(No Model.) 3 Sheets—Sheet 1.

D. H. CHURCH.

GRINDING MACHINE.

No. 494,058. Patented Mar. 21, 1893.

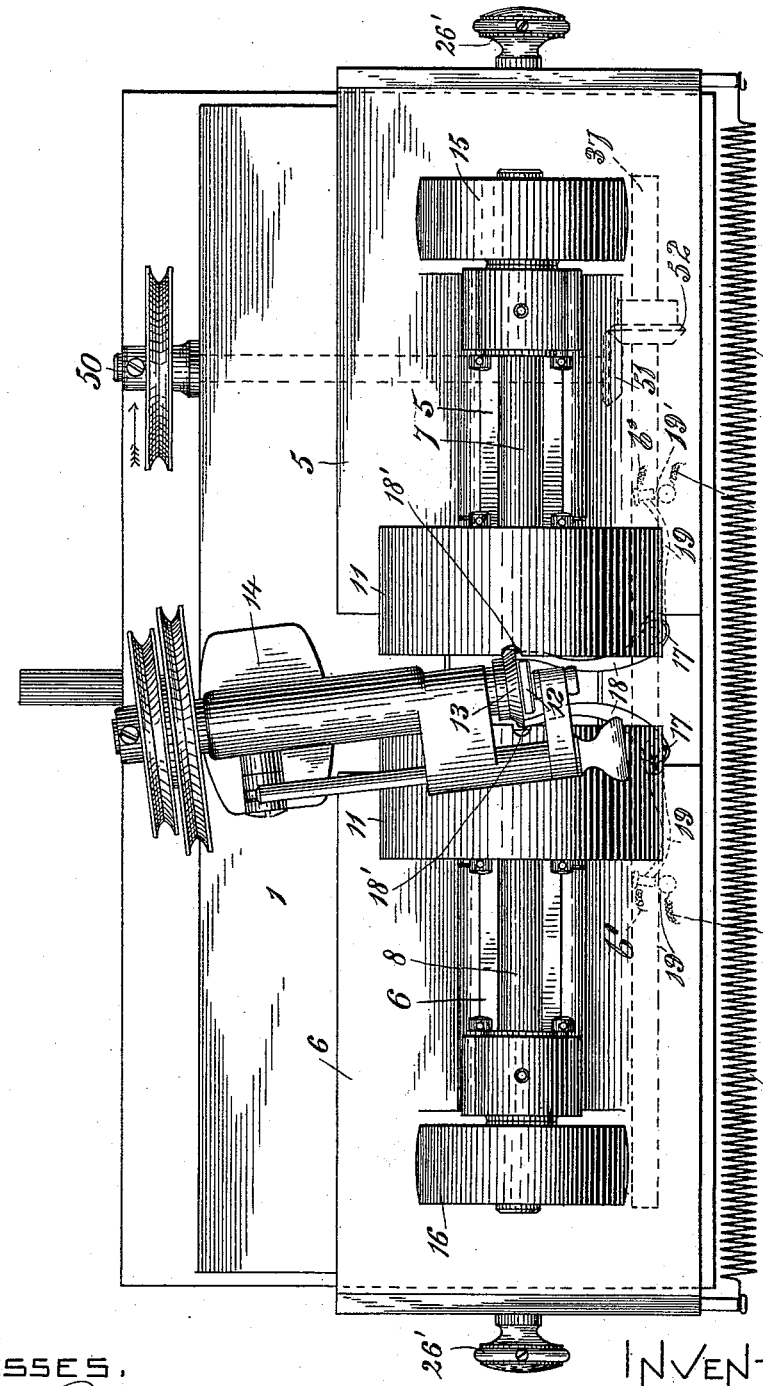

FIG. 1.

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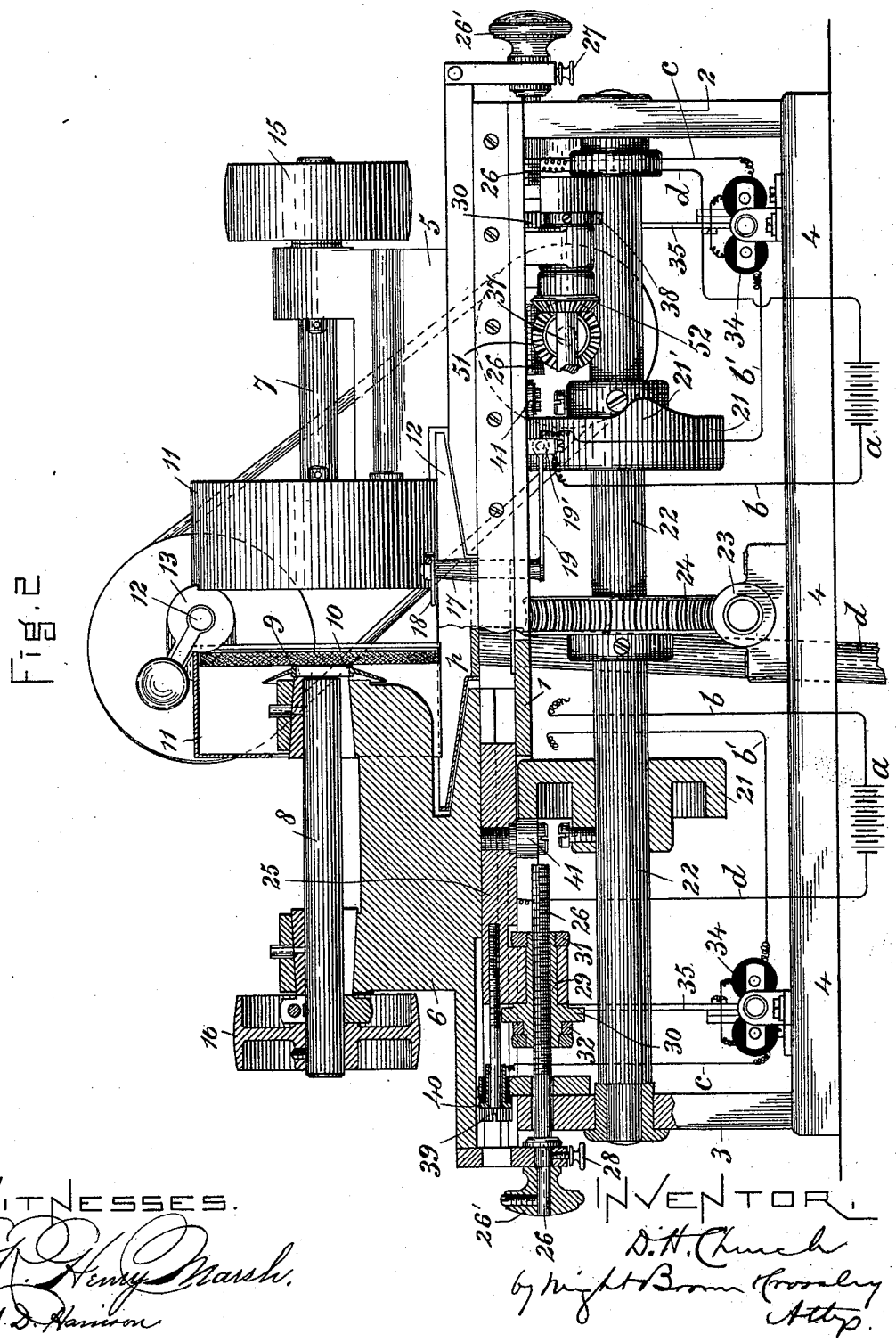
Fig. 2.



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(No Model.) 3 Sheets—Sheet 3.

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FIG. 4.

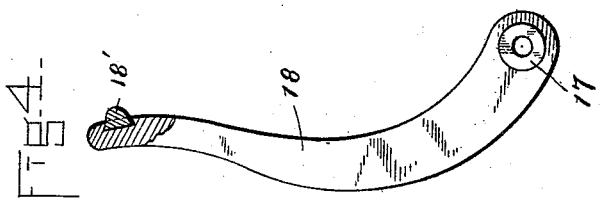
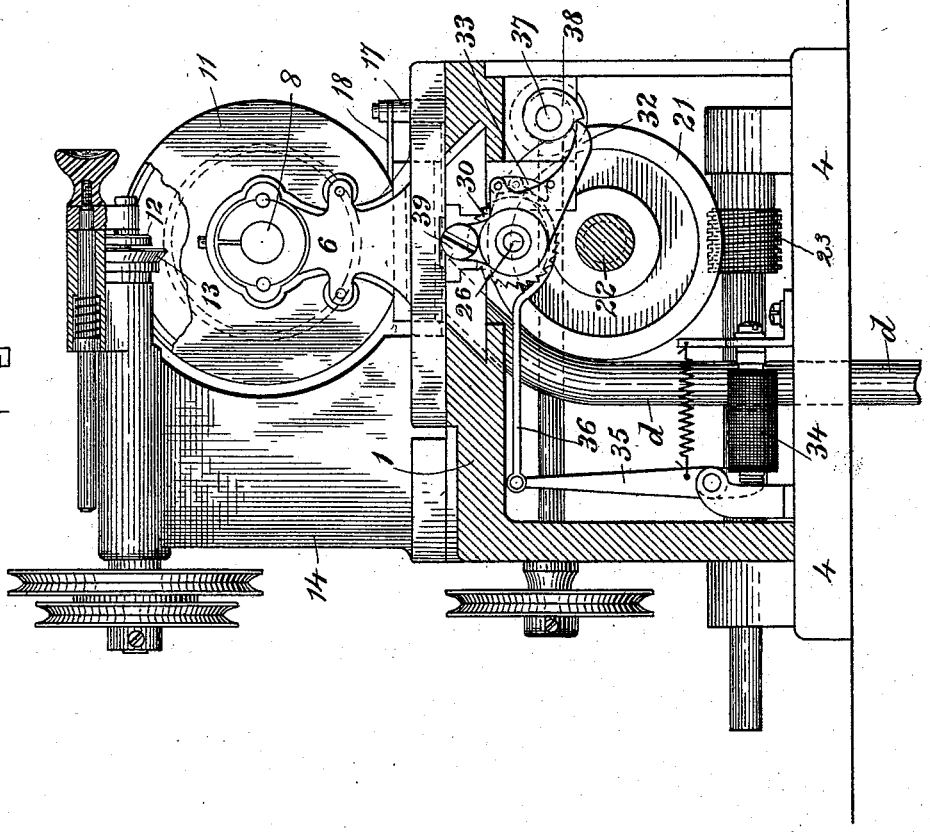


FIG. 5.



WITNESSES.

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UNITED STATES PATENT OFFICE.

DUANE H. CHURCH, OF WALTHAM, MASSACHUSETTS.

GRINDING-MACHINE.

SPECIFICATION forming part of Letters Patent No. 494,058, dated March 21, 1893.

Application filed March 1, 1892. Serial No. 423,416. (No model.)

To all whom it may concern:

Be it known that I, DUANE H. CHURCH, of Waltham, in the county of Middlesex and State of Massachusetts, have invented certain new and useful Improvements in Grinding-Machines, of which the following is a specification.

The object of this invention is to produce a means for grinding the peripheries of disks, to make them of a uniform diameter.

The invention is particularly adapted to the grinding of watch dials, and consists of a means for automatically compensating for the wear of the grinding surfaces, and so adjusting them relatively to the dial holder, as to cause each dial to be ground of exactly the same diameter, regardless of the wear of said grinding surface, caused by the previously ground dials.

In order that the invention may be fully understood I will proceed to describe it with reference to the accompanying drawings, in which—

Figure 1 represents a plan of a machine constructed according to my invention. Fig. 2 is a front elevation partly in section. Fig. 3 is an end elevation partly in section. Fig. 4 is an enlarged sectional view of one of the parts of the machine.

The frame of the machine consists of a bed 1 supported by legs 2 3 and base 4. Mounted on the bed 1 are slides 5 6 constructed to carry and support shafts 7 8 provided at their inner ends with holders 9 for carrying the substance desired to form the grinding surface. In the present case it is desired to use emery laps 10 for this purpose, and said laps are incased in suitable housings 11 11 which serve to protect them, and at the same time confine any dust or particles removed during the grinding operation.

Beneath the housings 11 11 is a pan *p* from which extends a duct *d*, for receiving and carrying off water which is supplied during the grinding operation.

Mounted on the bed 1 is a standard 14 which supports and carries the dial holding and operating devices 12 13 which are or may be of any suitable construction. When used for grinding watch dials it is preferred that the holding device 12 13 be obliquely disposed in relation to the shafts 7 8 to an extent corresponding to the desired bevel to be given to the periphery of the dials. Shafts 7 8 together with holders 9 and laps 10 are driven from any desired source by pulleys 15 16 respectively.

Mounted in the bed 1 are two vertical shafts 17 provided with arms 18 19 at their upper and lower extremities respectively. The arms 18 extend inward (between the grinding surfaces 10) and are provided on their extremities with diamond stops 18′, and said arms 18 are placed to bring the stops 18′ at a distance apart corresponding with the desired diameter of the dial to be ground. Thus the stops act as a caliper for measuring each dial, for the grinding of the dial continues until the faces 10 come in contact with the stops 18′ at which point the grinding ceases as hereinafter explained. The arms 19 are normally in electrical contact with binding posts 19′ and are separated from the latter to break the connection by the contact of the stops 18′ with the grinding surface 10. The slides 5, 6 have a longitudinally reciprocating motion, moving simultaneously toward and away from each other. They approach each other through the medium of spring 20, and are separated by cams 21 mounted on main shaft 22 which is journaled in the legs 2, 3 of the frame. Said main shaft 22 derives motion from worm 23 and gear 24.

Beneath the slides 5, 6 are supplemental take up slides 25 which are adjustably connected with the slides 5, 6 by screw shafts 26 attached to the slides 5, 6 by set screws 27 28 and to the take up slides 25 by internally threaded sleeves 29 carrying ratchet wheels 30. The slides 25 are held from endwise movement by ratchets 30 and nuts 31. These take-up slides 25 are for the purpose of adjusting the grinding surfaces 10 as they become worn, and cause them to bear the same relation to each other regardless of wear. Their operation is more particularly described hereinafter.

Mounted on sleeves 29 are arms 32 carrying pawls 33 which are brought into operation with the ratchets 30 by magnets 34 through the medium of connections 35 36, connection 35 being a lever pivoted at 35′ to a fixed support and having the armature 35″ of the electro magnet attached to one of its ends.

Beneath the bed of the machine is a shaft 37 (driven by any convenient means such as the shaft 50 and gears 51 52, as shown in Fig. 1). This shaft 37 carries cams 38 which act on the arm 32 and cause the pawls 33 to operate on ratchets 30. This shaft 37 is continuously driven, but the cams 38 have no effect except when the pawls 33 are thrown into engagement with the ratchets 30. This is caused by stop screws 39 forming part of the electric circuit and carried by slides 25, said screws coming in contact with insulated stops 40 located beneath slides 5 6. Two electric circuits are here shown each including a battery *a*, a wire *b* connecting one pole of the battery with a binding post 19', a wire *b'* connecting the arm 19 (which makes contact with said binding post) with an electro magnet 34 a wire *c* connecting said electro magnet with one of the insulated stops 40, and a wire *d* connecting one of the slides 25 with the opposite pole of the battery. The screw 39 is also included in the circuit, it being in metallic contact with slide 25. The shank of screw 39 passes through the insulated stop 40 without contact therewith, so that there is no contact until the head of the screw touches said stop. The circuit is in condition to be closed by the contact of screw 39 with stop 40 so long as arm 19 is in contact with binding post 19' but when said arm is separated from said binding post the circuit is broken and cannot be closed by the screw 39 and stop 40.

The take up slides 25 are provided with rollers 41 through which motion is imparted to slides 5 6 from cams 21.

The operation of the machine is as follows, assuming that the grinding surfaces 10 10 are fresh and not worn. The dial to be operated upon is placed in the holder 12 13 the slides 5 6 being separated. The machine is now set in motion. The dial holder revolves the dial at the desired speed. The pawl actuating shaft 37 through cam 38 operates on arm 32, thus oscillating pawls 33. Worm 23 drives shaft 22 and cams 21 allow the spring 20 to draw the slides 5 6 slowly toward each other, and the grinding surfaces 10 grind down the periphery of the dial until said surfaces come in contact with stops 18'. At this point the dial is completed, and stop screws 39 come in contact with stops 40 and make electrical connection to throw pawls 33 into engagement with ratchets 30. Simultaneously however the electrical connection is broken at 19' by stops 18' coming in contact with the grinding surfaces 10 and the pawls are thrown out of operation before cam 38 has time to act on arm 32. The portions 21' of cams 21 now act on rollers 41 and separate the grinding surfaces. At this point, if desired, the machine is stopped by any suitable shipping device, the completed dial is removed, and an unfinished one is inserted. The machine is again set in motion, and the grinding operation proceeds as before until the stop screws 39 come in contact with stops 40 and make the electrical connections which cause magnets 34 to operate pawls 33 through the connections 35 36. Up to this point the operation of the machine is precisely the same as upon the previously ground dial, but in the grinding of said dial and also the one being operated upon, the grinding surface has become worn off to a certain extent, consequently the dial being operated upon is as much larger than the previous one as the amount of grinding surface removed by the operation, and when stop screws 39 and stops 40 make connection, the grinding surfaces fail to make connection with stops 18' by exactly a distance corresponding to the amount of surface removed by the grinding operation. At this point of the operation the electrical circuit is closed and pawls 33 are in position to operate upon ratchets 30. Cams 38 consequently act on arms 32 and at each revolution of shaft 37 cause the pawls to rotate the sleeves 29 one notch of the ratchets 30. The sleeves act on the screw shafts 26, and feed the slides 5 6 inward toward each other independently of slides 25, until the grinding surfaces 10 come in contact with the stops 18'. This latter contact breaks the electrical circuit and pawl 33 is thrown out of operation. The second dial is now complete, and of an exact size with the previously ground one. Cam 21 now separates the grinding surfaces, and the shipping device stops the machine in a position for the operator to remove the finished dial and proceed as before. When the grinding surfaces have been entirely worn off and it is desired to place a new lap in the holders 9, the screw shafts 26 are set back to the first position by releasing set screws 27, 28 and turning the shaft 26 by hand wheels 26'.

I do not confine myself to the exact means shown and described for taking up the wear of the grinding surfaces, as any suitable mechanical means could be substituted for those shown.

The invention is not limited to the conjoint use of the two grinding mechanisms here shown and one of said mechanisms may be omitted without departing from the spirit of the invention. It will be seen that each grinding device has a normal or primary and a supplemental or compensating feed movement adapted to advance it upon the work. Said normal or primary movement is caused as here shown by the spring 20 which moves the main slide supporting the shaft of the grinding device toward the work. The supplemental feed movement is effected by means of the supplemental slide 25 which is arrested by the retracting cam 21, when the main slide has completed its normal grinder feeding movement, the internally threaded sleeve or nut 29 engaged with the supplemental slide, the screw shaft 26 engaged with said nut and with the main slide, and the automatic actuating mechanism made operative by the normal movement of the main slide, for rotating said nut at the completion of the said

normal movement, said rotation causing the nut to give the main slide an additional or compensating feeding movement. It will also be seen that the extent of said compensating feed movement is determined by an automatic stop device or mechanism which makes the said automatic actuating mechanism inoperative when the grinding surface reaches a predetermined position. It is manifest that as the cam 21′ does not stop its rotation during the time of contact at 39, 40, said cam must have a rest or portion removed long enough to permit the compensating feed mechanism time to move the grinding lap forward to the extent of the wear for each piece ground before the greatest elevation of the screws separates the slides and the machine is stopped by the shipping device. It is better to allow a surplus of time, as this makes allowance for uneven wearing laps, and has no other effect than to leave the edge of the lap in contact with the work for such surplus without further movement. It is also evident that if the cam shaft 22 should be stopped in a position which permits the electrical contact at 39, 40, the machine would be equally operative, the only difference being that the laps would have to be retracted by means of the feed screws 26 and hand wheels 26′.

I believe myself to be the first to combine with a grinding lap and a feed mechanism which causes a progressive action of the lap upon the piece to be ground, an automatic stop which renders the feed mechanism inoperative when the piece is reduced to a predetermined size, the feed motion continuing until the piece reaches said size and then stopping, so that the size imparted to the piece by the grinding operation is not affected by wear of the grinding lap, hence I do not limit myself to the details and organization of the said combination here shown and described.

The mechanism whereby the compensating feed movement and its automatic arrest may be effected may be variously modified and I do not confine myself to the particular organization and details of mechanism here shown.

I claim—

1. The combination of a grinding lap, a feed mechanism which causes a progressive action of the lap upon the piece being ground, and an automatic stop whereby said feed mechanism is rendered inoperative when the piece is reduced to a predetermined size, as set forth.

2. In a grinding machine, the combination of a movable grinding device, a normal feed mechanism, a compensating feed mechanism which is made operative by said normal feed mechanism to give the grinding device a movement in addition to its normal movement, and means for automatically arresting said compensating movement when the grinding surface reaches a predetermined position.

3. In a grinding machine, the combination of a movable grinding device, a normal feed mechanism, a compensating feed mechanism, an electric circuit and an electrically controlled device for making said compensating feed mechanism alternately operative and inoperative, a circuit closing device operated by the normal movement of the grinding device to make said compensating feed mechanism operative, and a circuit breaking device which makes said compensating feed mechanism inoperative when the grinding surface reaches a predetermined position.

In testimony whereof I have signed my name to this specification, in the presence of two subscribing witnesses, this 31st day of October, A. D. 1891.

DUANE H. CHURCH.

Witnesses:
E. A. MARSH,
A. D. HARRISON.