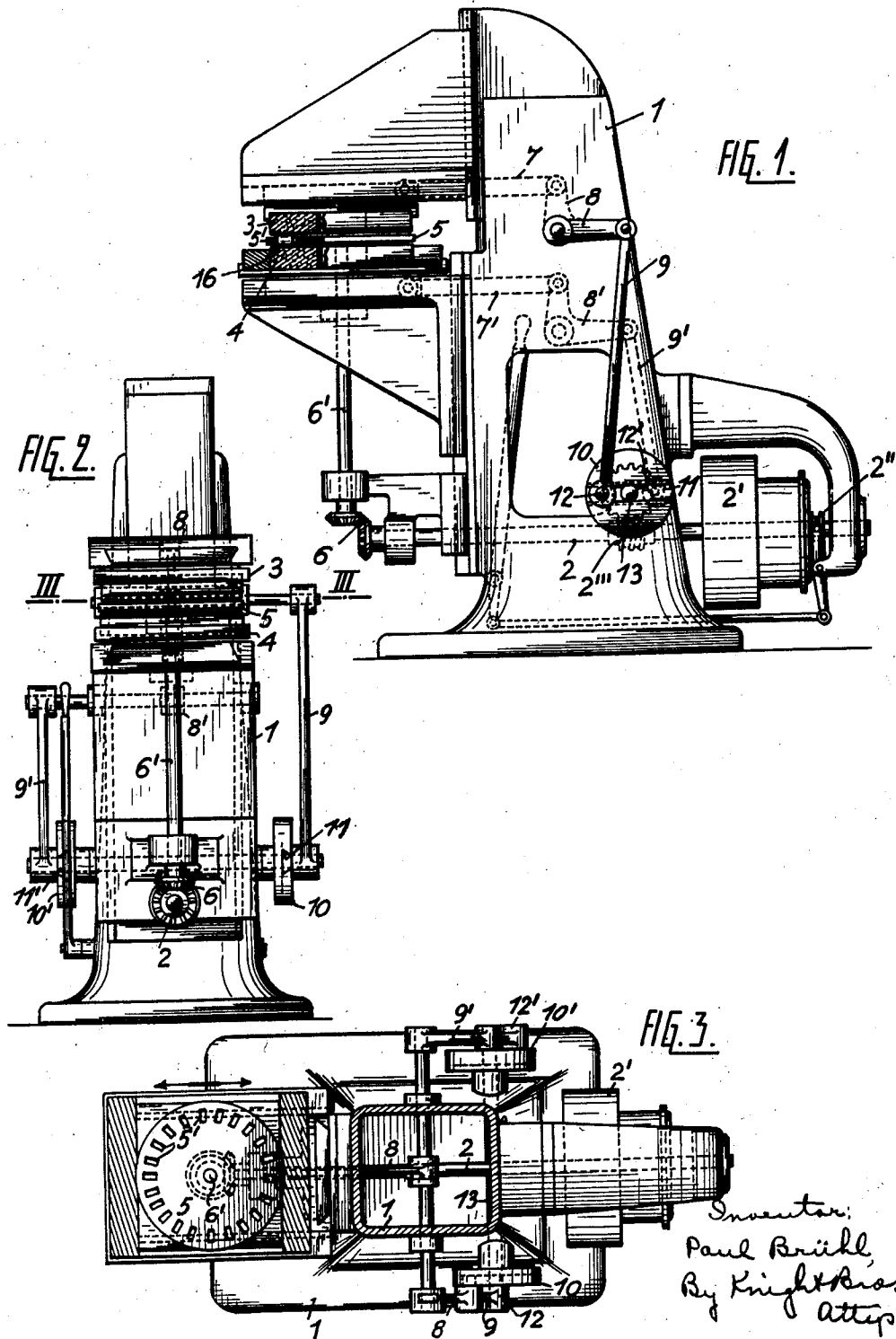


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P. BRÜHL
GRINDING MACHINE

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GRINDING MACHINE.

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My invention relates to a machine for the finish grinding of parts having parallel flat faces, such as gauge blocks, the side faces of rings for ball bearings, etc. or curved surfaces, such as balls and rollers.

It is an object of my invention to perform by mechanical means the operations which are performed in the hand grinding of such parts, and it is another object of my invention to provide a machine which will copy such hand operations by as simple means and as perfectly as possible. Such a machine is equipped with non-rotary grinding plates of old type.

In hand grinding, the operator displaces the parts on a stationary plate to and fro along substantially straight lines while describing circular curves so that the combined motion of the parts is along cycloids. While performing this operation, the operator periodically varies the position of the part with regard to his hand by partly turning it about an axis at right angles to the grinding plate.

In my improved machine, this combined motion is performed as follows:

The parts are placed in a cage of old type in which they are rotated bodily about the axis of the cage between two nonrotating but reciprocating grinding plates.

In this manner, all the motions are performed and all the conditions are fulfilled which have been found to be most suitable in hand grinding, but the motions are resolved into their components. While, in hand grinding one organ, the hand of the operator, imparts two motions, a straight and a circular one, these two motions are performed in my machine by two organs, the cage which performs the circular motion and the grinding plates which perform the straight-line motion. In both cases, however, the result is the same for in the machine the circular motion of the parts in the rotary cage is combined with the straight-line motion of the grinding plates into a cycloid, as in hand grinding, the partial turning about their axis at right angles to the grinding plate being effected by their motion in circular curves about the axis of the cage between the plates, due to the various velocities of the points at which they are engaged by said plates.

By providing two grinding plates instead of a single plate as in hand grinding, obviously the output will be increased and, at

the same time, the possibility is provided of reciprocating the plates in opposite directions, this involving the good feature that they are permanently maintained flat and it is not necessary to re-grind them periodically.

In my machine, all parts in a cage are ground exactly to the same dimensions and it is not necessary, as in the old machines, to vary the relative position of the parts in the cage periodically.

The grinding plates may be of grinding material or any other material of non-grinding properties, for instance, cast iron. In this latter case, a mixture of oil and emery is supplied to the grinding plates.

In the drawings, a machine embodying my invention is illustrated by way of example.

Figs. 1, 2 and 3 are an elevation, an end view from the left in Fig. 1, and a plan view in section along the line III—III of Fig. 2, showing a machine embodying the principles of my invention.

Referring now to the drawings, 1 is the frame of the machine in which a driving shaft 2 equipped with a step pulley 2' and a clutch 2'' is carried. 6 is a bevel gearing which imparts rotation to a vertical shaft 6' on which the cage 5 is secured concentrically, 5' designating recesses in said cage for the parts to be tooled, for instance, gauge blocks, rings for ball bearings, balls or rollers 16. 3 is the upper and 4 is the lower grinding plate which engage the parts in the cage on two sides. The distance apart of said plates may be adjusted by any suitable means, not shown, and if desired, they may be held onto the parts by springs, not shown.

Any suitable means may be provided for reciprocating said plates. In the present instance links 7, 7' are pivotally connected with the plate 3 and the slide 14 of the plate 4 at one end, and to bell-crank levers 8, 8' pivotally carried in the frame 1, at the other. Links 9 and 9' are connected to the other ends of said bell crank levers and to pins 12, 12' which pins are adapted to be displaced in slots 11, 11' of discs 10, 10' on the ends of a shaft 13 to which rotation is imparted by a worm gear 2''' on the main shaft 2.

By adjusting said pins 12, 12' in said slots any desired relative motion may be imparted to the plates 3 and 4. Displacing the plates in opposite directions is most favourable as in this case the points of contact will be varied most effectively, providing for reliable

action of the grinding plates on the parts and for reliable maintaining of the flat condition of the plates themselves. Such motion of the grinding plates is obtained when the pins are secured at opposite ends of their respective slots, as shown in Fig. 1, the plates 3 and 4 will move in opposite directions. If the pins are at the same ends of their slots, the plates will move in unison, and, if the pins are placed co-axially with the shaft, the plates will not move at all. Obviously, various intermediate stages may be provided by suitable adjustment of the pins. The operation of my machine will be understood from the foregoing description. The parts are bodily moved round and round between the reciprocating grinding plates until the operation is completed, and, as mentioned, it is not necessary to exchange the relative position of the parts in the cage in order to avoid irregularities in size. The continuous reciprocation of the grinding plates relatively to the parts, this reciprocation being such that the parts are ground

all over their surfaces, has the further advantage that the faces will remain flat without special operations for this purpose, viz, regrinding.

I claim:

1. Grinding machine comprising a pair of grinding plates, means for reciprocating said grinding plates, and a rotary cage between said plates in which the parts to be ground are inserted.

2. Grinding machine comprising a pair of grinding plates, means for alternately reciprocating said plates, and a rotary cage between said plates in which the parts to be ground are inserted.

3. Grinding machine comprising a pair of grinding plates, means for reciprocating said grinding plates, means for varying the stroke of said grinding plates, and a rotary cage between said plates in which the parts to be ground are inserted.

In testimony whereof the foregoing specification is signed.

PAUL BRÜHL.