

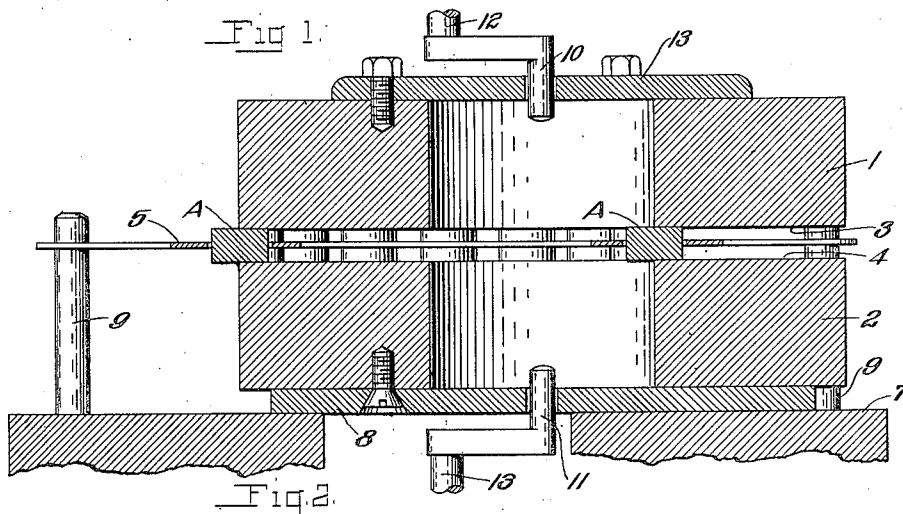
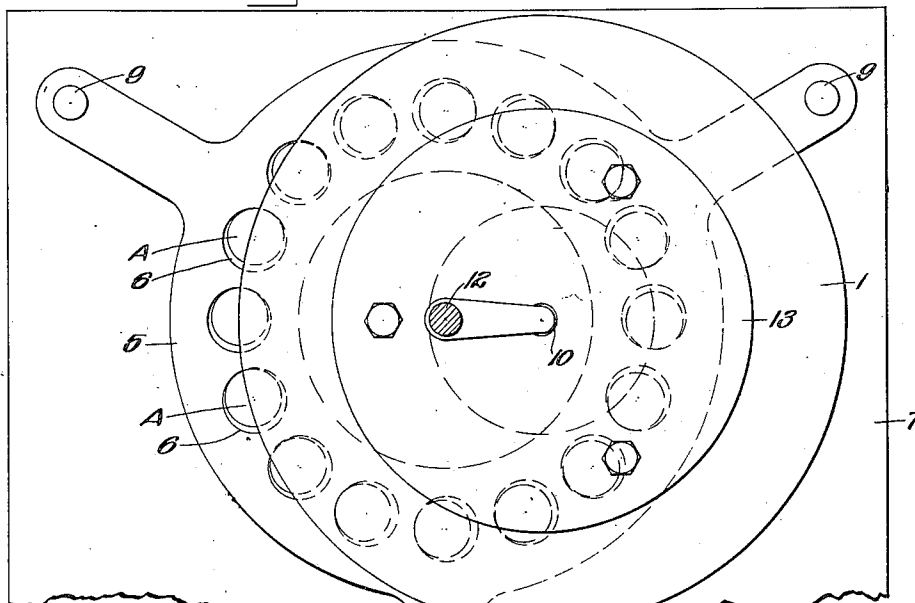
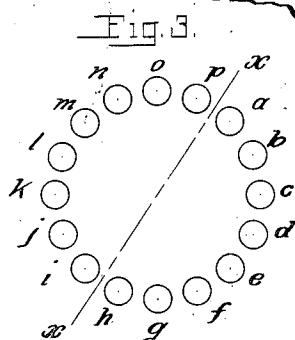
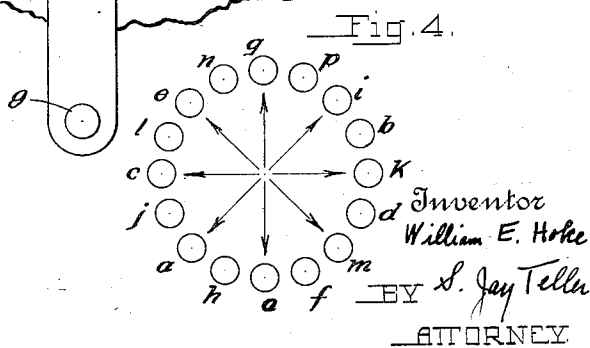
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W. E. HOKE

METHOD OF AND MACHINE FOR MAKING GAUGES AND OTHER ARTICLES

Filed July 8, 1919



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METHOD OF AND MACHINE FOR MAKING GAUGES AND OTHER ARTICLES.

Application filed July 8, 1919. Serial No. 309,451.

To all whom it may concern:

Be it known that I, WILLIAM E. HOKE, a citizen of the United States, residing at St. Louis, Missouri, have invented certain new and useful Improvements in Methods of and Machines for Making Gauges and Other Articles, of which the following is a specification.

This invention relates to a method of lapping gauge blocks or similar articles to produce identical sizes, and particularly to produce plane parallel opposite surfaces separated from each other by an assigned dimension, with a high degree of accuracy. The method is in some respects similar to the methods set forth in my copending applications for method of making identical articles, Serial No. 252,073, filed Aug. 30th, 1918, and for method of and machine for making gauges and other articles, Serial No. 289,591 filed April 12th, 1919. The invention further relates to a machine whereby the method may be practiced.

In the accompanying drawing I have illustrated in diagrammatic form a machine embodying the mechanical features of the invention and adapted for practicing the method. I have also presented further diagrams by which the method will be explained in detail. It will be understood that the drawings are for illustrative purposes only and are not to be construed as defining or limiting the scope of the invention, the claims appended to this specification being relied upon for that purpose.

Of the drawing:

Fig. 1 is a vertical sectional view of a machine adapted for carrying out my improved method.

Fig. 2 is a plan view of the principal parts of the machine shown in Fig. 1.

Figs. 3 and 4 are diagrammatic views further illustrating the method.

The blocks to be lapped are first formed with the desired shape and with a little more than the desired length, by any usual or preferred means. When they are to be used as gauges the blocks are hardened and otherwise suitably treated, but these preliminary steps constitute no part of the present invention. After the blocks have been thus formed and treated, they are then subjected to a lapping operation or a series of lapping operations and are otherwise acted upon, in the manner to be described.

Referring to Figs. 1 and 2 of the drawings, it will be seen that the machine includes two laps 1 and 2 of similar size and preferably annular in form, having their adjacent faces 3 and 4 made as nearly plane as possible in accordance with any method for producing plane surfaces. The adjacent surfaces of the two laps are suitably prepared and are charged with an abrasive such as fine emery. The character of the laps and of the abrasive may be varied as required. A number of similar blocks A—A are placed between the two laps 1 and 2, these blocks being preferably arranged in a circular series, as shown. For holding the blocks in proper relationship and for other purposes, as will be presently described, there is provided a flat plate or spider 5 preferably having suitable apertures 6 therein adapted to receive the respective blocks. Preferably the apertures 6 are larger than the blocks so as to permit turning or rolling movements between the blocks and the spider.

The lower lap 2 is supported on a table 7 preferably by means of an intermediate plate 8, the lap and the plate being movable horizontally. The blocks A—A rest upon the lower lap 2 and the upper lap 1 rests directly upon the blocks. The upper lap is free to move vertically and is also free to adjust itself as to parallelism with the lower lap in accordance with blocks of varying lengths. The spider 5 is held against horizontal movement, as for instance by means of pins 9, 9 which are secured to the table. In order to effect lapping, the two laps are moved relatively to the blocks and the movements of the two laps may be independent of each other when desired. Preferably each lap moves in a circular path, and for the purpose of effecting such circular movement, there are provided cranks 10 and 11 carried respectively by rotating spindles 12 and 13. The crank 10 enters an aperture in a plate 14 secured to the upper lap 1, and the crank 11 enters an aperture in the aforesaid plate 8 secured to the lap 2. It will be seen that when the two cranks are turned the two laps will be moved in circular paths. These movements may be made independent of each other by rotating the cranks at different speeds. It will be seen that when the cranks are thus rotated at different speeds

the centers of the two laps are normally out of alinement with each other. Inasmuch as the spider 5 is held by the pins 9, 9, the blocks are prevented from partaking of the movements of the laps. Preferably, as shown, the laps are free to turn about their central axes and the resistance to movement offered by the several blocks is such as to cause the laps to turn slowly. Inasmuch as the apertures 6, 6 in the spider are somewhat larger than the blocks A—A, the blocks are caused to roll slightly as the result of the movements of the laps, thus slowly turning on their individual axes. The lapping movement is continued preferably until all of the blocks have been lapped and until the laps engage all of them equally.

Then the lapping movement is stopped and the upper lap is removed, thus leaving the blocks exposed. Certain blocks are then transferred in such a way as to distribute any errors or variations in the respective lengths. It may be assumed that, with a group of blocks of slightly varying lengths, those at one part of the group will average longer than those at another part. Following this assumption it will be seen that the transferring must be such that the longer and shorter blocks will be commingled. In order that the longer and shorter blocks may be uniformly distributed, the transferring is preferably effected symmetrically. If the blocks are arranged in a circular series, it is to be expected that the lengths of those at one side will have a greater average than the lengths of those at the other side. Inasmuch as the surfaces of both laps are flat, the result is that some one or two of the blocks at one side will have a maximum length and some one or two blocks diametrically opposite will have a minimum length. The blocks between will have lengths successively varying from the maximum to the minimum. The blocks at one side of the diametral line will have lengths greater than the average and those on the other side will have lengths less than the average. The transferring of the blocks to distribute the errors and equalize the lengths is preferably done by moving alternate blocks or alternate groups of blocks to positions diametrically opposite. This places the longer blocks between the shorter ones.

For practicing the method in the preferred manner, the number of blocks in any one circular series, such as a to p , as shown in Fig. 3, should be a multiple of four and should be at least eight. By way of example I have shown sixteen blocks, but it will be understood that any desired multiple of four may be used. If it be assumed for instance that the blocks at one side of a diametral line $x-x$ have lengths greater than the average and that the blocks at the other

side of the line have lengths less than the average, then it will be seen that after the diametral transposition of alternate blocks the longer and shorter blocks will, in the main, be alternately arranged as shown in Fig. 4. The operator has no means of determining the position of the diametral dividing line $x-x$ and no means of determining which is the side of maximum length and which the side of minimum length, but it is not necessary for him to do so. It will be observed that inasmuch as the alternate blocks throughout the entire series are transposed, the required alternate arrangement of longer and shorter blocks is secured irrespective of the position of the dividing line.

The blocks having been transferred as described, the top lap is restored to position and the lapping operation is repeated. Obviously the laps will at first engage only the longer blocks, thus reducing their lengths. The lapping operation is continued preferably until the laps again engage all of the blocks. Obviously the blocks are more nearly uniform in length than before but there may still be some variation. Therefore alternate blocks are again transferred, as before described, and the blocks are again lapped. These operations are repeated alternately in succession for a number of times, and the final result is that all of the blocks have exactly the same length and have their end surfaces exactly flat and parallel. The manner of moving or transferring the blocks may be varied, particularly in the ways set forth in my aforesaid application.

The blocks having been made with identical lengths and with plane parallel end surfaces, the lapping operation is then continued to reduce the lengths to the desired predetermined amount. If considerable additional lapping is required to secure the desired uniform length, it may be preferable to continue the transferring of the blocks from time to time to avoid possible variation. The blocks may be measured in any desired way to ascertain when the predetermined lengths have been reached. Use may be made of the method set forth in my aforesaid application, but this method constitutes no part of my present invention and need not be here described.

What I claim is:

1. The method of reducing a number of similar blocks to produce parallel flat end faces and identical lengths, which consists in arranging the several blocks between two opposed laps, permitting one of the laps to adjust itself with respect to the other in accordance with the lengths of the blocks, and bodily moving the laps independently of each other with respect to the blocks.

2. The method of reducing a number of similar blocks to produce parallel flat end faces and identical lengths, which consists

in arranging the several blocks between two opposed circular flat laps, permitting one of the laps to adjust itself with respect to the other in accordance with the lengths of the blocks, and bodily moving the laps with respect to the blocks in circular paths about a common axis with the centers of the laps normally out of alinement.

3. The method of reducing a number of similar blocks to produce parallel flat end faces and identical lengths, which consists in arranging the several blocks between two opposed circular flat laps, permitting one of the laps to adjust itself with respect to the other in accordance with the lengths of the blocks, and bodily moving the laps with respect to the blocks in circular paths about a common axis at different speeds.

4. The method of reducing a number of similar blocks to produce parallel flat end faces and identical lengths, which consists in arranging the several blocks between two opposed circular flat laps, permitting one of the laps to adjust itself with respect to the other in accordance with the lengths of the blocks, bodily moving the laps with respect to the blocks in circular paths about a common axis with the centers of the laps normally out of alinement, and causing the laps to rotate about their centers.

5. The method of reducing a number of similar blocks to produce parallel flat end faces and identical lengths, which consists in arranging the several blocks between two opposed circular flat laps, permitting one of the laps to adjust itself with respect to the other in accordance with the lengths of the blocks, bodily moving the laps with respect to the blocks in circular paths about a common axis with the centers of the laps normally out of alinement, and causing the blocks to turn about their individual axes.

6. The method of reducing a number of

similar blocks to produce parallel flat end faces and identical lengths, which consists in arranging the several blocks between two opposed flat laps, permitting one of the laps to adjust itself with respect to the other in accordance with the lengths of the blocks, bodily moving the laps independently of each other with respect to the blocks, systematically transferring some of the blocks to distribute variations in length, and repeating the lapping and transferring operations alternately until identical lengths are obtained.

7. A lapping machine including in combination two opposed flat laps one of which is adapted to adjust itself as to parallelism with the other, means for holding a group of blocks to be lapped in fixed positions between the laps, and means for bodily moving the laps with respect to the blocks each independently of the other.

8. A lapping machine including in combination two opposed flat laps one of which is adapted to adjust itself as to parallelism with the other, means for holding a group of blocks to be lapped in fixed positions between the laps, and means for bodily moving the laps with respect to the blocks each independently of the other in a circular path.

9. A lapping machine including in combination two opposed flat laps one of which is adapted to adjust itself as to parallelism with the other, means for holding a group of blocks to be lapped in fixed positions between the laps, and means for bodily moving the laps with respect to the blocks each independently of the other in a circular path, the said means leaving each lap free to rotate about its own center.

In testimony whereof, I hereto affix my signature.

WILLIAM E. HOKE.