

No. 665,905.

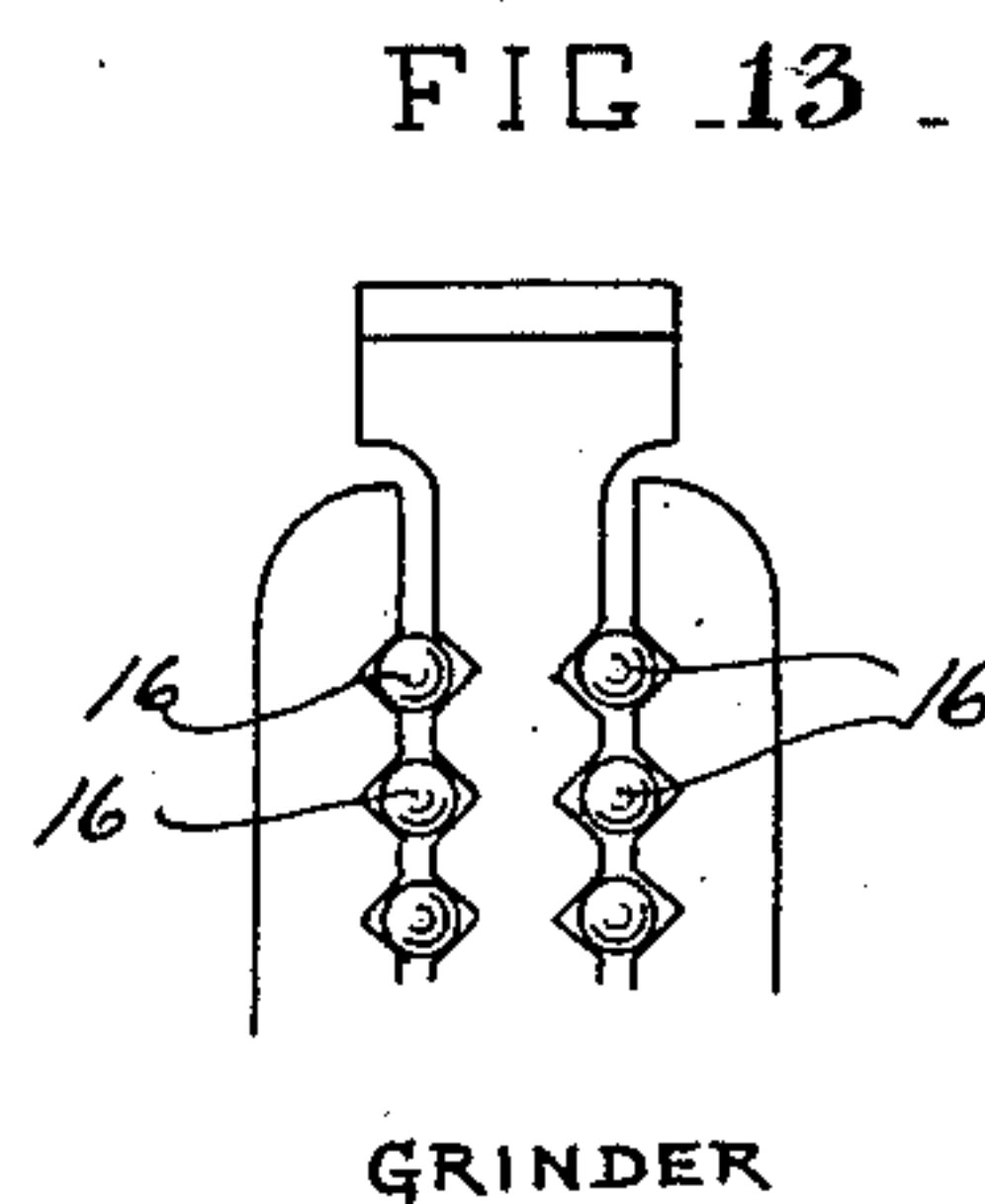
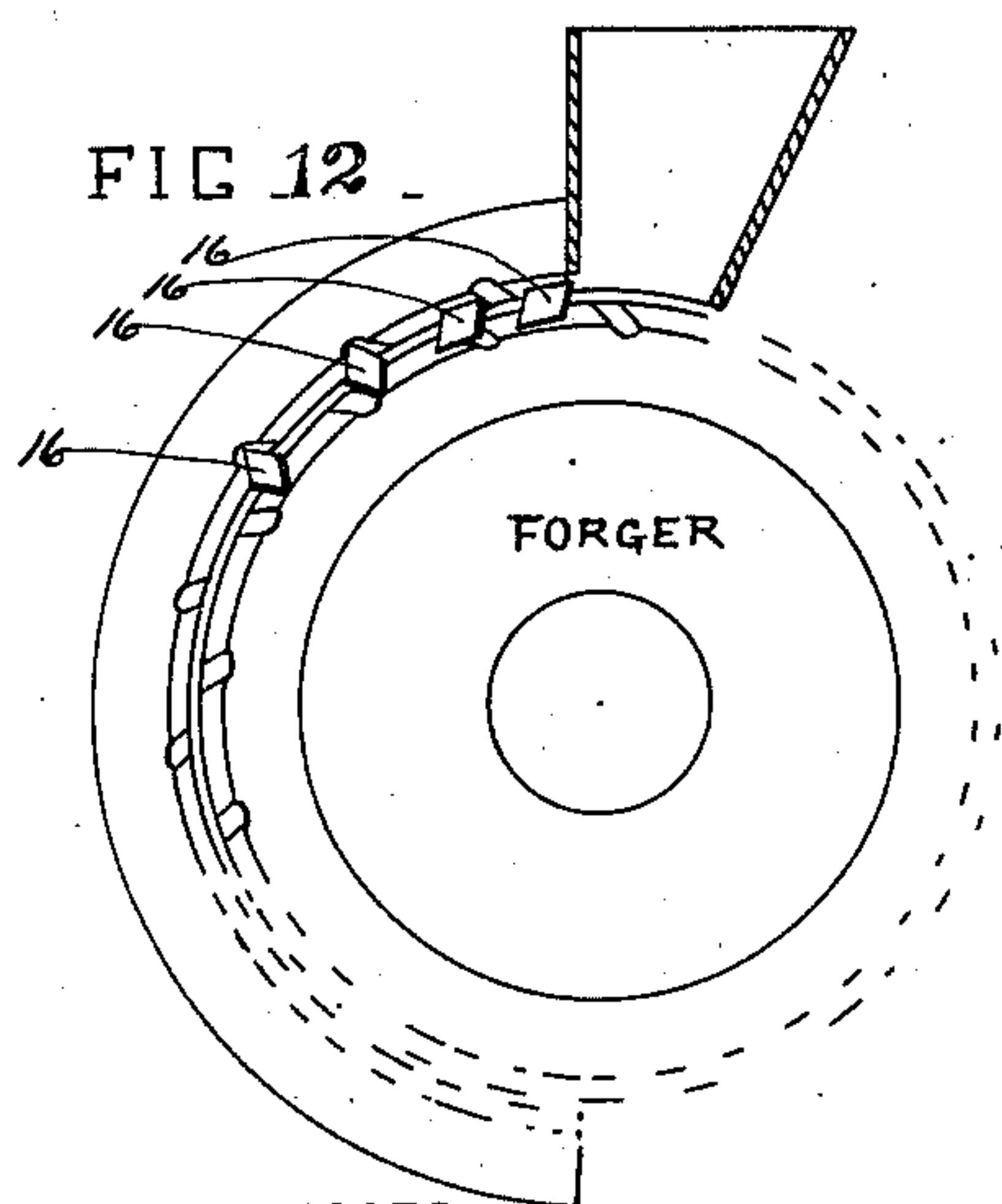
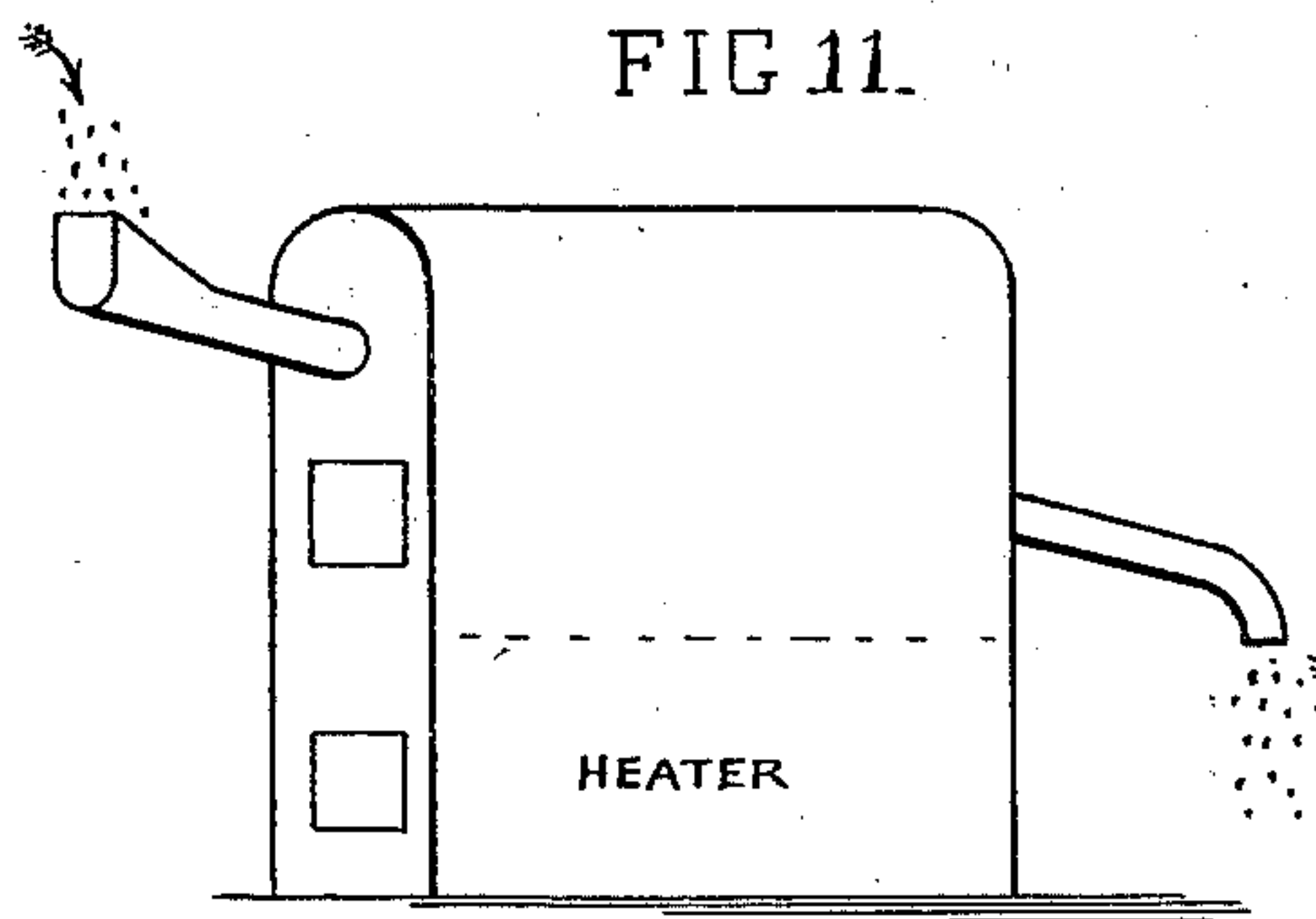
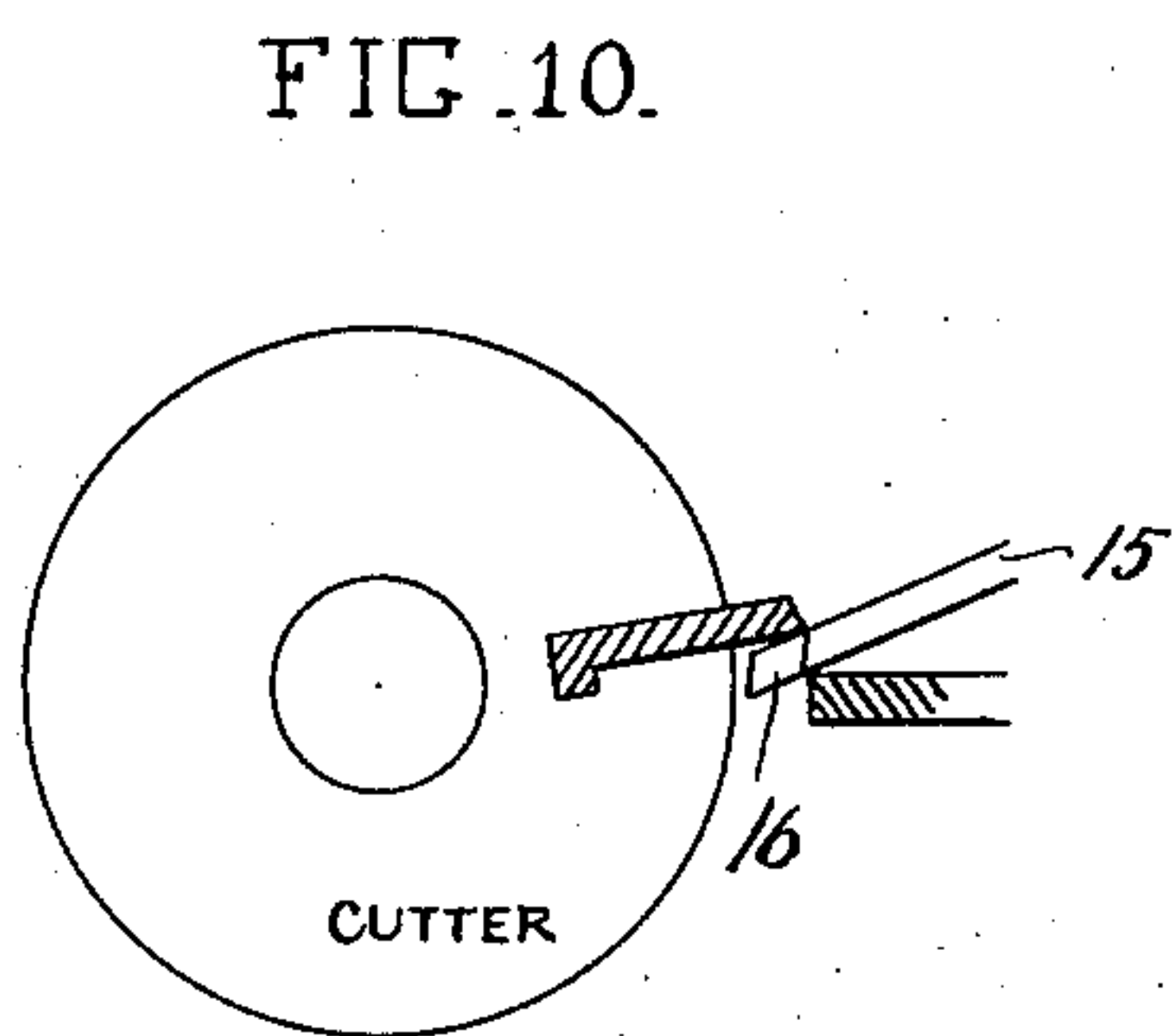
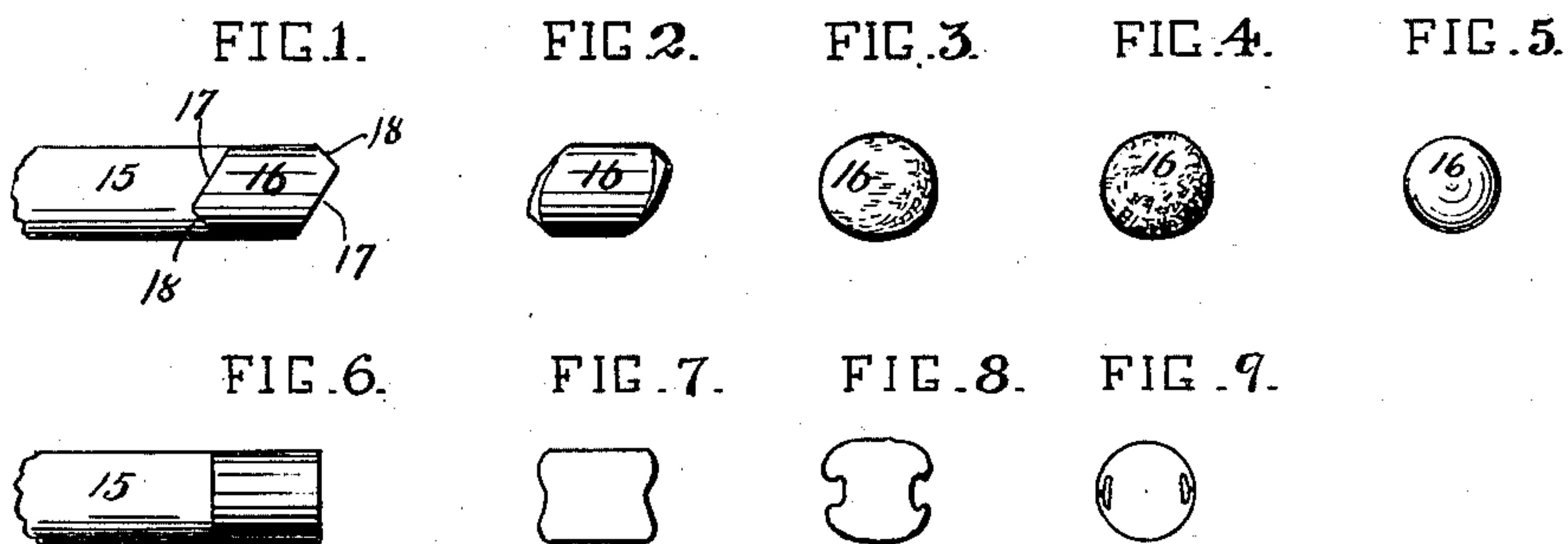
Patented Jan. 15, 1901.

C. C. HILL.

ART OF MANUFACTURING STEEL BALLS FOR BALL BEARINGS.

(Application filed June 15, 1900.)

(No Model.)



WITNESSES:
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UNITED STATES PATENT OFFICE.

CHRISTIAN C. HILL, OF CHICAGO, ILLINOIS, ASSIGNOR TO THE STEEL BALL COMPANY, OF SAME PLACE.

ART OF MANUFACTURING STEEL BALLS FOR BALL-BEARINGS.

SPECIFICATION forming part of Letters Patent No. 665,905, dated January 15, 1901.

Application filed June 15, 1900. Serial No. 20,399. (No model.)

To all whom it may concern:

Be it known that I, CHRISTIAN C. HILL, a citizen of the United States, residing in Chicago, in the county of Cook and State of Illinois, have invented a new and useful Improvement in the Art of Manufacturing Steel Balls for Ball-Bearings, of which the following is a specification.

My invention relates to improvements upon the process or method of manufacturing steel balls for ball-bearings now commonly in use and which consists, essentially, in first cutting a continuous steel rod or wire into short lengths or blanks, each of the required size to form a ball, then heating the blanks, then by a combined rolling and forging operation rolling and forging the short blanks into a spherical or approximately spherical shape, and then finally grinding and lapping or polishing them to a uniform size and true spherical form. In manufacturing steel balls for ball-bearings in this way great difficulty has heretofore been experienced in producing uniformly-perfect balls free from spots or defects, because of the tendency of the flat square-ended ball-blank cut from the rod to form a cavity by the folding over of the edges of the blank in the rolling and forging step of the process.

The object of my invention is to provide a simple and effective method or means of practically overcoming this defect or difficulty, and after much experimenting I have discovered that perfect balls, free from cavities or defects in their surface, may be uniformly and very rapidly and cheaply manufactured by first cutting the continuous steel rod or wire into short lengths or blanks having oblique ends, then heating the oblique-ended cylindrical ball-blanks thus cut, and then rolling and forging them into approximate spherical shape, the rolling and forging step operating, by reason of the peculiar or diagonal shape of the flat oblique-ended cylindrical blank, first upon the larger or diagonal dimension or diameter of the blank, and thus swelling or bulging outward the oblique flat ends, sides, or faces of the blank as formed and left by the cutting instead of causing the flat faces of the blank to tend to form cavities, as heretofore. After the rolling and forging step the blanks after being allowed to cool are next

subjected to the usual grinding, lapping, and polishing steps, and thus reduced to uniform size and true spherical shape.

In the accompanying drawings, forming a part of this specification, I have illustrated at Figure 1 the ball-blank as it is cut from the continuous rod or wire of steel. Fig. 2 shows the same after it has been heated and partially rolled and forged, illustrating the action of the rolling and forging step in swelling or bulging outward the flat oblique end faces of the blank as formed and left by the cutting step. Fig. 3 illustrates the blank at a still further stage of the rolling and forging step. Fig. 4 illustrates the blank after the rolling and forging step has been completed, and Fig. 5 the finished ball after being ground and polished to a true spherical form and to the exact required diameter. At Figs. 6, 7, 8, and 9 I have illustrated successive stages of a blank of the ordinary plain cylindrical or square-ended form as heretofore cut from the rod or wire when subjected to the rolling and forging operation and showing how the flat ends of the blank left by the cutting step tend to form cavities, scales, or defects in the ball. Fig. 10 illustrates the first step of my improved process, Fig. 11 the second or heating step, Fig. 12 the third or rolling and forging step, and Fig. 13 the grinding or lapping step.

In the drawings, 15 represents a steel rod or wire from which the ball-blanks 16 are cut by an oblique or diagonal cut, thus forming the blanks with flat but oblique-ended faces 17 17 parallel to each other. The operation of the knives or cutters also gives each blank two small angle-faces 18 18. After the ball-blanks are thus cut from the rod they are passed into and through a suitable furnace and heated to a dull-red heat and then subjected to a combined rolling and forging step or operation, preferably by passing them between a grooved shoe and a rotating grooved roll, the grooves of the shoe and roll being furnished with enlargements at intervals. As the longer or diagonal dimension of the blanks is first acted on or compressed by the rolling and forging devices and as the blank by reason of its parallel oblique end faces is already out of symmetrical shape, the first action of

the rolling and forging step is to swell or bulge outward the flat but oblique end faces 17 17 of the blank, and thus prevent any tendency of these flat faces to form a cavity, defect, 5 scale, or flake on the ball. I am by my process therefore enabled to manufacture steel balls very rapidly and cheaply, and at the same time form all the balls perfectly and with the minimum amount of grinding.

10 I claim—

The improvement in the art of manufacturing steel balls for ball-bearings, consisting in first cutting a steel rod or wire by oblique cuts

into short lengths or ball-blanks with parallel oblique end faces, then heating the blanks, 15 then subjecting the heated blanks to a rolling and forging step and thereby causing the flat end faces of the blanks to first bulge or swell outward and the blanks subsequently to assume an approximate spherical shape, and 20 then grinding the blanks to true spherical form, substantially as specified.

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