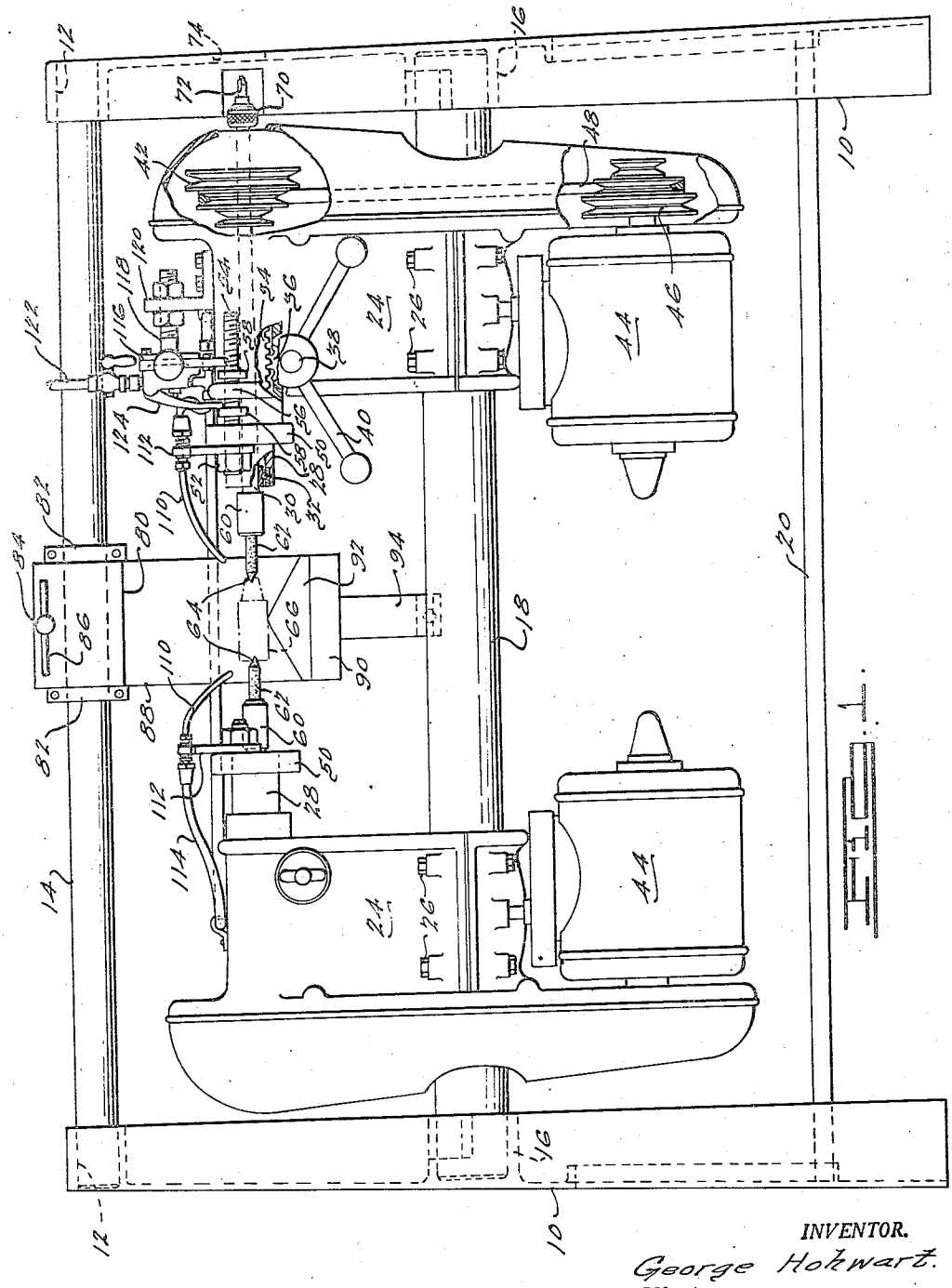
Dec. 14, 1948. G. HOHWART 2,456,061

DOUBLE END CENTER LAPPING MACHINE

Filed Aug. 6, 1945 2 Sheets-Sheet 1



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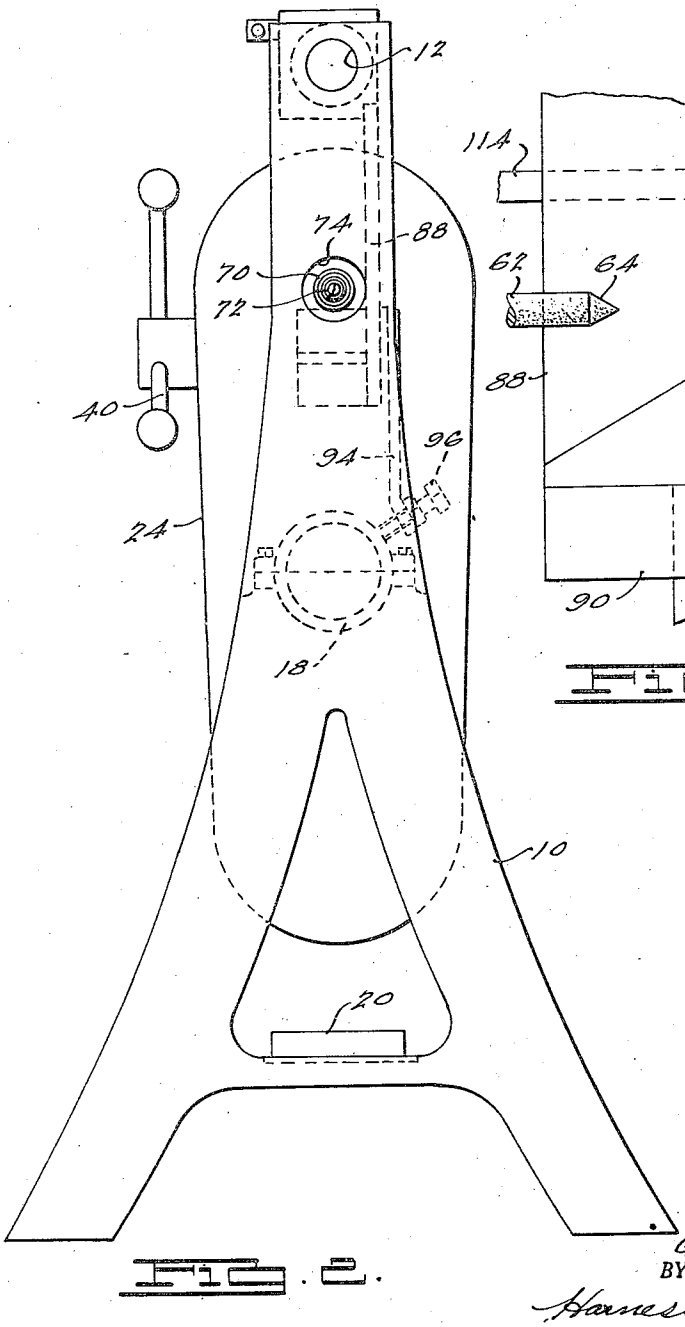


Fig. 2.

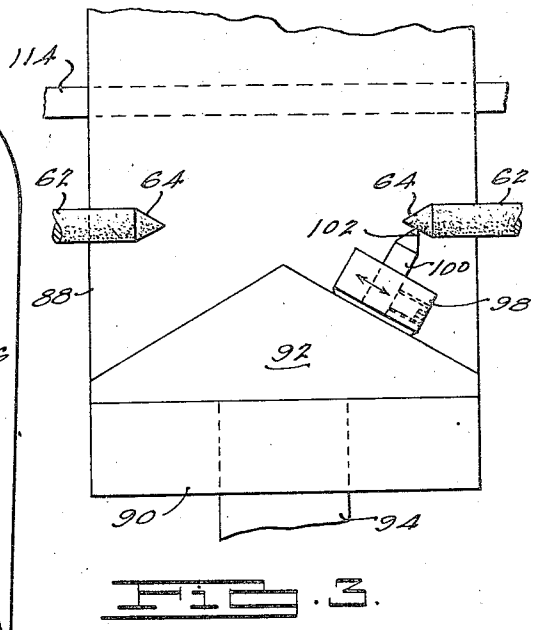


Fig. 3.

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DOUBLE END CENTER LAPPING MACHINE

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This invention relates to lapping machines and particularly to such machines as are capable of lapping the center holes at the opposite ends of a workpiece simultaneously, the principal object being the provision of a machine of this type that is simple in construction, efficient in operation and economical to build.

Objects of the invention include the provision of a machine by means of which center holes at opposite ends of a workpiece may be lapped simultaneously with assurance of absolute concentricity; the provision of a double end center lapping machine including a supporting frame and a pair of heads supported in opposed relation thereon, each head including a spindle and a driving motor, the spindles being aligned and each carrying a lapping instrumentality, the spindles together with the lapping instrumentalities being relatively movable toward and away from each other; the provision of a machine of the type described in which the heads are adjustable toward and away from each other whereby to render the machine adjustable to take care of workpieces of different lengths; the provision of a machine of the type described in which the heads may be of a conventional type commonly employed in drilling apparatus and the frame of the machine is provided with a bar for mounting the heads in the same manner as the heads are conventionally mounted on the post of a drill press; the provision of a machine of the class described including means for directing a blast of air against the center holes of the workpiece at the time the workpiece is applied to the machine and at the time the workpiece is removed from the machine; and the provision of a machine of the class described including means for mechanically cleaning the center holes of the workpieces.

The above being among the objects of the present invention, the same consists in certain novel features of construction and combinations of parts to be hereinafter described with reference to the accompanying drawings, and then claimed, having the above and other objects in view.

In the accompanying drawings which illustrate a suitable embodiment of the present invention and in which like numerals refer to like parts throughout the several different views,

Figure 1 is a partially broken, partially sectioned front elevational view of my improved lapping machine;

Figure 2 is an enlarged end view of my improved machine taken looking from the right-hand side of Figure 1; and,

Figure 3 is a still further enlarged, fragmentary

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front elevational view illustrating the means and method employed in dressing the lapping instrumentalities.

The present invention deals with a machine by means of which the center holes at opposite ends of a workpiece may be simultaneously lapped in a quick and easy manner and requiring no more time to lap two center holes than is ordinarily required to lap one. Not only is the machine designed to thus halve the labor cost of lapping center holes in workpieces but the machine itself is of extremely simple construction and insures absolute concentricity of the two lapped holes in a workpiece, which is an important advantage in itself. The main elements may be of standard parts or assemblies readily obtained on the market at reasonable prices, thereby providing a machine which is economical to build.

Referring now to the accompanying drawings it will be noted that the machine comprises a frame-like structure consisting of a pair of identical A-shaped end members 10 arranged in spaced and opposed relation. The lower ends of the members 10 are adapted to rest directly upon a floor or other supporting surface. The upper ends of the members 10 are each provided with a cylindrical eye 12, between which eyes extends a cylindrical shaft or tube 14 with its opposite ends received therein and securely fixed thereto. Intermediate its top and bottom each frame member 10 is provided with an inwardly opening cylindrical socket 16, such sockets opening inwardly and receiving the opposite ends of a larger shaft or tube 18 which is rigidly secured therein. A flat bar 20 is extended between and rigidly connected to the lower portions of each frame member 10. Thus the tubes 14 and 18 and the bar 20 serve to rigidly interconnect the frame members 10 and coact therewith to form a rigid frame-like structure.

Mounted upon the tube 18 and in a spaced relation with respect to each other are a pair of heads indicated generally at 24. The heads 24 may be and are shown as of a well-known and conventional type manufactured for use as a part of a light, high speed drill press, and each head 24 is mounted on the tube 18 in identically the same manner that these heads are mounted on the post of a drill press when employed in connection therewith. In other words each embraces and is clamped to the tube 18 by means of clamping screws 26 and, when occasion requires, may be shifted axially of the tube 18 by loosening the screws 26 and moving the head to the desired axial position on the tube. Tightening up the

screws 26 serves to relock such heads in their so adjusted positions.

The two heads 24 are identical except for the minor differences hereinafter described, so that a description of one will suffice for both.

Each head 24 includes an axially movable quill 28, which rotatably supports therein a spindle 30 as by means of bearings 32, but which spindle is held against relative axial movement therein. The axes of the quills 28 and spindles 30 are parallel to the axis of the tube 18. In order to effect axial movement of the quills 28, each quill is provided with a rack 34 thereon in meshing relationship with respect to a pinion 36 fixed to a shaft 38 carried by such head, the rotatable position of which shaft is controlled by conventional hand wheel 40. At its outer end, each spindle 30 is nonrotatably but axially slidably associated with a step pulley 42 through which driving movement of the spindle is imparted. An electric motor 44 carried by each head 24 is provided with a complementary stepped pulley 46 connected to the pulley 42 by means of a V-belt 48, thus to provide a driving means for each head.

Each quill 28 has secured thereto adjacent to its inner end a flange member 50 to which is locked, as by means of a threaded connection therewith and lock nut 52, a stud 54 arranged with its axis parallel to the axis of the quill 28 and spindle 30. The stud 54 projects through an ear or lug 56 formed integrally with the housing of head 24, and nuts 58 threaded on the stud 54 on either side of the ear 56 are ordinarily employed to limit axial movement of the quill 28 in the head 24.

The inner end of each spindle 30 is provided with a chuck 60 in which is received a lapping element 62 the free end of which is coned or pointed as at 64 at a 60 degree angle to conform to the angle of the center holes to be lapped in a workpiece which may, for instance, be a plug gage such as indicated at 66.

It will, of course, be understood that the axes of the spindles 30 are aligned with each other. In this connection, in the drawings the heads 24 are disclosed as arranged with the shafts of the motors 44 in vertical alignment with the axes of the quills 28, spindles 30 and tubes 14 and 18, whereas in actual practice it is preferable that the axes of the quills 28 and spindles 30 be located forwardly, that is towards the observer as viewed in Fig. 1, out of vertical alignment with the plane connecting the axes of the tubes 14 and 18, as this renders the machine more accessible to the operator. The heads are shown in the position illustrated simply for ease in illustration. When the spindles are positioned forwardly as above described, then braces (not shown) may be employed between the tubes 14 and each head 24 and connected to the heads 24 at a point spaced from the axis of the tube 18, so as to positively locate and hold the heads with the axes of the spindles 30 in aligned relation with respect to each other. In practice the left-hand head 24 is preferably clamped in fixed position on the tube 18 and the quill 28 is clamped against axial movement, under which circumstances the handle 40 for moving such quill may be removed from the machine, and this is the arrangement shown.

In practice, the spindle 30 of the right-hand head 24 being retracted by the usual springs provided to rotate the corresponding handwheel 40 in a clockwise direction when relieving the pressure, the workpiece such as the plug gage 66 is placed between the lapping elements 62, the center hole at the left-hand end of the workpiece is guided upon the point 64 of the left-hand abrasive element 62 and the operator then rotates the handwheel 40 to bring the right-hand point 62 into the center hole at the right-hand end of the workpiece. The heads 24 being reversed, the abrasive elements 62 will rotate in opposite directions when the motors 44 are energized, so that all that is required of the operator is to lightly grasp the workpiece in his hand while positioned between the points 62 and apply the desired pressure to the handwheel 40 to cause the abrasive elements 62 to lap out the center holes in the workpiece. When the lapping elements 62 have been engaged with the center holes the length of time which experience indicates should be sufficient to properly lap them out, the operator simply relieves the pressure on the handwheel 40 and the right-hand spindle 30 is automatically withdrawn and the workpiece may then be removed. Thus, both center holes in the workpiece are quickly and easily lapped to final condition and in view of the fact that the abrasive elements 62 are aligned with each other, the center holes are bound to be lapped in alignment with each other, this overcoming a problem which is constantly present in construction where only one center hole is lapped at a time, as in the latter case extreme care must be taken to see that work is aligned with the lapping elements each time a center hole is lapped.

It often occurs that when hardened workpieces are received from a hardening operation foreign material has found its way into one or more of the center holes of the workpiece and requires to be mechanically removed before the lapping operation. In accordance with the present invention and to facilitate the removal of such foreign material the outer end of the spindle 30 for the right-hand head 24 has a conventional chuck 70 mounted thereon. A center drill 72, corresponding in size to the size of the center hole in the work, is mounted in the chuck 70 so that the workmen may remove the foreign material by simply pressing that end of the workpiece having the plugged center hole on to the center drill 72. In order to afford access to the center drill 72 the right-hand frame member 10 is provided with an opening 74 therein in alignment with the spindle 30.

The lapping elements 62 are preferably circular in section and formed from a fine abrasive material. The pointed ends 64 thereof wear away in service and require frequent dressing. In accordance with a further phase of the present invention the dressing of the points of the abrasive elements is accomplished as follows. A block 80 is rotatably mounted on the upper tube 14 and is held against axial movement and in axially adjusted position thereon by means of a pair of clamping collars 82 clamped to the tube 14 on either side of the block 80. The block 80 is of a longitudinally split type having a screw 84 projected across the line of split so that upon tightening up of the screw 84 the block 80 is caused to be clamped against rotation to the tube 14. The screw 84 is provided with a cross pin 86 to facilitate the turning of the same.

The block 80 has fixed thereto one end of a depending plate-like member 88 of a greater length and distance between the center of the tube 14 to the axes of the spindles 30. At its

lower edge, the plate 88 is provided on its forward face with a transverse block 90 arranged with the upper face thereof perpendicular to the plane of the face of the plate 88 and parallel with the axis of the tube 14. Upon such upper face of the block 90 is received the base of a triangular block 92, the sides of which are each arranged at an angle of 30 degrees with respect to the plane of its bore and therefore the upper face of the block 90, this being half the angle of the points 64 of the abrasive elements 62. A rigid downward extension 94 on the plate 88 is provided at its lower end with a screw 96, best brought out in Fig. 2, the end of which is adapted to contact the tube 18 when the plate number 88 is swung to one limit of its position, thereby to locate the triangular block 92 in proper relation with respect to the abrasive element 62 for a dressing operation.

The dressing operation, which is best brought out in Fig. 3, is accomplished by means of a diamond dressing tool consisting of a short cylindrical base 98 in which is axially secured a cylindrical holder 100 having a concentric diamond point 102. In practice, the cylinder 98 is rested in flat contacting relationship with respect to the angular faces of the block 92 and against the forward face of the plate 88, the screw 96 having been adjusted so that under such circumstances and when the screw 96 abuts the tube 18, the diamond point 102 and the axis of its holder 100 are arranged radially of the axis of the abrasive element 62. The spindles 30 being put into rotation, the quills 28 therefore are advanced until the points 64 of the lapping elements 62 are moved into dressing relationship with respect to the diamond point 102 under the circumstances stated, the diamond point assembly being first moved along one of the angular faces of the triangular block 92 to dress one of the points 64 and then being moved over to and moved along the remaining angular face of the number 92 to dress the remaining point 64. It will be appreciated that in this manner, the points 64 of the lapping elements may be quickly and accurately dressed. When the dressing operation is completed, the screw 84 is loosened and the plate 88 and associated parts are swung back out of interfering relation with respect to the work, the screw 84 is tightened to hold them in such position, and the lapping operation may then be resumed.

To further remove foreign material from the centers in the workpieces before the lapping operation and to aid in cleaning out the material removed from the workpiece and the abrasive elements during the lapping operation, after the lapping operation has been completed, it is desirable to direct the blasts of air into the center holes of the workpiece. In accordance with the present invention, this is accomplished by mounting a pair of nozzles 110, one on each head 24, with its point directed toward the corresponding center hole of the workpiece in the position which it occupies when supported between the abrasive elements 62, as shown. Each nozzle 110 is mounted upon one end of a bracket 112 the opposite end of which is clamped to the end of the corresponding quill by being received on the corresponding stud 54 between the corresponding flange 50 and the corresponding lock nut 52 as shown. Each nozzle 110 is connected by a tube 114 to a valve 116 which is mounted upon the right-hand head 24. The valve is mounted by means of a mounting stud 118 clamped in a bracket 120 suitably mounted on the housing for the right-hand head 24. Air is fed to the valve 116 through a tube 122 connected to any suitable source of air under pressure.

The valve 116 is provided with an operating handle 124 the free end of which is projected into the space between the left-hand nut 58 on the stud 54 for the right-hand head 24 and the lug or flange 56, and such nut is so adjusted that when its corresponding spindle 30 is advanced to operative position for lapping operation on a workpiece, the handle 124 is released and the valve 116 is closed. When the spindle 30 of the right-hand head 24 is withdrawn to remove the workpiece from between the lapping elements 62 and to insert a new workpiece, the last mentioned nut 58 strikes the free end of the handle 24 and opens the valve, thereby admitting air to the tubes 114 and nozzles 110. Thus, whenever the right-hand spindle 30 is withdrawn, to insert a new workpiece between the lapping element 62 and a workpiece is positioned to be received by the abrasive element 62, the center holes in the opposite ends will receive a blast of air from the nozzles 110 and, similarly, when the right hand spindle 30 is withdrawn to remove the workpiece from between the abrasive element 62, a blast of air will issue from the nozzles 110 into the center holes thus lapped in the workpiece to aid in removing any foreign material therein.

From the foregoing will be appreciated that the device of the present invention is of extremely simple construction and its main parts may be formed from standard drill heads readily available on the market at relatively low prices. It will also be appreciated that not only is the device of the present invention of value in cutting down the labor charges required for lapping the center holes one at a time but, in providing means for lapping both simultaneously, insures absolute alignment of the two center holes and this without requiring any special fixtures or the like for holding the workpiece during the lapping operation.

Having thus described my invention what I claim by Letters Patent is:

1. In a lapping machine, in combination, a support, a pair of heads mounted on said support in opposed and spaced relationship, means for locking said heads in adjustably spaced relation with respect to each other on said support, a quill axially slidably and nonrotatably carried by each of said heads in axially aligned relation with respect to each other, a concentric spindle rotatably supported by each of said quills and held against relative axial movement with respect thereto, means for driving said spindles in opposite directions of rotation, a pointed lapping element carried by each of said spindles in axially concentric relation with respect thereto, means for effecting relative axial movement between said spindles, an air nozzle directed approximately at the point of each of said lapping elements, a valve for controlling the flow of air through said nozzles, and means controlled by the relative movement between said spindles for operating said valve.

2. In a lapping machine, in combination, a support, a pair of heads mounted on said support in opposed and spaced relationship, means for locking said heads in adjustably spaced relation with respect to each other on said support, a quill axially slidably and nonrotatably carried by each of said heads in axially aligned relation with respect to each other, a concentric spindle rotatably

supported by each of said quills and held against relative axial movement with respect thereto, means for driving said spindles in opposite directions of rotation, a pointed lapping element carried by each of said spindles in axially concentric relation with respect thereto, means for effecting relative axial movement between said spindles, an air nozzle directed approximately at the point of each of said lapping elements, a valve for controlling the flow of air through said nozzles, and means carried by one of said quills engageable with said valve when said spindles are retracted relative to one another for opening said valve.

3. In a lapping machine, a pair of opposed and spaced tool heads each including a spindle and means for driving said spindle, means for supporting said heads with the spindles in axial alignment with each other, means for effecting relative axial movement between said spindles, lapping elements carried by said spindles and having working ends, an air nozzle directed approximately at the working end of each lapping element, valve means for controlling the flow of air through said nozzles, and means rendered operable by relative movement of the spindles to open said valve means.

4. In a lapping machine, a support, a pair of tool heads mounted on said support in opposed and spaced relation with respect to each other, axially aligned, rotatable spindles carried by said heads, at least one of said spindles supported for axial sliding movement relative to the other, means for axially advancing and retracting said slidable spindle, lapping elements carried by said spindles and having working ends, an air nozzle directed approximately at the working end of each lapping element, valve means for controlling the flow of air through said nozzles, and means actuated by axial sliding movement of said spindle for operating the valve.

GEORGE HOHWART.

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