Oct. 1, 1963 J. TORRES 3,105,328

APPARATUS FOR LAPPING THIN ARTICLES

Filed Nov. 3, 1960 3 Sheets-Sheet 1

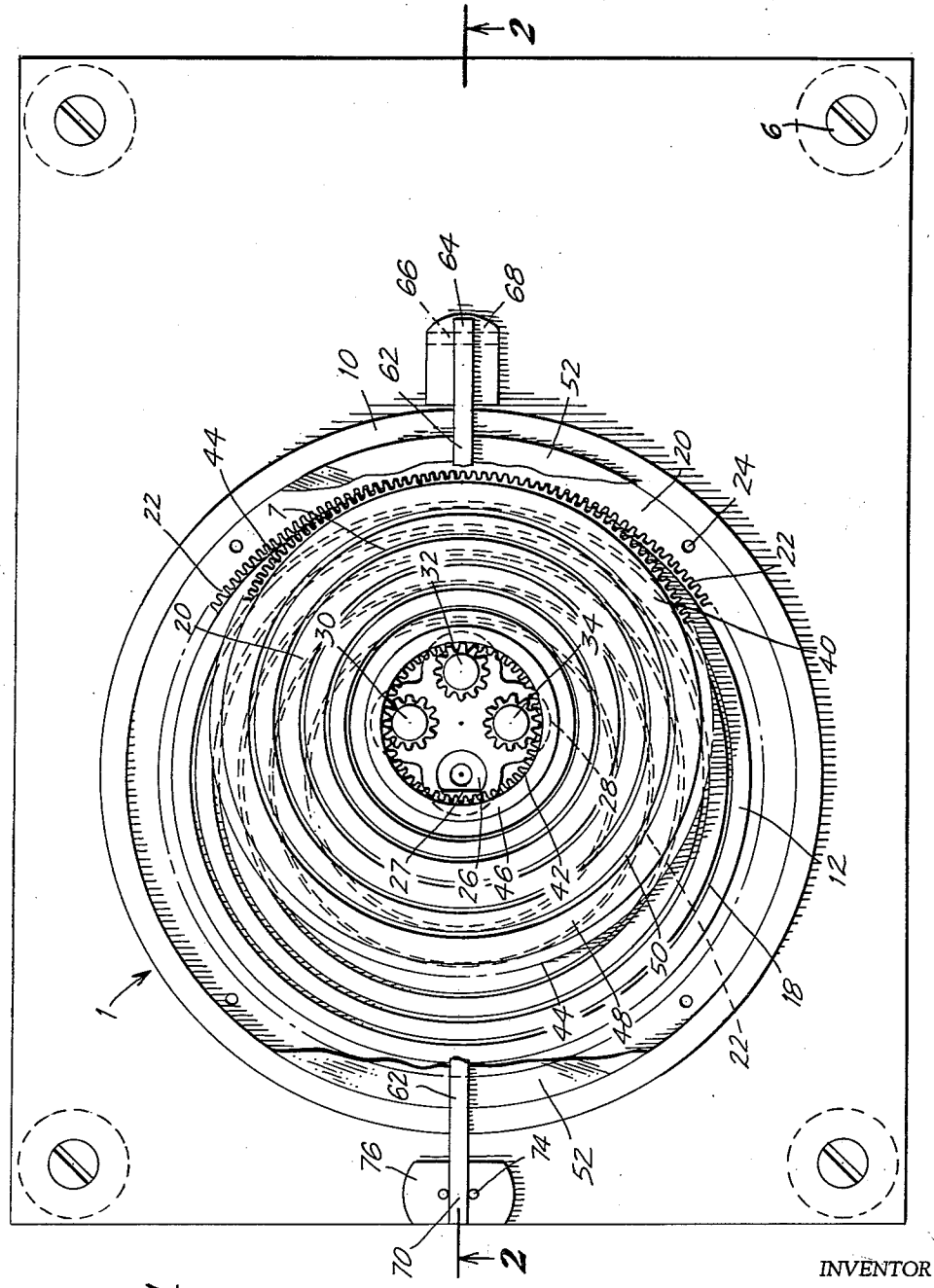


Fig. 1

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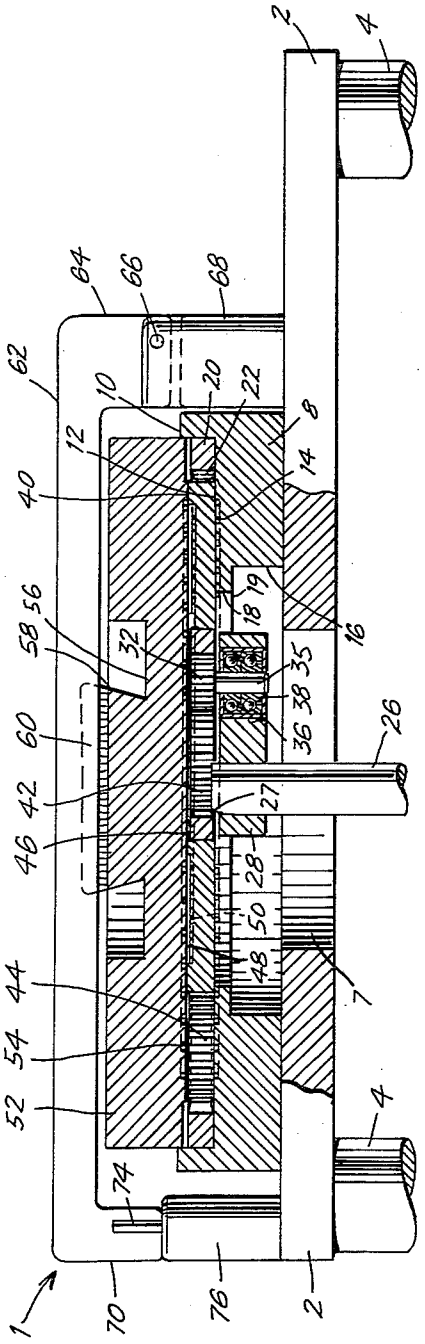


Fig. 2

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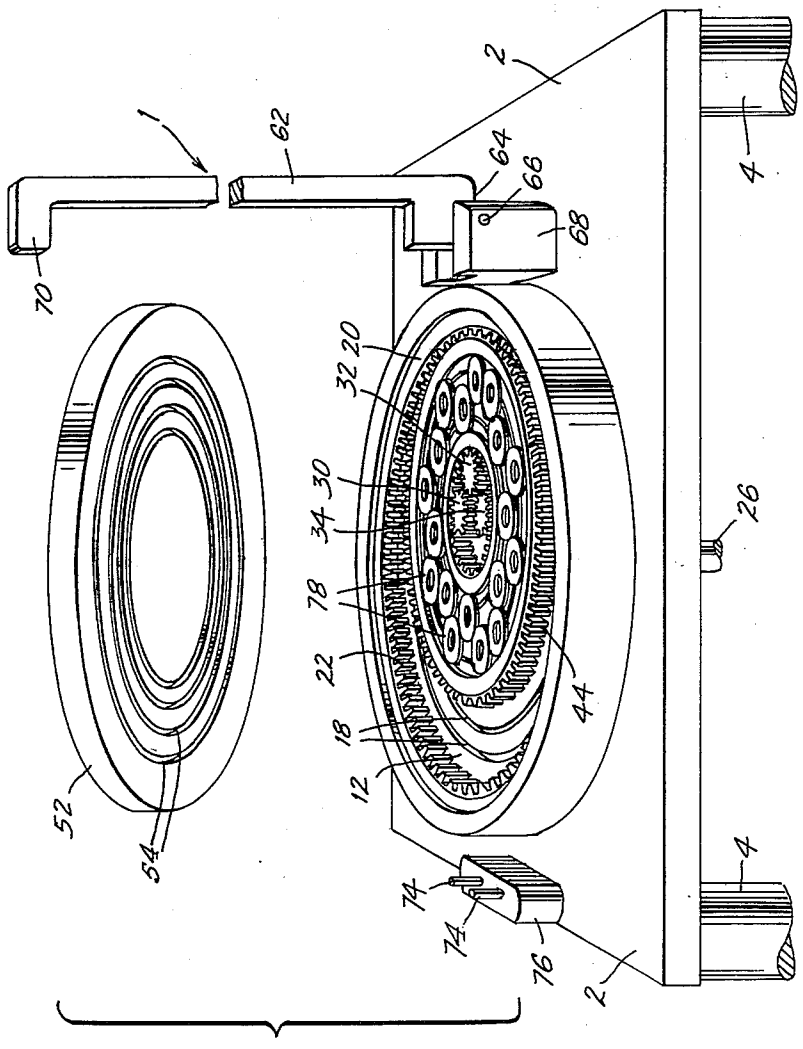


Fig. 3

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APPARATUS FOR LAPPING THIN ARTICLES

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8 Claims. (Cl. 51—3)

This invention relates to a lapping machine and more particularly relates to such a machine for lapping ultra-thin metal parts perfectly parallel to a desired thickness.

In the splitting of very thin metal foils into very narrow strips, it is imperative that the slitting cutters be perfectly flat and parallel. For example, in the manufacture of precision instruments such as watches, it is often necessary to provide metallic strips cut from .000125 inch thick foil and having a width of .005 inch. Since the cutters should be no thicker than the width of the strip to be cut, it is necessary that all the cutters be machined to an extremely close tolerance. Such cutters are usually finished by lapping. However, up to the present time, no lapping machine has been provided that can produce metal parts as fine as those now found necessary.

According to the present invention, it has now been found that by using a novel lapping concept, wherein the articles to be lapped are movably maintained between two relatively movable lapping plates, much better results can be achieved than was heretofore possible.

It is therefore a primary object of this invention to provide a machine for lapping very thin metal parts.

It is also an object of this invention to provide a simple and compact lapping machine for lapping to very close tolerances.

It is also an object of this invention to provide a lapping machine in which the bottom lap moves relative to the top lap.

It is a further object of this invention to provide a lapping machine wherein the articles to be lapped are freely movable relative to both the top and bottom laps.

It is another object of this invention to provide a lapping machine wherein the bottom lap moves relative to the top lap and wherein the articles to be lapped are maintained for free movement between the top and bottom laps.

It is still a further object of this invention to provide a machine for producing extremely thin parts.

These and further objects and advantages of the invention will become more apparent upon reference to the following specification and claims and appended drawings wherein:

FIGURE 1 is a partial plan view of the lapping machine of the present invention;

FIGURE 2 is a vertical elevation partly in section taken along line 2—2 of FIGURE 1; and

FIGURE 3 is a perspective view of the lapping machine of the present invention before it has been completely assembled.

Referring now to the several figures, a lapping machine, generally indicated at 1, is mounted on a table 2. The table is provided with suitable legs 4 which are attached in any desired fashion, such as by screws 6. The table is provided with an annular opening 7 for a purpose to be later described.

An annular lapping machine casing 8 is mounted on the table 2 so that it is coaxial with the hole 7. The casing 8 is preferably made with a raised outer portion 10 and a flat base portion 12. A number of grooves 14 are provided in the base portion 12. The base portion 12 is undercut at 16 to provide a lateral projection or ledge 18 which defines a central opening 19. The casing is provided with an internal gear 20 which can be made integrally with the casing, but is preferably made of a

softer material. As shown, the internal gear 20 having gear teeth 22 is a bronze ring which may be mounted in the casing 8 by force fitting or in any other suitable fashion. A plurality of screws 24 are provided for securing the gear to the casing and for securing this assembly to the table 2.

A shaft 26 which can be driven by any suitable motor, not shown, extends through the annular hole 7 in the table 2 and the opening 19 formed by the projection 18 of the casing 8. A plate or spider 28 carrying a cluster of planetary gears 30, 32 and 34 is fixedly mounted on the shaft 26. The gears 30, 32 and 34 are freely rotatable in the plate 28. For example, as shown in FIGURE 2, the gear 32 is provided with a shaft 35 that is journaled for rotation in an annulus 36 in the plate 28 by means of any suitable bearing 38. As can be seen from FIGURE 1, the plate 28 is eccentrically mounted on the shaft 26, the plate having four arms, in three of which are mounted the gears 30, 32 and 34. The shaft 26 is attached at the other of these arms.

A bottom lap plate 40 is provided with an internal gear 42 and an external gear 44 as is best seen in FIGURE 1. In the preferred embodiment, the external gear 44 is cut from the plate itself, which is preferably of steel while the internal gear is a bronze ring 46 which may be attached to the plate by force fitting or by any other suitable method. The external gear 44 of this bottom lapping plate is designed to engage the teeth 22 of the gear 20 of the casing 8 while the internal gear 42 of the bottom lap plate engages the cluster of three planetary driving gears 30, 32 and 34. The bottom lapping plate 40 is provided with a turned recess 48 which is charged with a suitable lapping compound. A plurality of concentric circular grooves 50 are formed in this recess to keep the lapping compound from being worked to the outside of the plate and out of the working area. The recess 48 is of a depth equal to the desired thickness of the finished parts.

A circular top lapping plate 52, preferably made of steel, is provided with a number of concentric circular grooves 54. As in the case of the bottom lapping plate, the top lapping plate is charged with a suitable lapping compound and the grooves 54 prevent it from being worked to the outside. The top of the plate 52 is provided with an annular groove 56 which forms a handle 58. The handle 58 extends above the surface of the plate 52 and is provided with a diametric groove 60.

A U-shaped locking bar 62 of any suitable material has one leg 64 pivotally mounted on a pin 66 carried by a bifurcated stud 68 which is mounted in any suitable manner on table 2. The other leg 70 of the locking bar fits between a pair of pins 74 mounted on a stud 76 which is mounted on the table 2 in any suitable fashion. The bar 62 fits in the groove 60 of the top lapping plate and secures it in position against turning. It is to be understood that any suitable locking mechanism for the top lapping plate could be used with equal facility and that the invention is not limited to the embodiment shown.

In operation, the metal parts or cutters 78 to be lapped are placed in the recess in the bottom lapping plate 40. As can be seen in FIGURE 3, the parts to be lapped keep each other from moving too freely and the vertical side wall of the recess 48 keeps them from moving off the lap, yet still allows the parts to move and rotate against the bottom of the recess, giving a lapping action to the bottom of the parts.

The top lapping plate 52 is then placed in position. The diameter of the top lapping plate is preferably such that it loosely fits in the lapping machine casing 8. The top lapping plate is then secured in position by the bar 62. The face of the top lapping plate rests on top of

the cutters and its weight provides the pressure for lapping.

When the motor is turned on, the shaft 26 rotates, causing the gear plate 28 to rotate. The cluster of planetary gears on the plate 28 engage with the internal gear teeth 42 of the bottom lapping plate causing the bottom lapping plate to move eccentrically on the base 12 of the casing 8. The eccentric motion of the bottom lapping plate 40 causes a section of its external gear 44 to engage with the internal gear 22 of the casing. As the bottom lap rotates under the weight of the fixed top lap, a lapping action is given to the top part of the parts being lapped. As stated above, the relative movement of the parts to be lapped with the charged recess in the plate 40 gives a lapping action to the bottom of the parts 78. When the parts are lapped down to their desired thickness, no further lapping action will take place because the top lapping plate will rest on the bottom lapping plate, while the workpieces are contained in the recess in the bottom lapping plate.

In a preferred embodiment of this machine, the pitch diameter of the internal gear of the bottom lapping plate is 1½ inches; the pitch diameter of the external gear of the bottom lapping plate is 5 inches; and the pitch diameter of the internal gear 22 of the casing 8 is 6 inches. A satisfactory speed of rotation for the cluster of planetary gears has been found to be 43.8 r.p.m. Using this machine, a number of cutters having a width of .005 inch can be made having perfectly flat and parallel surfaces.

It will be apparent from the foregoing that the present invention provides a simple and compact machine for lapping parts far thinner than has been previously possible. In addition, the invention provides a practical way for producing a plurality of very thin parts, all being perfectly parallel and having a uniform thickness.

The invention may be embodied in other specific forms without departing from the spirit or essential characteristics thereof. The present embodiment is therefore to be considered in all respects as illustrative and not restrictive, the scope of the invention being indicated by the appended claims rather than by the foregoing description, and all changes which come within the meaning and range of equivalency of the claims are therefore intended to be embraced therein.

What is claimed and desired to be secured by United States Letters Patent is:

1. In a lapping machine having a casing, an input shaft, a spider eccentrically mounted on said input shaft, at least one planetary gear carried by said spider, a lapping plate, said lapping plate having an internal gear and an external gear, said internal gear meshing with said planetary gear, a section of said external gear meshing with a section of a gear provided on said casing.

2. In a lapping machine having a casing, drive means, gear means eccentrically driven by said drive means, a first annular lapping plate having an internal gear and an external gear, said gear means meshing with said internal gear of said lapping plate and causing a section of said external gear to mesh with a section of an internal gear provided on said casing, and a second lapping plate, said second lapping plate being fixed relative to said casing whereby said first lapping plate moves eccentrically relative to said second lapping plate.

3. A lapping machine comprising in combination, a casing, said casing having an annular internal gear, a drive shaft extending through said casing, a spider eccentrically mounted on said drive shaft, at least one planetary gear mounted on said spider, a first annular lapping plate, said first lapping plate having an internal gear and an external gear, said external gear having a diameter less than the diameter of said annular gear, said planetary gear engaging said internal gear and causing said first lapping plate to move eccentrically, said eccentric motion causing a section of said external gear to engage a section of said annular gear, said first lapping plate supporting articles to be lapped, and a second lapping plate, said second lapping plate being supported by said articles to be lapped and being restrained from rotational movement.

4. The apparatus of claim 3 wherein said first lapping plate is provided with a recess in which are supported said articles to be lapped.

5. The apparatus of claim 4 wherein said recess has a depth equal to the desired thickness of said articles to be lapped.

6. The apparatus of claim 3 wherein said casing has an annular raised portion having an inside diameter slightly larger than the diameter of said second lapping plate.

7. The apparatus of claim 3 wherein said spider has four arms, one of said arms being fixedly attached to said driving shaft, and the others of said arms having planetary gears mounted therein.

8. In a lapping machine having a casing: said casing having a first gear means; second gear means; drive means for eccentrically driving said second gear means; a first lapping plate having third and fourth gear means; said second gear means meshing with said third gear means and causing a section of said fourth gear means to mesh with a section of said first gear means; a second lapping plate; said second lapping plate being fixed relative to said casing so that said first lapping plate moves eccentrically relative to said second lapping plate when said drive means drives said second gear means.

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