March 21, 1950 K. W. KLINKSIEK 2,501,129

APPARATUS FOR CLEANING INTERNAL SURFACES OF HOLLOW CASTINGS

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FIG. 1.

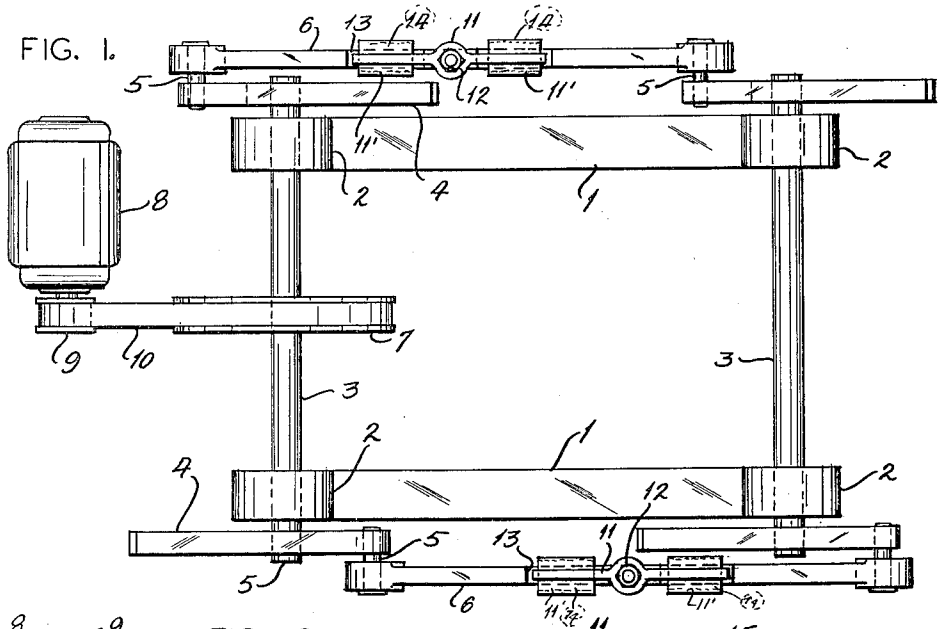


FIG. 2.

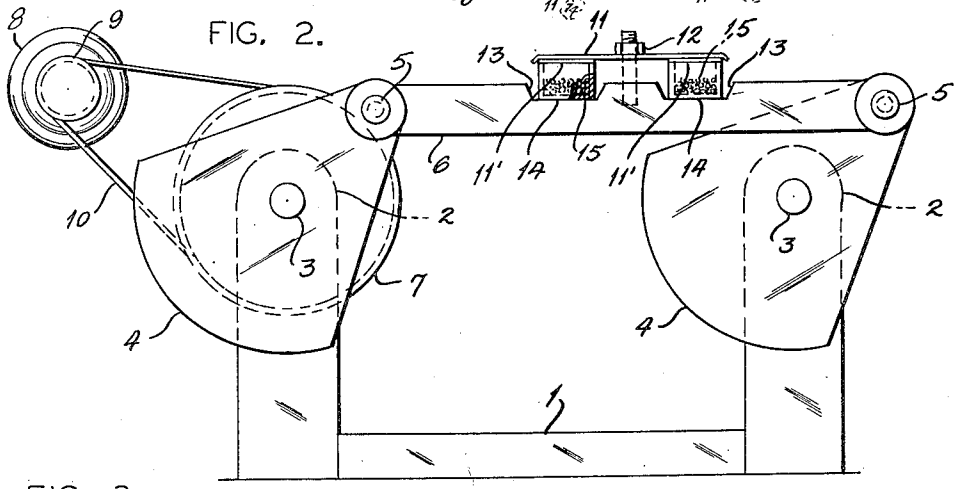
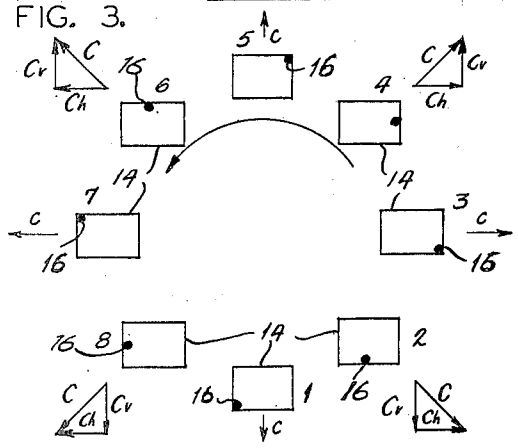


FIG. 3.



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APPARATUS FOR CLEANING INTERNAL SURFACES OF HOLLOW CASTINGS

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7 Claims. (Cl. 51—2)

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This invention is concerned with an apparatus which will clean the interior surfaces of hollow metal pierced castings or the cavities in various hollow bodies in which the cleaning material is moved about in the hollow casting or body.

The invention consists of a supporting member on which a hollow casting or other hollow body is received that contains a quantity of abrasive material such as shot. The supporting member is caused to move through a predetermined path while it is held in the same relative vertical or horizontal position so that the shot or abrasive will move through the predetermined path to thereby clean and work the interior surfaces of the casting or hollow body.

One of the objects of this invention is to provide an apparatus that will uniformly clean and work the inner surfaces of pierced hollow castings or other hollow bodies.

A further object of the invention is to provide an apparatus which will remove projections from and otherwise clean the inner corners of castings or hollow bodies.

Another object of the invention is to provide a cleaning method applicable to small castings which is capable of reproducing the results obtained so that a pair or multiplicity of such castings or hollow bodies may be uniformly cleaned.

In the drawings:

Fig. 1 is a top plan view of an apparatus embodying the invention,

Fig. 2 is a left side elevational view of the apparatus with all parts on the rear of the machine omitted; and

Fig. 3 is a diagram illustrating the forces acting on the shot utilized in the apparatus.

A machine embodying this invention consists of a frame member 1 provided with a plurality of bearings 2, the bearings being arranged in pairs and axially aligned and preferably disposed on uprights formed on the ends of the frame members 1, as viewed in Fig. 2. Shafts 3 are rotatably mounted in each pair of aligned bearings and each is provided with a counter-balanced crank 4 secured to the outer ends of each of the shafts. Each crank is provided with a pin 5 and the pins on each side of the machine are connected by bars 6. The bars 6 are displaced 90° from each other so that one of them will always be positioned 90° from dead center should the other be in either of the two dead center positions. One of the shafts 3 has a pulley 7 secured thereto which is driven from a suitable prime mover, such as an electric motor 8 on whose armature shaft a pulley 9 is secured. The two pulleys are

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connected by suitable power transmitting means, such as a belt 10, in order that the shafts 3 may be rotated.

Each of the bars 6 is provided with work piece clamping members 11 that is supported thereon by a clamping screw 12. Each bar 6 also has a pair of work piece receiving cavities 13 cut therein in which hollow bodies 14, each containing a quantity of shot 15, are supported. Each of the clamping members 11 acts as a closure for the hollow bodies 14 although auxiliary covers 11' (Fig. 2) may be placed over the hollow bodies and under the clamping members in the event the cavities are of such size as not to be covered by the clamping members 11.

The operation of the apparatus is begun by placing a hollow pierced casting, or other hollow body, partially filled with shot in each of the work piece receiving cavities 13. The size and hardness of the shot is chosen in accordance with the size and nature of the casting or hollow body to be cleaned and the finish to be produced on the interior surface thereof. The motor 8 is now started, which will rotate shafts 3, thereby rotating every point on each of the bars 6 through a rotary path and in a vertical plane. The crankpins 5 are made to define circular paths while a pair of lines drawn through the longitudinal axes of bars 6 remain parallel to the line through the centers of bearings 2. Any point on bars 6 which remains horizontal, will move through the circular path described, hence any particle constrained to a volume or space in a hollow body mounted on one of bars 6, will be subjected to a centrifugal force proportional both to the mass of the particle and to the velocity of rotation.

Attention is now directed to Fig. 3 which discloses a diagram of forces on a single piece of shot 16 at the various positions of rotational movement of the hollow body 14. At position 1 an individual shot 16 placed in the hollow body as it is rotated, is subject to several forces. The centrifugal force C at position 1 is substantially vertical, thereby holding the shot against the bottom of the inner surface of the hollow body 14, and inertial force (not shown), due to the mass of shot, operates at right angles to the centrifugal force serving to hold the shot against the left inner surface. As the hollow body 14 moves toward position 3, the centrifugal force operates in two components C_v, which holds the shot against the bottom inner surface, and C_h which is perpendicular to C_v and in a direction opposite to the inertial force. C_h increases as the hollow

body moves to position 3 where it becomes equal to C, while C_v decreases simultaneously from value C at position 1 to zero at position 3. The shot 16 does not move away from the left inner corner until C_h becomes equal to and greater than the inertial force in the opposite direction. Actually C_h must be appreciably greater than the inertial force because added to the inertial force is a frictional force (not shown) which must also be overcome. This frictional force, a function of C_v, is exerted between the opposing surfaces of the shot and the wall of the casting or hollow body.

At some position, such as 2, intermediate positions 1 and 3, C_h will become equal to the sum of the inertial and frictional forces. At position 2 the shot will begin to move along the lower inner surface under the action of C_h, it being held against that surface by C_v. This action performs a scrubbing or cleaning of the interior surface of the hollow body 14. At position 3, C_v vanishes and C_h will equal C. The result of this increase in C_h is to drive the shot forcibly into the right lower corner of the hollow body, removing the projections therefrom and producing a peening effect on the surface contacted by the shot that is angularly disposed with respect to the surface over which 16 traveled. Similar force diagrams are shown in Fig. 3 for the forces C_v and C_h in the other quadrants of the circular path.

The casting to be cleaned is filled approximately one-third full of shot in order to produce the most satisfactory cleaning and peening results. The use of a multiplicity of shot produces a highly useful and desirable effect. In moving from position 1 to 3 the shot pellets are all directed toward the lower right hand corner of the hollow body by the action of centrifugal force C. There is a spreading effect of the shot because their paths interfere with each other. This piles up the shot in the corner and effectively cleans the surface parallel to the path of movement of the particles and peens those perpendicular thereto, producing on the inner surfaces of the casting or hollow body a uniform action of cleaning and peening so that all work pieces subjected to this treatment will have their inner surfaces uniformly treated or worked.

The machine is operated for a predetermined length of time after which the bodies 14 are removed and replaced by untreated or unworked bodies.

What I claim is:

1. An apparatus for cleaning the interior of a hollow body by means of loose abrasive particles contained therein, said apparatus comprising a support for said body, means for rigidly securing said body to said support, and means for imparting a complete circular motion to said support while maintaining the same in parallel planes in all positions of said circular motion.

2. An apparatus for operating on the interior surface of a hollow body comprising a pair of spaced apart parallel shafts; cranks of equal length secured to the ends of said shafts; parallel bars of equal length connecting the cranks on the ends of said shafts; means for rotating said shafts to thereby cause a point on the bars to move through a circular path; means to support a hollow body on one of said bars; and a quantity of shot in said hollow body that is caused to move through a constrained path as said bars are moved through their circular path in order that the shot may operate upon the interior surface of the hollow body.

3. An apparatus for cleaning the interior surfaces of a hollow body with shot comprising means for horizontally disposing a bar for supporting a hollow body; means for supporting said hollow body containing shot on said bar; and means for moving said bar such that a point thereon moves through a rotary path while maintaining said bar horizontally disposed so that the shot in said body contacts all portions of the interior surfaces of said hollow body.

4. An apparatus for cleaning and peening the interior of a hollow body with shot comprising a pair of shafts having cranks thereon; means in which said shafts are rotatably supported; a bar connecting the cranks on each shaft and maintained in a horizontal plane; means on said bar for supporting the hollow body into which a quantity of shot has been introduced; means for rotating said crank shafts to move a point on said bar through a rotary path in a vertical plane while maintaining the bar horizontal to enable the shot to clean and peen the interior surface of said hollow body.

5. An apparatus for cleaning and peening the interior surface of a hollow body in which a quantity of shot has been introduced comprising a crank shaft; a second crank shaft; bars connecting the cranks on said shafts so that each bar is held in a horizontal plane; means for clamping said hollow body to said bar and for maintaining the shot therein; means to rotate said shafts so that points on said bars will be moved through a rotary path in a vertical plane while maintaining said bars, horizontal so that said shot will clean and peen the interior surfaces of said body.

6. An apparatus for moving a hollow body in a circular path comprising means for rotatably supporting a pair of shafts; cranks mounted on the ends of each shaft; a bar connected between the cranks mounted on ends of the shafts; means for supporting the hollow body on one of said bars; and means for rotating said shafts so that a point on each bar is moved through a circular path while being constantly held horizontal.

7. An apparatus for moving a hollow body in a circular path comprising means for rotatably supporting a pair of shafts; cranks mounted on the ends of each shaft, the crank on one end of each shaft being displaced 90° from the crank on the other end of the shaft; bars connected between the cranks mounted on the ends of the shafts; means for supporting a plurality of hollow bodies on one of said bars; and a prime mover for rotating said shafts so that a point on each bar is moved through a circular path while the bar is being constantly held horizontal.

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