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MACHINE FOR TESTING BLASTING CAP SHELLS

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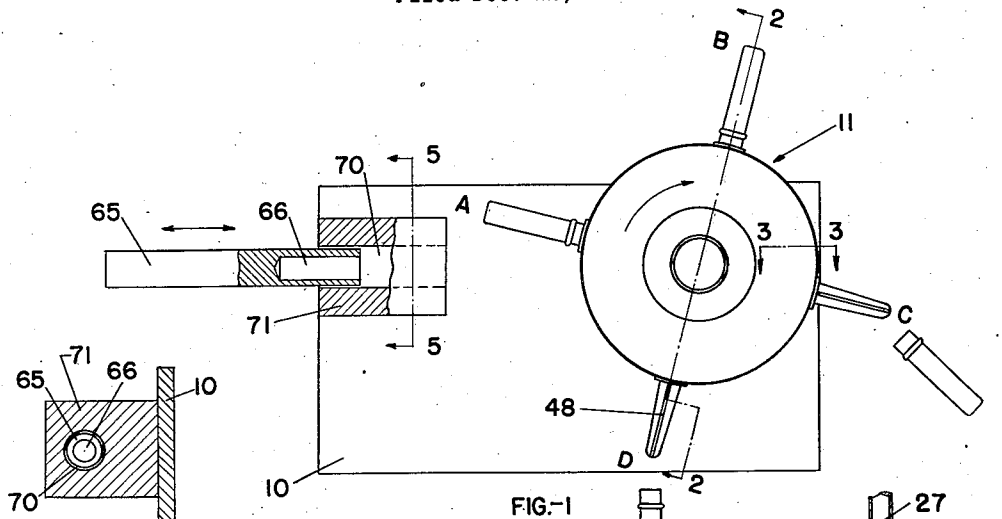


FIG-1

FIG-5

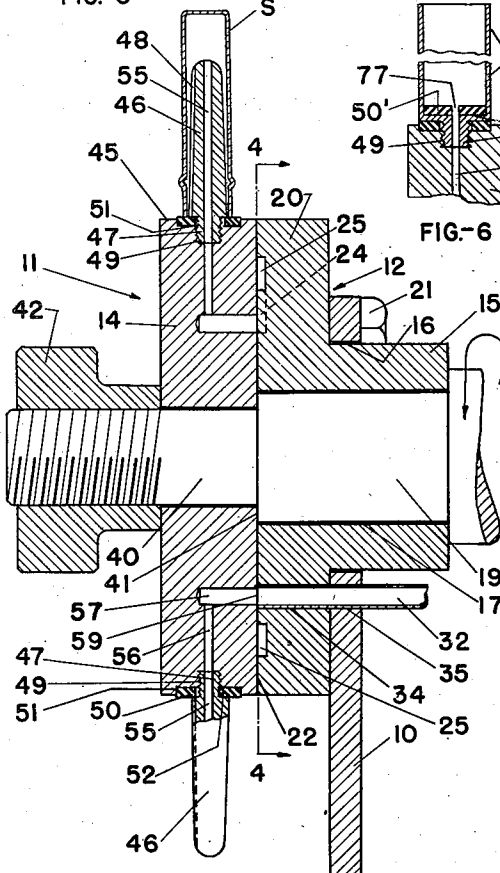


FIG-2

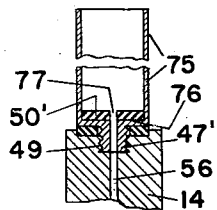


FIG-6

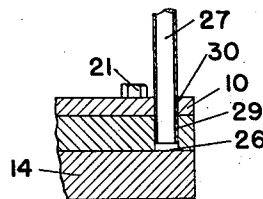


FIG-3

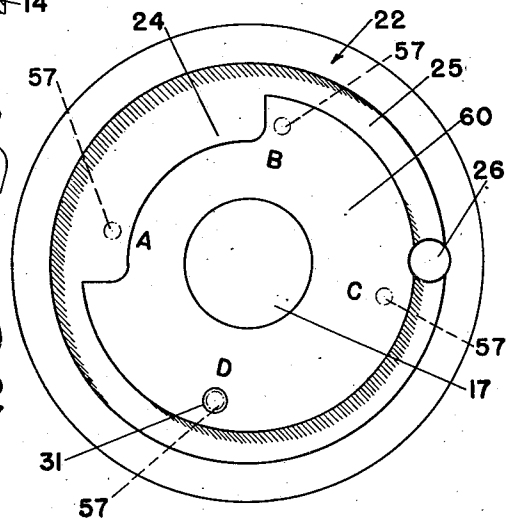


FIG-4

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MACHINE FOR TESTING BLASTING CAP SHELLS

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3 Claims. (Cl. 73—51)

This invention relates to testing machines, and more particularly to a machine for testing blasting cap shells and the like.

Blasting cap shells usually are between about .22 and .30 of an inch in diameter and between about 1½ and 6½ inches in length, and are constructed of a ductile metal, such as, copper, aluminum, or bronze, brass or other suitable alloys. These shells are formed by a succession of drawing operations which elongate the shell while maintaining a desired diameter. In the course of these operations, the metal is subjected to severe strains which may cause the metal to rupture at one or more points and form holes in the shell. Such holes are formed more particularly during the latter stages of the final drawing operation, when due to the elongation of the shell, the metal has become extremely thin.

If such holes are not detected, the weakened walls of such imperfect shells may buckle while pressing a charge of explosive therein which may cause an explosion damaging the press. This will necessitate interrupting the operation of the press until the resulting debris is cleared and the press has been repaired. If the shells having holes therein are filled, portions of the charge may be forced through the holes and be exposed. Friction caused by the rubbing of adjacent shells may set off the charge while the blasting caps are being shipped or stored.

A further and serious difficulty is that moisture may enter through the holes and render the charge in the cap insensitive. If the charge in a cap fails to explode, the cap and explosive in a bore hole may be recovered by washing or blowing them out with air or water, or another charge of explosive may be positioned and exploded in a bore hole adjacent the charge which has not been exploded by reason of failure of the cap. These operations are hazardous and frequently result in personal injury. Also, an explosive charge which has not been exploded due to the failure of the cap, may be scattered in the broken material produced by the explosion of adjacent charges. Thus when the muck is removed, the scattered explosive may be accidentally detonated, and cause injury. Another difficulty resulting from the failure of one or more caps to set off portions of the explosive is that the muck is not properly disintegrated or is of the wrong size. Also, objectional lumps or toes may remain which are difficult and costly to remove.

An object of the present invention is to over-

come the foregoing difficulties and disadvantages.

Another object is to provide a simple, inexpensive machine for testing blasting cap shells which is readily constructed of a minimum number of parts.

Another object is to provide a machine for testing shells which is rapid in operation and with which the amount of labor required to inspect shells is reduced to a minimum.

Another object is to provide a machine for testing shells which is highly accurate, reduces the labor cost of testing shells to a minimum, and is not subject to human error.

Another object is to provide a machine for testing shells which may be operated automatically or semi-automatically if desired.

Another object is to provide a machine which tests the shells, and automatically separates the imperfect and perfect shells.

Another object is to provide a shell testing machine which is readily adjusted to accommodate shells of different lengths and diameters.

Other and further objects will be obvious upon an understanding of the illustrative embodiment about to be described, or will be indicated in the appended claims, and various advantages not referred to herein will occur to one skilled in the art upon employment of the invention in practice.

In the accompanying drawing,

Fig. 1 is an elevational view, partly in section, illustrating an embodiment of the invention;

Fig. 2 is a sectional view, taken along line 2—2 on Fig. 1;

Fig. 3 is a sectional view, taken along the line 3—3 on Fig. 1;

Fig. 4 is an elevational view of a valve, as viewed substantially along line 4—4 on Fig. 2;

Fig. 5 is a sectional view, taken along the line 5—5 on Fig. 1; and

Fig. 6 is a sectional view of a modified shell testing and supporting device.

Described generally, the present machine comprises a supporting bracket, a rotatable member mounted on the bracket, and shell testing and supporting stations on the rotatable member. Suitable means are associated with each station which first apply a vacuum to the shells to hold them on the rotatable member and thereafter vent or supply air pressure for discharging the shells from the rotatable member. Suitable automatic feeding means may be utilized to feed the shells to the testing stations or the shells may be placed thereon manually. These stations

are adapted to support the shells on the rotatable member. A vacuum is then applied to hold the shells on the member and the vacuum is then shut off, but the vacuum created in a shell is adapted to be maintained if the shell does not have any holes therein. The rotatable member then is rotated to move the shells into a position whereby they project downwardly from the supporting stations, and if the shells have holes therein, they will fall by gravity from the member. The perfect shells are retained on the supporting stations which then are moved to another position where they are vented to release the vacuum or air pressure is applied to discharge the shells.

Referring again to the drawing, and more particularly to Figs. 1 to 5, there is shown an upright member or supporting bracket 10 for mounting a shell testing device 11 which comprises a stationary valve member 12 and a rotatable member 14 (Fig. 2) adapted to rotate in a vertical plane about a horizontal axis. The valve member 12 may have a collar portion 15 extending rearwardly through an aperture 16 in the bracket 10 and the collar portion 15 has an aperture 17 which serves as a bearing for a rotatable shaft 19. The valve member 12 also has a circular flange 20 which may be secured to the bracket 10 by bolts 21 or the like (Figs. 2 and 3).

The front side of the flange 20 provides an annular or circular valve face 22 (Fig. 4) which has a groove or recess 24 spaced inwardly from the periphery of the flange. The recess 24 preferably is arcuate and extends circumferentially upon the face for about 90°. This recess is connected to a source of vacuum, for example, by a circumferential groove or recess 25 having a port or aperture 26 therein which is connected to a vacuum supply line 27 (Fig. 3) extending through apertures 28 and 30 in the flange and bracket, respectively. The valve face further is provided with an aperture or port 31 spaced circumferentially from the vacuum recess 24 a little less than about 90° in a counter-clockwise direction. This port has connected thereto a tube 32 in communication with the atmosphere or a supply of air pressure and the tube 32 extends through apertures 34 and 35 in the flange and base, respectively.

The shaft 19 extending through the collar 15 of the valve member has a forward end portion 40 of reduced diameter to provide a shoulder 41 in vertical alignment with the valve face 22. This shoulder serves as an abutment for the rotatable member 14, about to be described, which is mounted on the reduced portion 40 of the shaft and is secured thereon by a nut member 42 threaded to the end of the shaft. The nut member is adapted to hold the rotatable member against the shoulder 41, but may be easily unscrewed to permit removal of the rotatable member for inspection and repair.

The rotatable member 14, which will now be described in detail, preferably is disc-shaped and has a cylindrical peripheral surface 45. On this surface a suitable number of shell supporting stations, for example four, may be provided. As illustrated more particularly in Fig. 2, each station may comprise a substantially radially outwardly projecting finger or pin 46 over which a shell S may be telescoped, and the finger may be tapered outwardly to facilitate receiving the shells. If desired, each finger may have a longitudinal slot or groove 48 at one side to facili-

tate vacuumizing the shell adjacent its open end. The inward end of the finger has a threaded portion 47 of reduced diameter which is threaded into a threaded aperture 49 of the rotatable member. The fingers in this manner may be readily removed and replaced by fingers of another size suitable for supporting shells of a different length and diameter.

The supporting stations are further provided with a resilient portion such as a rubber washer 50, seated in a recess 51 on the peripheral surface of the rotatable member and held in place by a shoulder 52 on the pin to provide an airtight seal at the joint between the threaded aperture 49 and the threaded portion 47. These washers are adapted to be engaged by the open end of a shell and when vacuum is applied, seal the shell at the point of engagement.

In order to connect the fingers to the source of vacuum whereby they will serve to evacuate the shells and hold them on the supporting stations, each finger has a longitudinal bore or aperture 55 in communication with a radially extending conduit portion 56 in the rotatable member. The conduit portion 56 meets a second conduit portion 57 extending transversely to the rear face 59 of the rotatable member. The rear face 59 is positioned for rotation against the valve face 22 to complete the valve construction. The conduit portions 57 in the rear face are adapted to register with the vacuum recess 24 to supply vacuum to the fingers or pins and are adapted to be closed by the valve face surface 60 to disconnect the supply of vacuum, and also are adapted to register with the vacuum relief port 31 (Fig. 2).

The shells may be positioned on the fingers in any suitable manner, for example, manually or may be fed by an automatic device. To accomplish this, the shaft 19 is rotated clockwise intermittently by a suitable Geneva drive which is well known and need not be shown. The feeding device may comprise a pin 65 having a bore 66 for receiving the closed end of a shell and suitable means (not shown) for reciprocating the pin to pick up a shell from a stack of shells in a magazine (not shown) and telescope the shell over a pin. The feed pin slides through the bore 70 of a guide block 71 (Figs. 1 and 5) secured to the bracket 10, and this block is positioned adjacent the path of the outer ends of the fingers and in alignment with one position at which the fingers are at rest. The feed pin preferably is moved by an eccentric mechanism (not shown) which feeds a shell and moves away from the fingers while the fingers are at rest and picks up another shell while the fingers are moved from one position to another.

In Fig. 6, a modified shell supporting station is shown, which comprises a sleeve 75 having a threaded nipple 47' threaded into the aperture 49 of the rotatable disc 14. The sleeve may have a bottom 76 wherein is secured a resilient member 50'. An aperture 77 extends through the member 50' and the nipple and registers with the conduit portion 56 of the rotatable disc 14. The shells are adapted to be telescoped into these sleeves 75.

The method of operation, regardless of how the shells are fed is essentially the same and the description of this method will serve for both manual and automatic feeding.

Preferably, a shell is placed on a finger at the left side of the device while it is in horizontal position or has been moved slightly into

upwardly inclined position, as indicated at A in Fig. 1. When in this position the conduit 57 of the pin is at A, indicated in dotted lines in Fig. 4, and is in communication with the vacuum recess 24, whereby the vacuum is effective to withdraw air in the shell and cause the open end of the shell to engage the resilient member 50.

As the shell is moved by rotation of the rotatable member 14 towards the position, indicated as B in Fig. 1, the conduit 57 remains in communication with the vacuum recess 24, so that the shell if free from holes is substantially vacuumized and is sucked against the resilient member 50. Just prior to reaching position B, the valve face surface 60 (Fig. 4) closes the conduit 57, indicated at position B, and shuts off the vacuum.

If the shell has a hole in it, air will enter into the hole and destroy whatever partial vacuum might have been created in the shell. Thus, the shell will be resting loosely on the finger and will not be sucked against the resilient member 50. As the finger moves into position C (Fig. 1) it will dip downwardly and the shell, if not held by suction, due to being imperfect, will slide by gravity from the finger. The shells discharged at position C by reason of being imperfect fall into a receptacle and are kept out of the production line.

The shells which are free from holes, when once vacuumized will maintain a sufficient vacuum to hold the open ends of the shells against the resilient members 50 so long as the conduit 57 is kept closed by the valve surface 60 to prevent the escape of the vacuum. Thus, a perfect cap while moving from positions B to C to D is held on the rotatable member 14 even when the finger dips downwardly. At position D (Fig. 3) the conduit 57 registers with the port 31 connected to the atmosphere, whereby the vacuum is destroyed and the shell falls by gravity at position D (Fig. 1) into a receptacle for the perfect shells. If desired the port 31 may be connected to a supply of air pressure which positively discharges the shell from the finger. This is desirable in the event the open end of the shell has adhered to the resilient member 50 or 50'.

From the foregoing description it will be seen that the present invention provides a shell testing machine which will separate shells having holes therein from those free from holes. The machine is rapid in operation and automatically separates the good and bad shells. Furthermore, the machine can be economically constructed and can be operated at a minimum labor cost. The machine is rugged in construction and can readily withstand any rough usage to which it may be subjected.

As various changes may be made in the form, construction and arrangement of the parts herein, without departing from the spirit and scope of the invention, and without sacrificing any of its advantages, it is to be understood that all matter herein is to be interpreted as illustrative and not in a limiting sense.

What I claim and desire to protect by Letters Patent is:

1. In a machine for vacuum inspecting and classifying closed-end tubular shells of relatively greater length than diameter such as blasting caps; the combination of a vertical, cylindrical, rotatable member, mounted upon a horizontal

axis, a plurality of elongated fingers each having a bore extending therethrough and extending radially from the periphery of the said member, said fingers being at least longer than half the length of said shells and being capable of receiving and mechanically supporting said shells adapted to be inspected and classified, a feeding means disposed radially of and at the side of said rotatable member, a three-way valve mechanism operatively connected with said member and in successive fluid communication with the bore portion of each elongated finger and valving each finger to a source of vacuum during said finger's periphery rotation from one lateral extremity to the top of the circumferential travel and closing each finger to said source of vacuum during its rotation from the top to the bottom of its travel and venting each finger to a source of air during its rotation from the bottom of its travel to the said lateral extremity, whereby shells are supported by the said fingers during application of vacuum.

2. In a machine for vacuum inspecting and classifying closed-end tubular shells of relatively greater length than diameter such as blasting caps; the combination of a feeding mechanism comprising a tubular guide having a reciprocating plunger acting therein, a vertical, cylindrical, rotatable member mounted upon a horizontal axis, elongated fingers each having a bore therethrough and extending radially from the periphery of said rotatable member, said feeding mechanism being located radially of and at the side of said rotatable member and adapted for moving said shells onto said fingers, said fingers being at least longer than half the length of said shells and being capable of receiving and mechanically supporting said shells, a three-way valve mechanism operatively connected with said member in successive fluid communication with the bore portion of each elongated finger and valving each finger to a source of vacuum during said finger's periphery rotation from one lateral extremity to the top of the circumferential travel and closing each finger to said source of vacuum during its rotation from the top to the bottom of its travel and venting each finger to a source of air during its rotation from the bottom of its travel to the said lateral extremity, whereby shells are supported by the said fingers during application of vacuum.

3. In a blasting cap shell testing machine, the combination of a vertically disposed, cylindrical, rotatable shell supporting means mounted upon a horizontal axis, a plurality of elongated fingers each having an opening therethrough terminating in a common face of said shell supporting means, said fingers being at least longer than half the length of said shells, a shell feeding means disposed radially of and at the side of said shell receiving means, and a valve means in airtight relationship with said common face of said shell supporting means, a vacuum producing chamber and a vacuum releasing chamber disposed in the upper and lower left-hand quadrant respectively of said valve means, and means adapted to close said finger openings after movement of said openings away from said vacuum producing chamber and prior to movement into said vacuum releasing chamber.

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