SHELL MARKING MACHINE

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The invention described herein may be manufactured and used by or for the Government of the United States of America for governmental purposes without the payment to me of any royalty thereon.

This invention is directed to a device for printing on the surface of objects which are of circular cross section but of varying diameters, such as shells, bombs, and the like. These articles have a cylindrical portion and also a tapering portion.

The printing is accomplished by rolling the article over a type. The cylindrical portion of the article rolls along a track and in doing so rolls over stationary type. Various portions of the tapering surface to roll over type, which, however, cannot be stationary for the reason that the movement of any point on the surface of the tapering portion relative to a stationary member contacting it combines rolling and sliding, whereas the contact with the type must be pure rolling. In order to secure the latter relationship, I provide means for moving the type during contact at a velocity equal to the sliding component of the motion of the corresponding point on the surface relative to a stationary tangent. For each revolution of the article as it rolls along the track this sliding component is equal to the difference between the circumferences of the portion being printed and the portion rolling on the track. For example, if the cylindrical portion of a shell has a circumference of nineteen inches and printing is being applied to a portion having a circumference of ten inches, the type contacting the latter portion is moved nine inches per revolution of the article. The movement of the type is in the same direction as the movement of the article and the velocities must at all times be in the correct proportion. For example, in the example just given, the velocity of motion of the type must at every instant be 9/19 times the rolling velocity of the shell.

I secure this motion by the use of a positive drive mechanism which imparts a constrained rolling to the article and, through a group of properly sized gears and racks, moves a series of type bars at the proper relative speeds.

In the drawing,
Fig. 1 is a top plan view of the machine.
Fig. 2 is a front side view.
Fig. 3 is a right end view.
Fig. 4 is a transverse section on line 4—4, Fig. 1.
Fig. 5 is a bottom plan view.
Fig. 6 is a partial longitudinal section on line 6—6, Fig. 4.
Figs. 7, 8 and 9 are diagrammatic views showing the relationship of the main drive rack and the subsidiary rack at various points in the cycle of operation.
Fig. 10 is an enlarged view of the sprocket chains and the pusher assembly.
Fig. 11 is a fragmentary view showing one of the shoes of the pusher assembly.

The machine is mounted on a frame which supports a table and an ink tray and is preferably provided with drawers to hold type and other supplies. The table carries rubber covered tracks along which the shell to be marked is rolled and at guard, which is preferably adjustable, for positioning the shell. Between the tracks is a fixed type which contacts the cylindrical portion of the shell as it rolls along tracks. Stripping bars may also be stationary if their points of contact do not vary greatly in diameter from the cylindrical portion.

In order to print indicia on the tapering portion of the shell, I employ movable type holders. Each of these type holders is independently movable and each is moved as the shell turns over at such a speed that the contact of the shell with the type is substantially pure rolling, as explained earlier in this specification.

The mechanism for producing the proper movement of the various parts will now be described. Supported beneath the table is a double acting air cylinder which is air supplied by suitable conventional connections controlled by manually operated valve. The piston of the cylinder is connected by a link, which is preferably adjustable as to length, to the main drive rack which is mounted for reciprocation in guide rails and which may be provided with anti-friction rollers. Rack meshes with main drive gear secured to shaft in which is hung from table 3 in bearings 43, 45 and 47. Also secured to shaft are sprockets and 51, which engage sprocket chains pass over idler sprockets and in their upper reaches pass tracks. The chains 53 and 55 carry pusher bar assemblies for rolling the shell along the track. These assemblies may be of any suitable form, one embodiment being best shown in Figs. 4 and 10. Two spaced standards 61 and 63 are secured to each sprocket chain by pivot connections and are stabilized by shoes which rest on the chain on its straight stretches. A pin 69 joins the standards and carries journaled rollers. On the working stroke, main drive rack 35 drives main drive gear 39 which turns sprocket 49, causing the pusher assembly to move from the left end of the table in Fig. 1 to the right end. On the return stroke the assemblies move back to the left end. For ease in loading and unloading the apparatus, one pair of standards should pass below the table at each end of the stroke.

A subsidiary rack 73 is mounted in guides 75 adjacent rack 35 and may be equipped with anti-friction rolls. These racks are provided with mutually engaging lugs so positioned that, during the portion of the cycle in which the pusher assembly is adjacent the type bars, the main drive rack drives the subsidiary rack.

In the drawings, Figs. 5, 7, 8 and 9, I have shown on the main drive rack a lug and on subsidiary rack 73 two spaced lugs and 81 lying one on each side of lug 77.

The cycle of operations can be seen from Figs. 7, 8 and 9. At Fig. 7 the main drive rack is at the extreme left end of its path. As rack 35 moves to the right, lug 77 at first does not engage rack 73, so that the latter remains stationary. This phase of the cycle is shown in Fig. 8. As the movement to the right continues, lug 77 engages lug 81, moving rack 73 to the right until the end of the stroke, shown in Fig. 9, is reached. As will be apparent, the return stroke will eventually return the racks to the position shown in Fig. 7.

While we have shown two lugs on rack 73 and one on rack 35, it will be obvious that the reverse arrangement could be employed equally well, or, if desired, two lugs might be employed on each rack, with the lugs correctly spaced to give the desired movement.

The lugs are so positioned that when the pusher assembly reaches the type, lug 77 engages lug 81, driving...
subsidary rack 73 which rotates main type gear 83 which turns shaft 85, journaled in bearings 87, 89 and 91 and thus secondary type gears 93, 95, 97, 99 and 101 which are also secured to shaft 85.

The type holders 17, 19, 21, 23 and 25 are secured to type racks 103, 105, 107, 109 and 111 respectively, which racks are slidably mounted in brass guides 113. These racks mesh with the secondary type gears 93, 95, 97, 99 and 101 respectively. It will be noted that these gears are graduated in size, gear 93 being the smallest and 101 the largest, so that the racks move at progressively higher speed toward the right as viewed in Fig. 4. The gears are so proportioned that each type bar moves at the correct speed to produce pure rolling contact between the shell and the type. To secure good contact with the shells, the type holders are preferably resiliently mounted on the racks, for example by springs 115 and pins 117.

While I have described the apparatus in considerable detail, it will be obvious that numerous changes are possible. I therefore desire this invention to be limited solely by the scope of the appended claims.

I claim:

1. A device for printing indicia on articles having a cylindrical portion and a tapering portion comprising a track, positive drive means for rolling said article along said track, type so positioned as to be tangential with said tapering portion, and positive drive connections between said positive drive means and said type so constructed and arranged as to move said type at such a speed as to give substantially pure rolling contact between said type and said tapering portion, said positive drive means comprising a reciprocating means, and said positive drive connections comprising a first rack driven by said reciprocating means, a first gear driven by said first rack, a second rack connected to said type and a second gear driven by said first gear and engaging said second rack.

2. A device as defined in claim 1 wherein said first and second gear are secured to a common shaft.

3. A device for printing indicia on articles having a cylindrical portion of one diameter and a second portion having at least one diameter different from that of said cylindrical portion, comprising a track for receiving said cylindrical portion, a reciprocating means comprising a main drive rack, a main drive gear meshing with said main drive rack, at least one sprocket mounted to rotate with said main drive gear, a sprocket chain engaging said sprocket, a pusher assembly mounted for travel along said track and connected to said sprocket chain, said pusher assembly being adapted to roll an individual article along said track under constraint, type so positioned as to tangentially engage said second portion of said article as it is rolled along said track, a subsidiary rack, cooperating means on said main drive rack and said subsidiary rack so positioned as to be engaged at the time said article reaches said type, a main type gear fixed to a shaft and engaging said subsidiary rack, a secondary type gear fixed to said shaft, a type rack meshing with said secondary type gear and directly connected with said type, said gears and racks being so proportioned as to cause said type to move at such a speed that said second portion of said article will make pure rolling contact with said type.

4. A device defined in claim 3 wherein said cooperating means comprise a first lug on one rack and a second lug on the other rack positioned so as to be engaged by said first lug during a working stroke of said main drive rack.

5. A device as defined in claim 4, and further comprising second cooperating means on said main drive rack and said subsidiary rack constructed and arranged to return said subsidiary rack to its initial position on a return stroke.

6. A device as defined in claim 5 wherein said second cooperating means comprise a third lug mounted on said one rack and spaced from said first lug, said third lug being so positioned as to engage said second lug on the return stroke.

7. A device as defined in claim 3 and further including fixed type so positioned as to tangentially contact the cylindrical portion of said article as it rolls along said track.

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