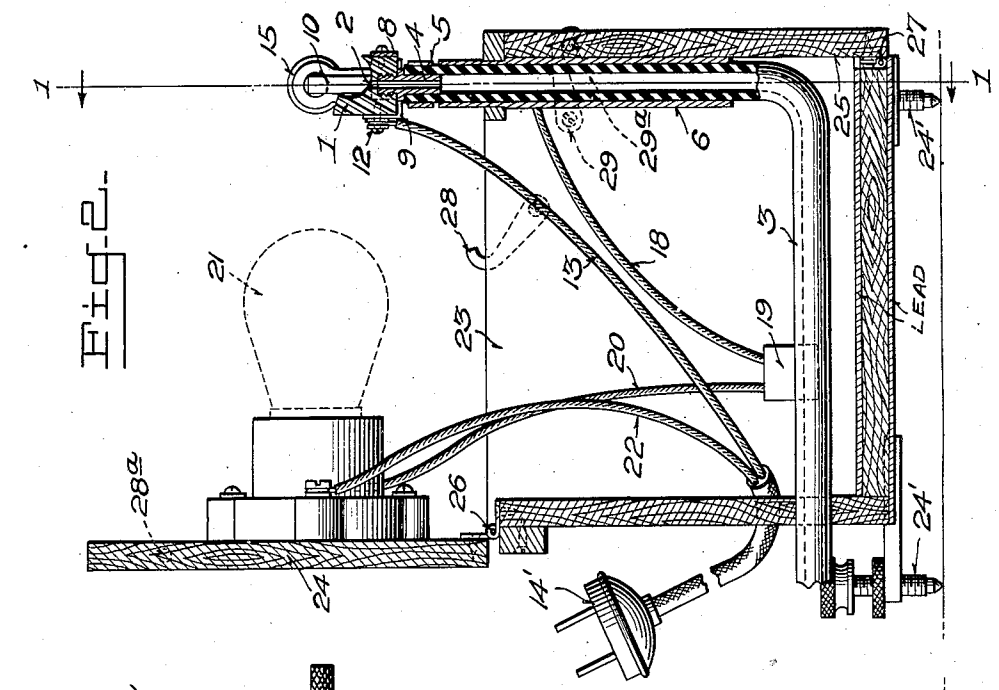

Fig. 2.

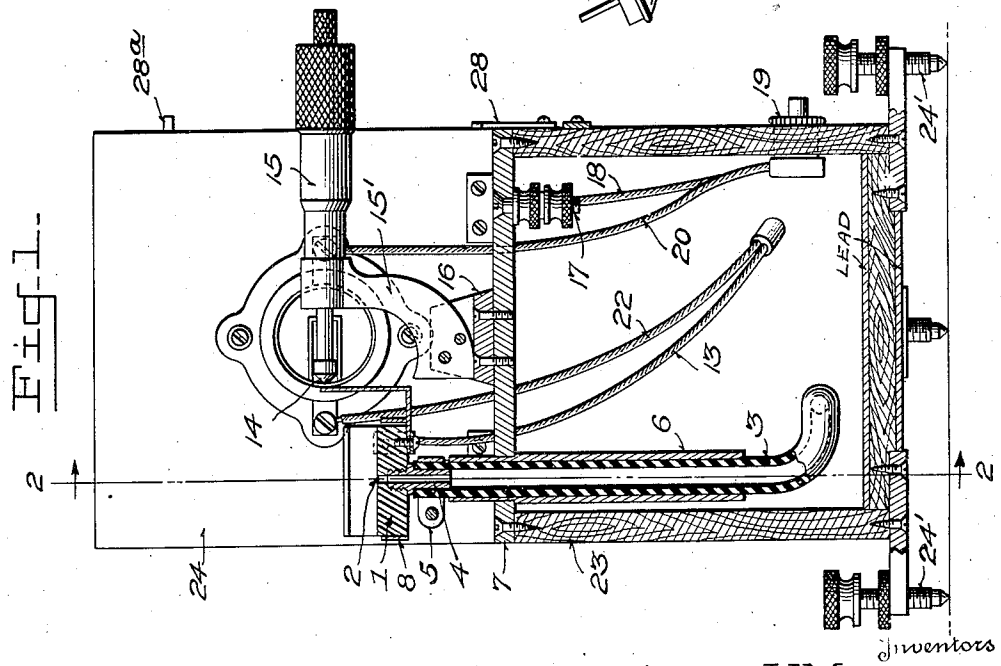

Fig. 1.

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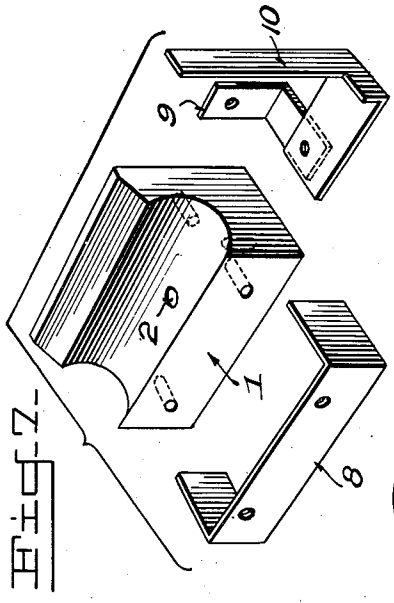

Fig. 7.

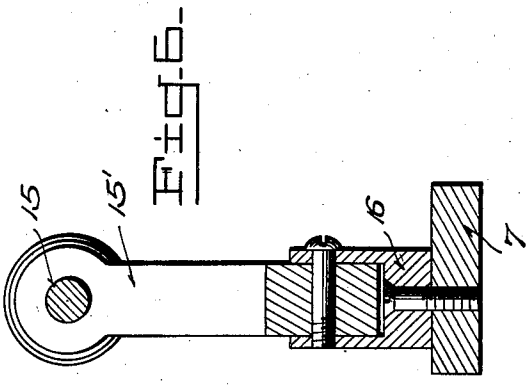

Fig. 6.

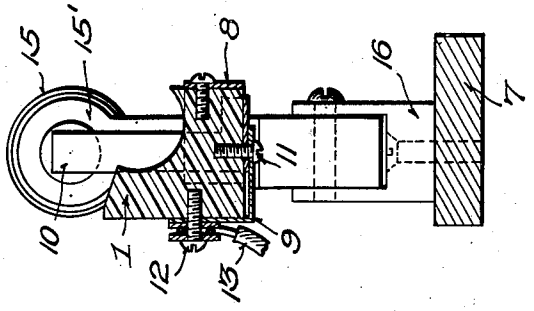

Fig. 5.

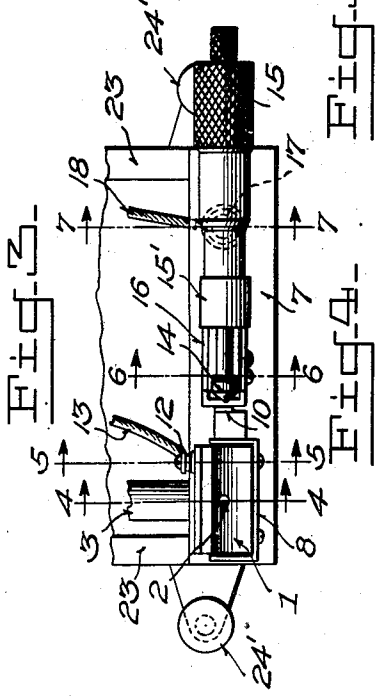

Fig. 3.

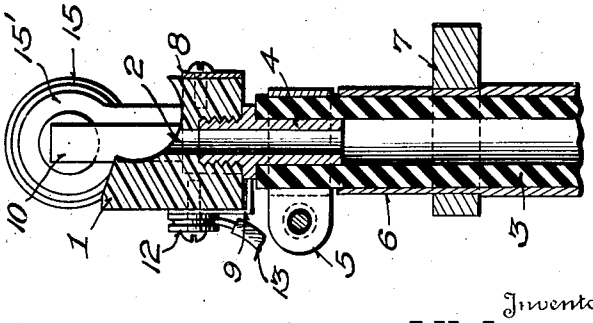

Fig. 4.

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UNITED STATES PATENT OFFICE

2,478,663

PROJECTILE TESTING MACHINE

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Application March 29, 1946, Serial No. 658,304

4 Claims. (Cl. 73—66)

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This invention relates to a pneumatic device for spinning at high velocities objects such as bullets and artillery shells in order to test their stability. The objects are rotated on an axis of symmetry, free of any direct mechanical connection or thrust, by the action of an air jet.

An object of this invention is to provide means for spinning at high speed on its geometric axis, a bullet or an artillery shell, in order to test its degree of dynamic unbalance.

A further object is to provide means for automatically indicating an unsatisfactory degree of unbalance of the spun object, so as to provide means enabling routine inspection of same. Another object is to spin at high speed on their geometric axis, ballistic objects such as artillery shell fuzes so as to permit study or routine inspection of the action of the arming pin at high speed. Further purposes will become evident from the following descriptions and claims.

The present best use of our invention appears to be in the selection of high grade bullets for small arms ammunition, the selection being made on the basis of dynamical asymmetry about the geometric axis. A bullet which is dynamically asymmetrical about its geometric axis is unbalanced so that its axis of spin in flight is not coincident with its geometric axis. There is ample evidence that the "spread" of a pattern of bullets fired at a target can be correlated with the amount of dynamic unbalance of the individual bullets.

It is therefore important when special accuracy of fire is required that the bullets used be in substantial dynamic balance.

In the drawings:

Figure 1 is a front elevation in partial section on line 1—1 of Figure 2 of a preferred embodiment of our invention,

Figure 2 is a sectional view on line 2—2 of the device shown in Figure 1,

Figure 3 is a plan view of the stator and associated contact making means of Figure 1,

Figure 4 is a sectional view taken on line 4—4 of Figure 3,

Figure 5 is a sectional view taken on line 5—5 of Figure 3,

Figure 6 is a sectional view taken on line 6—6 of Figure 3,

Figure 7 is a disassembled perspective view of the stator showing the stator retainer and contact strips.

Essentially our invention consists of a horizontal stator or trough dimensioned to receive the bullet or other object to be tested, and perforated in a plane normal to its axis to provide an eccentrically disposed jet through which a stream of air or other gas under pressure strikes eccentrically against a bullet placed in the trough. The rapid streaming of air around the bullet provides torque to spin the bullet, and also generates sufficient Bernoulli force to keep the bullet in place due to the stabilizing effect of zones of diminished pressure resulting from the high velocity of the contracted stream of escaping gas, both in the circumferential and in the axial directions. The stator is flexibly mounted to permit vibration thereof, which will be imparted to it by either static or dynamic unbalance of the bullet. If vibration of the stator exceeds a predetermined amount, the bullet is rejected as unsatisfactory. In the embodiment shown, for routine inspection purposes a contact between a member fixed to the stator and an adjustable stationary member is used to close a signal circuit to indicate that the bullet being tested is unsatisfactory.

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Referring to the figures, the stator 1, preferably of light plastic or similar material, is drilled at 2 to provide an eccentrically disposed jet, and is flexibly mounted on an air hose 3 which furnishes air under pressure to jet 2 through air hose extension 4, which is firmly fastened to the air house by clamp 5. Air hose 3 is made of rubber or any suitable material of similar characteristics and is firmly held by a rigid tube 6 which passes through a hole in metal support plate 7 to position the stator. A certain amount of stator vibration is thus permitted due to flexibility of air hose 3.

Stator retainer 8, best seen in Figure 7 is fastened to the stator 1 by any suitable means such as screws. This retainer serves to reinforce the stator 1. Contact connecting strip 9 and contact strip 10 are fastened to stator 1 by screw 11. Contact connecting strip 9 is provided with a binding post 12 for connection of lead 13 from the signalling circuit. This circuit leads from plug 14', which may be connected to any suitable source of electricity, through lead 13, connecting strip 9 and contact 10, which upon sufficient vibration of stator 1 will make at least intermittent contact with contact point 14.

An inexpensive micrometer 15 may be cut down to provide an adjustable contact point 14, thereby permitting fine gradation in adjustment to be made, or a fine contact point adjustment may be provided by any other known means. In the embodiment shown we use a micrometer suit-

ably cut down and screwed to a mount 16 which is in turn fastened to support plate 7 (Figure 6).

The signal circuit continues from contact point 14, through the micrometer and mount 16 and plate 7 to binding post 17, through lead 18 to switch 19 thence through lead 20 to signal lamp 21 and through lead 22 back to plug 14.

The entire assembly is mounted in a housing 23 provided with adjusting legs 24' to permit leveling of stator 1. Two lead plates are shown one on either side of the bottom of box 23, to add stability and to aid in absorbing vibrations.

The side 24 containing the signal lamp and the side 25 containing the stator and contacts are hinged at 26 and 27 respectively to facilitate accessibility. Hooks 28 and 29 cooperating with brads 28a and 29a respectively are shown for keeping the respective hinged sides closed, although it is obvious that any other suitable fastening means may be used.

It will be apparent that the contact means are provided for convenience in routine inspection and that visual observation of the vibration of the stator will provide useful information regarding the stability of the bullet. Also, stroboscopic inspection of the bullet by known means can be utilized to provide detailed information regarding the angular position of unbalance of the bullet.

We claim:

1. A spinning device for testing dynamic balance comprising; a stator having a curved inner surface comprising a horizontally disposed trough dimensioned to receive an object to be tested, there being a jet orifice in the stator eccentrically disposed relative to the axis of curvature of said stator surface and communicating with the curved inner surface, means for supplying gas under pressure to said jet orifice and flexible support means for said stator.

2. A spinning device for testing dynamic balance comprising; a stator having a curved inner surface dimensioned to receive an object to be tested and forming a horizontally disposed trough of which one horizontal edge is higher than the other horizontal edge, there being a jet orifice in the stator eccentrically disposed toward the said higher edge in a plane normal to the axis of curvature of said stator surface and communicating with the curved inner surface, flexible supporting means for said stator, and means for supplying gas under pressure to said jet orifice without interfering with the flexing action of said flexible supporting means.

3. The invention as recited in claim 2 and comprising a first electrical contact rigidly attached to said stator, a second contact normally spaced from said first contact but arranged to be contacted by said first contact upon a predetermined degree of vibration of said stator, an electric circuit including a signal lamp and said contacts, said circuit being so arranged as to be closed upon the touching of said contacts, whereby a predetermined degree of vibration of said stator may be indicated by the closing of the signal lamp circuit.

4. A spinning device for testing dynamic balance comprising; a horizontal stator having a curved inner surface dimensioned to receive an object to be tested, there being a jet orifice in the stator eccentrically disposed relative to the axis of curvature of said stator surface in a plane normal to said axis and communicating with the curved inner surface, means for supplying gas under pressure to said jet orifice, flexible support means for said stator, an electrical circuit including a signalling device, normally fixed contact means and movable contact means rigidly attached to said stator for cooperating with said fixed contact means whereby upon vibration of said stator beyond a predetermined point said circuit will be closed to said electrical signalling device, a housing for said spinning device, adjustable supporting means for said housing whereby said stator may be adjusted to a horizontal position, adjusting means for varying the distance between said normally fixed and said vibrating contacts, and a hinged cover for said housing, said signalling device being supported upon said hinged cover.

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