June 10, 1930. F. D. VAN NORMAN 1,763,201

MAGNETIC THROW-OFF FOR GRINDING MACHINES

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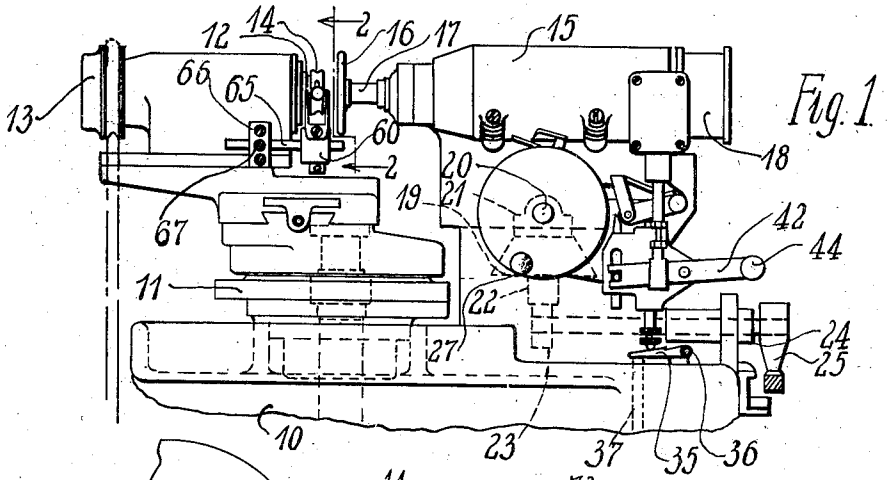


Fig. 1

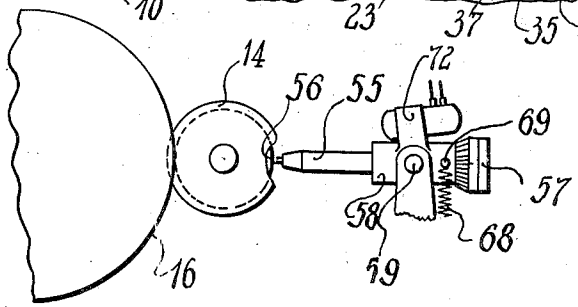


Fig. 2

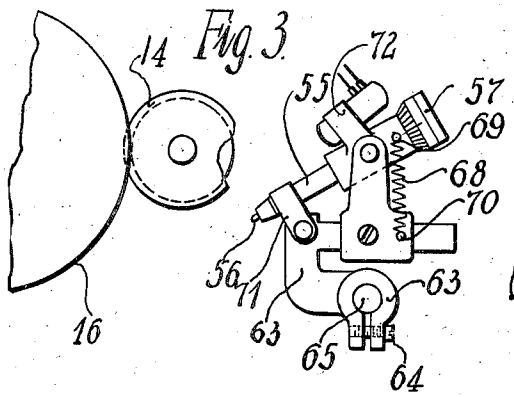


Fig. 3

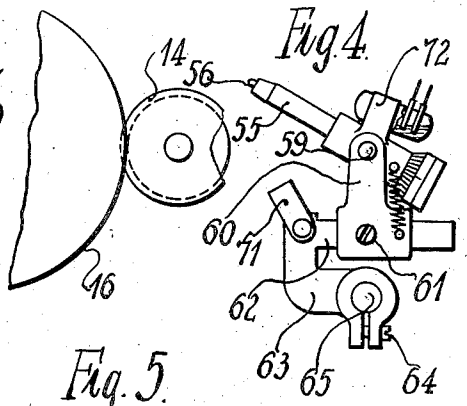


Fig. 4

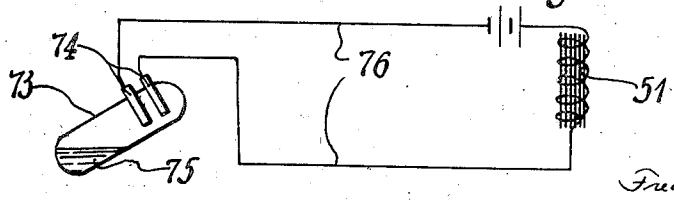


Fig. 5

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Fig. 6.

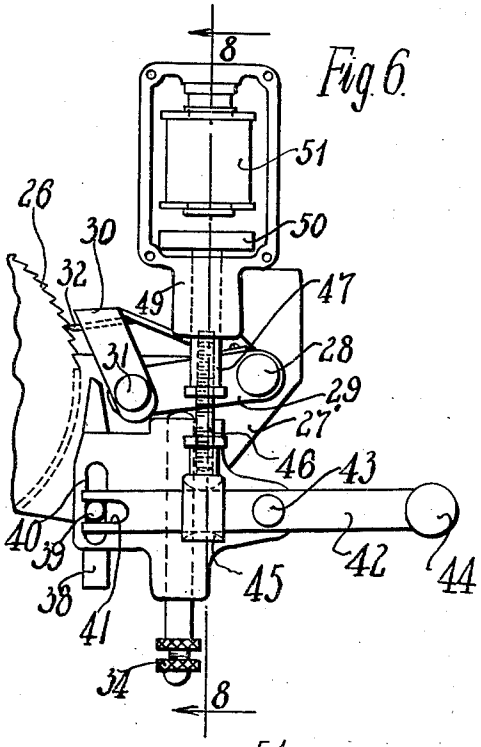


Fig. 7.

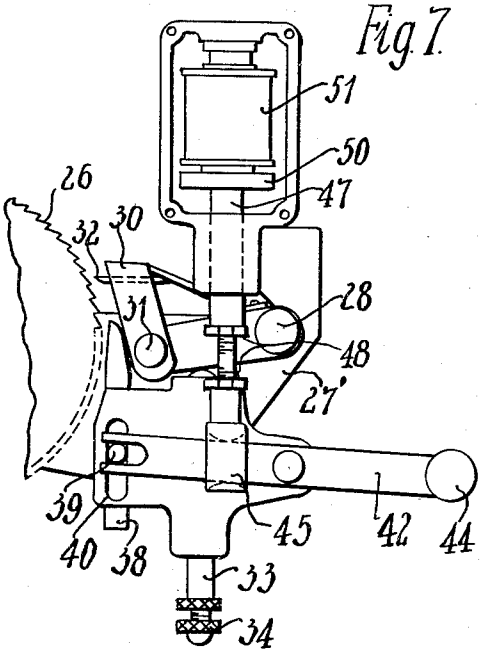
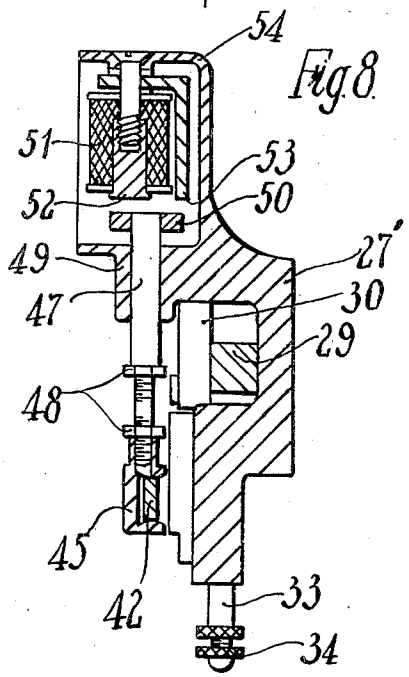


Fig. 8.



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UNITED STATES PATENT OFFICE

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MAGNETIC THROW-OFF FOR GRINDING MACHINES

Application filed May 18, 1928. Serial No. 278,892.

The present invention relates to precision grinding machines, and has for its object the provision of automatic means for stopping the relative approach of the work and the grinding element when the dimensions of the work reach a predetermined point. While the invention will be illustrated in connection with a grinding machine of the oscillating type it is applicable also to other varieties with only such changes as will be apparent to those skilled in the art.

Referring to the drawings,

Fig. 1 is a partial side elevation of a grinding machine embodying my invention;

Fig. 2 is a detail, on line 2—2 of Fig. 1, of a gauge or feeler operated by the work to cause actuation of certain other parts, the feeler being shown in the position in which it is about to operate the feed-stopping mechanism;

Fig. 3 is a similar view showing the feeler in an inactive position;

Fig. 4 is a similar view showing the feeler in the position it assumes after it has operated;

Fig. 5 is a wiring diagram;

Fig. 6 is an enlarged side view of a portion of the apparatus shown in Fig. 1, with a cover plate removed;

Fig. 7 is a similar view showing the parts in a different position of operation; and

Fig. 8 is a section on line 8—8 of Fig. 6.

The machine as shown is generally of the type illustrated in the patent to C. E. Van Norman, Reissue 13,892, dated March 16, 1915, and in the application for patent filed by C. E. Van Norman, Serial No. 105,458, filed April 29, 1926. The machine is mounted on a base 10, the most of which, together with the main operating mechanism, has been omitted from the drawings as not necessary to an understanding of the present invention. Suitably journaled in the base 10 for oscillation about a vertical axis is a work head 11, preferably fitted with adjustment slides in the usual manner. A work holder 12 is mounted in the head for rotation upon a horizontal axis by means of a pulley 13, and carries by any suitable chucking device the article 14 to be worked upon. In the present case the article 14 is illustrated as the cone of a ball bearing.

In opposition to the oscillating work head is a tool head 15, bearing a grinding wheel 16 upon a shaft 17 adapted for rotation by means of a pulley 18. The tool head is slidably mounted upon the base 10, and is also movable relative to a dovetail slide 19 also slidably mounted in the base independently of the tool head. A screw 20 is secured against endwise movement in the dovetail slide and has a nut 21 fitted upon it. This nut is secured to the tool head whereby upon rotation of the screw the tool head will be moved slowly forwards or backwards to provide an accurate feeding adjustment of the grinding wheel relative to the work. To move the tool head quickly out of the way in order to permit the work to be replaced, slide 19 is provided with a rack 22 with which meshes a pinion 23 on a shaft 24 journaled in the base and bearing at its outer end a lever 25. This mounting of the tool head, with certain refinements not necessary to describe here, is described and claimed in the application of Charles E. Van Norman, Serial No. 268,712, filed April 9, 1928.

To secure automatic advance of the tool head I prefer to actuate the screw 20 by mechanism substantially as shown in the Reissue Patent 13,892 cited above. This mechanism comprises a ratchet wheel 26 mounted on the screw or suitably geared to it, and provided with a handle 27 for coarse adjustment; and pawl mechanism actuated periodically during the operation of the machine. A bracket 27′ is mounted upon the slide 19 adjacent the ratchet wheel, and has pivoted to it at 28 a pawl carrier 29. Upon this carrier a pawl 30 is pivoted at 31, bearing on its end a small detent or blade 32 which coacts with the fine teeth on the ratchet wheel.

A rod 33 is slidably mounted in the bracket so as to strike the under side of the pawl carrier 29 when the rod is raised vertically, causing the ratchet wheel to be moved a number of teeth dependent on the amount of movement given to the rod. The

lower end of the rod has an adjustable tappet 34 positioned to be struck by a lifter plate 35 pivoted at 36 to the base and operated periodically by a rod 37 controlled by any suitable cam mechanism. Suitable operating devices are described in the reissue patent referred to.

Also vertically slidable in the bracket 27' is a striker 38 movable into contact with the under side of pawl 30. A pin 39 on the striker projects through a slot 40 in the bracket, thus preventing rotation of the striker, and extends into the forked end 41 of a lever 42 pivoted to the bracket at 43. A handle 44 at the other end of the lever 42 serves to permit manual actuation where desired, and is designed to possess a weight sufficient both to counterbalance substantially the weight of the parts operated by the lever, and to impart additional mass to the lever system in order to assist a momentum effect described below.

Loosely embracing the lever 42 is a yoke 45 joined to a rod 46 threaded into a second rod 47 and held in adjusted position by nuts 48. The rod 47 slides in a bearing 49, and carries at its upper end an armature 50 disposed adjacent the end of an electromagnet 51. The armature is acted on by the lower pole 52 of the magnet and by an iron strip 53 bent around from the upper pole to a point on the same level as the lower pole. The magnet is conveniently enclosed in a casing 54 attached to the tool head and carrying the bearing 49.

The magnet is preferably energized by mechanism contacting with and controlled by the work piece and operable to complete the electrical circuit through the magnet coils as soon as the work is ground to a predetermined size. This mechanism in the embodiment shown comprises a feeler 55, carrying on its end a diamond or other hard work-contacting surface 56, and adjustable by a micrometer head 57 movable in a support 58. This support is pivoted at 59 in a yoke member 60 adjustably held by a set screw 61 on a rod 62 projecting from a bracket 63. The bracket 63 is adjustably held by a clamp screw 64 on a rod 65 held to a bracket 66 on the tool head by a screw 67.

The feeler is constantly urged clockwise as viewed in Fig. 2 by a spring 68 strained between a pin 69 on the support 58 and a pin 70 on the yoke member. In the normal operation of the machine this spring urges the end of the feeler upwardly against the surface of the work piece being ground, as is indicated in Fig. 2. When the size of the work piece has been reduced to the magnitude for which the device has been set, the end of the feeler slips by, and the spring draws it to the position of Fig. 4. When a new work piece is being placed in the machine the feeler must be held out of the way, a spring clip 71 secured to the bracket 63 being convenient for this purpose.

On the upper side of the support 58 is mounted a clip 72 holding a switch of the mercury contact type, comprising a tube 73 into which contacts 74 are sealed. A small quantity of mercury 75 is also sealed into the tube, short-circuiting the contacts when the tube is tilted as in Fig. 4 and flowing away from the contacts to open the circuit when the tube is tilted as in Fig. 5. The contacts 74 are connected by a wire 76 in series with a battery 77 or other current supply and with the coil of the electromagnet 51.

One property of the described mechanism is of great value in insuring the prompt stoppage of the ratchet wheel. As the armature 50 approaches the magnet poles 52, 53 the force of attraction increases vary rapidly. At the same time the momentum of the striker 38 and the counterbalanced lever 42 likewise increases rapidly, so that when the striker hits the pawl 30 it gives it a hammerlike impact blow effectively driving the detent 32 out of engagement with the ratchet teeth. The striker and the parts associated with it have a length of free travel, that is, travel after the magnet is energized and before the striker hits the pawl, of substantial extent, so that the momentum of the parts may have a chance to be built up before the resistance of the pawl is encountered. If it is desired to disengage the pawl from the ratchet wheel manually it can be done by giving the handle 44 a sharp push or blow with the hand.

After the magnet has been energized by the tilting of the mercury contact switch it is necessary to rock the feeler 55 again to the position of Fig. 3 and thus de-energize the magnet before the insertion of a fresh work piece. As it is not desirable to have the feeding movement of the grinding wheel start up at this period, which would occur were the lever 42 and the striker 38 permitter to resume the positions shown in Fig. 6 when the magnet is de-energized, means are preferably provided for holding the striker up until it is manually released. If the lever 42 were exactly counterbalanced the inertia of the parts alone, or assisted by the inevitable friction, might be sufficient to prevent the striker dropping. Preferably, however, the armature 50 is arranged actually to contact with the core of the electromagnet, whereby the residual magnetism of the latter will prevent the armature from dropping until the lever 42 is manually shifted.

Other types of switch control, other forms of work-measuring devices, and variant details of mechanism, such as the substitution of a solenoid and plunger for the

electromagnet and armature, may be employed as may be desired without departing from the invention as pointed out in the appended claims.

I claim:

1. A machine of the class described comprising a feed ratchet, a pawl for rotating the ratchet, a striker movable through a substantial free travel to contact with the pawl to disengage it from the ratchet, a work-controlled electromagnet, an armature movable by the force of the electromagnet and normally spaced from it, and mechanism coupling the armature and striker and so proportioned that a movement of the armature causes a movement of the striker of greater amplitude.

2. A machine of the class described comprising a feed ratchet, a pawl for rotating the ratchet, a striker movable through a substantial free travel to contact with the pawl to disengage it from the ratchet, a work-controlled electromagnet, an armature movable by the force of the electromagnet and normally spaced from it, and mechanism coupling the armature and striker and so proportioned that a movement of the armature causes a movement of the striker of greater amplitude, said armature being positioned to come into direct contact with the magnet whereby it, and the parts connected with it, will be held in their pawl disengaging positions by the residual magnetism of the deenergized electromagnet.

3. A machine of the class described comprising a feed ratachet, a pawl for rotating the ratchet, a striker movable through a substantial free travel to contact with the pawl to disengage it from the ratchet, a work-controlled electromagnet, an armature movable by the force of the electromagnet and normally spaced from it, and a lever bearing a counterweighting and inertia-producing weight coupling the armature and striker and so proportioned that a movement of the armature causes a movement of the striker of greater amplitude.

4. A machine of the class described comprising a feed ratchet, a pawl for rotating the ratchet, a striker reciprocally mounted and movable to contact with the pawl to disengage it from the ratchet, a work-controlled electromagnet, an armature reciprocably mounted so as to be movable by the force of the electromagnet and normally spaced from it, and a rocking lever connected both to the striker and to the armature with its pivotal distance to the armature connection less than its pivotal distance to the striker connection whereby a movement of the armature causes a movement of the striker of greater magnitude.

5. A machine of the class described comprising a feed ratchet, a pawl for rotating the ratchet, a striker reciprocally mounted and movable to contact with the pawl to disengage it from the ratchet, a work-controlled electromagnet, an armature reciprocably mounted so as to be movable by the force of the electromagnet and normally spaced from it, and a rocking lever connected both to the striker and to the armature with its pivotal distance to the armature connection less than its pivotal distance to the striker connection whereby a movement of the armature causes a movement of the striker of greater magnitude, said rocking lever having a weighted portion positioned so as to be moved substantially vertically downwardly by the energizing of the electromagnet.

6. A machine of the class described, comprising a feed ratchet, a pawl for rotating the ratchet, a striker reciprocably mounted and movable through a substantial free travel to contact with the pawl to disengage it from the ratchet, a work-controlled electromagnet, an armature reciprocably mounted so as to be movable by the force of the electromagnet and normally spaced from it, and a rocking lever positioned for alternative manual operation and connected both to the striker and to the armature with its pivotal distance to the armature connection less than its pivotal distance to the striker connection whereby a movement of the armature causes a movement of the striker of greater magnitude and a momentum of the parts is acquired sufficient to free the pawl from the ratchet by an impact blow.

7. A machine of the class described comprising a feed ratchet, a pawl for rotating the ratchet, a striker positioned to be reciprocable substantially vertically into contact with the pawl on the side thereof adjacent the ratchet and thereby to disengage the pawl from the ratchet, a work-controlled electromagnet, an armature movable by the force of the electromagnet and normally spaced from it, and mechanism coupling the armature and striker whereby motion of the armature towards the electromagnet will cause disengagement of the pawl from the ratchet.

In testimony whereof I have affixed my signature.

FREDERICK D. VAN NORMAN.