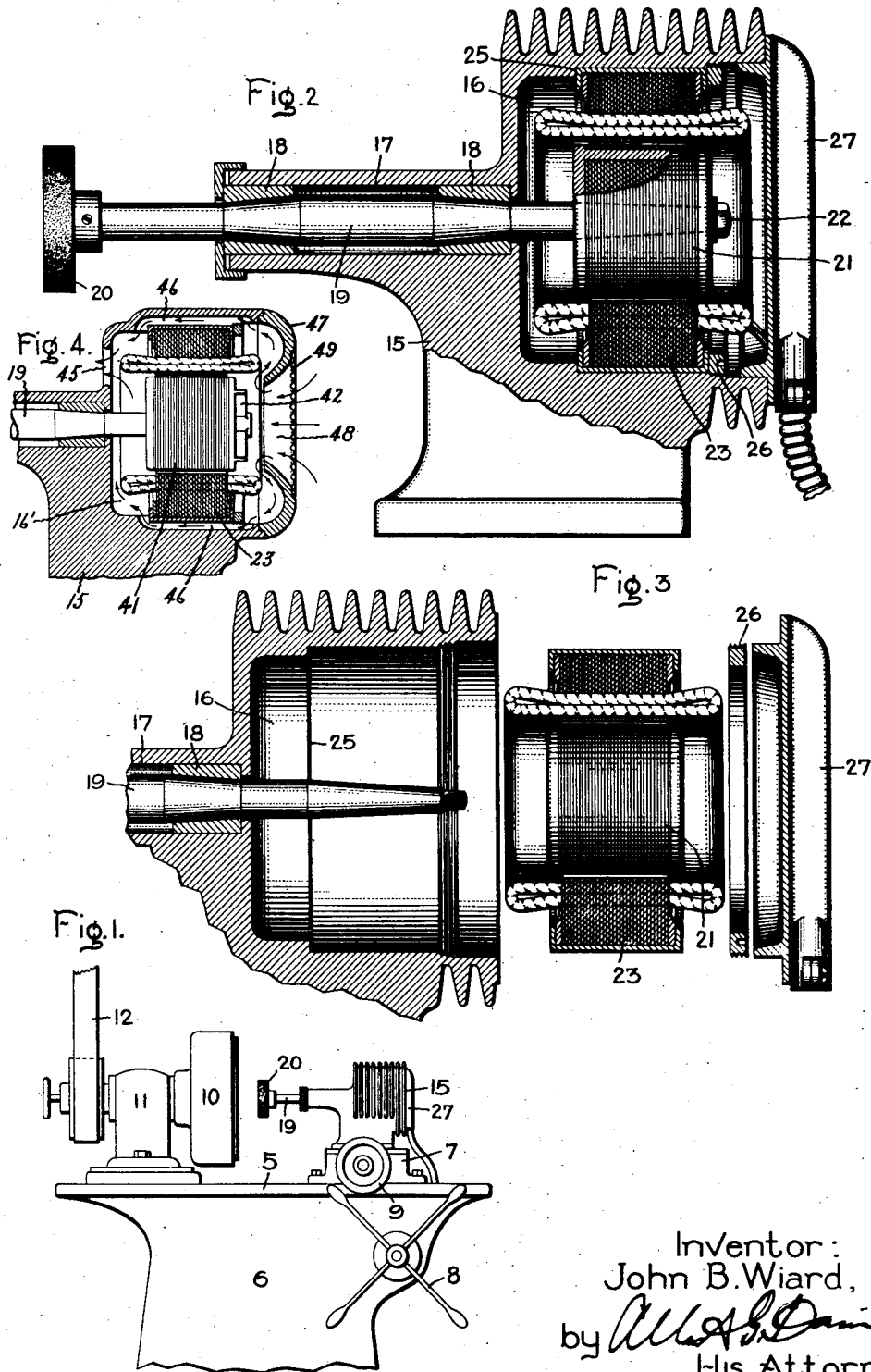


J. B. WIARD.
HIGH SPEED GRINDING MACHINE.
APPLICATION FILED JULY 3, 1915.

1,304,229.

Patented May 20, 1919.



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UNITED STATES PATENT OFFICE.

JOHN B. WIARD, OF LYNN, MASSACHUSETTS, ASSIGNOR TO GENERAL ELECTRIC COMPANY, A CORPORATION OF NEW YORK.

HIGH-SPEED GRINDING-MACHINE.

1,304,229.

Specification of Letters Patent.

Patented May 20, 1919.

Application filed July 3, 1915. Serial No. 38,020.

To all whom it may concern:

Be it known that I, JOHN B. WIARD, a citizen of the United States, residing at Lynn, in the county of Essex, State of Massachusetts, have invented certain new and useful Improvements in High-Speed Grinding-Machines, of which the following is a specification.

My invention relates to machines having a rotatably mounted spindle adapted to be driven at high speed, and in particular to high speed grinding machines, such for example as are employed for grinding ball-bearing races and the like.

The object of my invention is to provide a novel and improved construction of electrically-driven machine having a rotatable spindle adapted to be driven at high speed, and particularly of electrically-driven grinding machines adapted to be operated at high speed. The novel features which I believe to be patentably characteristic of my invention are definitely indicated in the claims appended hereto; the construction and mode of operation of a high speed grinding machine embodying these features will be understood from the following description taken in connection with the accompanying drawings, in which:

Figure 1 is an elevation of a high speed grinding machine embodying the novel features of my present invention, and Figs. 2 and 3 are sectional views of the electrically driven spindle showing the electric motor elements assembled and disassembled, respectively, and Fig. 4 is a modification.

High speed grinding machines, such as those employed for grinding out the inside of ball-bearing races, use very small grinding wheels rotating at high speed, such for example as 5,000 to 25,000 revolutions per minute. The spindles of such machines have heretofore been generally belt driven, and the up-keep on bearings and belting is very high. The design of an electric motor for such high speed operation is a matter of considerable difficulty and for this reason, among others, the electric drive has not been generally adopted in high speed grinding machines. A two pole induction motor operating on a commercial circuit of 60 cycles has a synchronous speed of only 3,600 R. P. M., very much too low for a high speed

grinding machine. It has been found practicable in electrically-driven high speed grinding machines to employ a frequency changer, such as a motor-generator set, operating from a commercial circuit of 60 cycles and producing alternating current of much higher frequency, such as 100 to 450 cycles. With alternating current of 100 or 450 cycles a two pole induction motor has a synchronous speed of 6,000 or 27,000 R. P. M., respectively. Such high frequency induction motors have heretofore been directly connected to the spindle of the grinding machine, which of course is provided with its own bearings, so that there are four bearings in a line, two belonging to the spindle of the grinding machine and two belonging to the electric motor. The use of four bearings in a line is obviously most undesirable, particularly at such high speeds as herein mentioned. The aim of my present invention is to provide high speed grinding machines with an efficient, practical and in all respects satisfactory form of electric drive. This I accomplish by constructing the electric motor as a part of the grinding machine, with the electric motor elements removably mounted, so that these elements may be supplied as separate units and mounted in the grinding machine in the course of the latter's construction.

My invention will be best understood by reference to the accompanying drawings. In Fig. 1, I have illustrated a typical form of high speed grinding machine having a flat bed or table 5 supported upon a base or pedestal 6. A carriage 7 is suitably mounted upon the table 5 and is adapted to be moved longitudinally by a wheel 8 and transversely by a wheel 9. A chuck or other work-carrier 10 is suitably mounted in a stationary head 11 and is adapted to be driven by a belt 12.

The carriage 7 includes a supporting base or grinding head 15 having a housing 16 therein. The base 15 has a circular bore 17 communicating with the housing 16, and mounted in this bore are two bearings 18 for the spindle 19 of the machine. The spindle extends at one end into the housing and is tapered at this end, as clearly shown in Figs. 2 and 3 of the drawings. A small grinding wheel 20 of carborundum, or other

suitable material, is secured to the end of the spindle exteriorly of the housing 16.

The rotor element 21 of an induction electric motor is positioned within the housing 16 and is adapted to be removably secured to the tapered end of the spindle 19. The rotor element 21 illustrated in the drawings comprises a laminated magnetic core carrying a squirrel cage winding of cast aluminum. Cast aluminum gives a particularly solid rotor construction which when once made and balanced is inherently free from change, and is thus peculiarly adapted for such high speed operation as is herein contemplated. The rotor is mounted on the spindle as a unit and is secured thereto by a nut 22. The stator element 23 of the induction motor is removably mounted within the casing 16. This stator element comprises a laminated magnetic core and an induction motor primary winding designed for alternating current of relatively high frequency. The housing 16 is formed with a shoulder 25 which serves to accurately position the stator. The stator element is mounted in the housing as a unit, and is secured in position by a screw-threaded ring 26. A cover 27 closes the end of the housing after the motor elements have been secured in their operative positions.

The housing 16 serves as a frame for the motor and at the same time is an integral part of the grinding head. The spindle 19 supports the rotor of the motor in an overhung fashion, and the only bearings for the spindle are positioned exteriorly of the housing and hence of the motor elements. The external surfaces of the housing and cover are ribbed, as indicated in Figs. 2 and 3, to increase their heat radiating surfaces, since a comparatively large amount of power is developed in a very small space, and hence a relatively large amount of heat must be radiated.

The construction of an electrically driven grinding machine as herein described possesses many advantages. For such high speeds as are herein contemplated, it is a difficult and delicate problem to couple an independent electric motor to a rotatable spindle. The shaft of the motor must be in exact alinement with the spindle, and to this end four bearings have to be alined. In accordance with my present invention, there is employed a single shaft or spindle having only one set of bearings. The housing or frame for the electric motor elements is an integral part of the grinding machine, and is formed in the course of the manufacture of such machine. The rotor and stator elements of the electric motor can be independently manufactured to suit the specifications of any particular grinding machine, and are assembled as units in the grinding machine, thus forming when assembled a part of the

grinding machine itself. A manufacturer of grinding machines need thus secure from a manufacturer of electrical apparatus only the rotor and stator elements of an electric motor, and can assemble these elements in a frame built as a part of the grinding machine. The cost of the electric drive is thus lowered, and a very compact structure secured.

In cases where the heat radiating means provided by ribbing or corrugating the exterior surface of the housing 16 is insufficient for preventing objectionable heating of the motor parts, forced ventilation may be employed. Fig. 4 of the drawing illustrates a modified construction adapted for ventilating purposes. The rotor element 41 has a cast squirrel cage winding, for example of aluminum, with integral fan blades 42. This integral cast construction of an induction motor secondary winding is described and claimed in my application for Letters Patent, Ser. No. 3224, filed Jan. 20, 1915. The cover 47 is provided with a central opening 48 for the intake of the ventilating air. The opening 48 is preferably provided with a screen 49. The interior of the housing 16, of Fig. 4 is provided with ducts 46, providing transverse passages for the ventilating air. Suitable outlet ports 45 are also provided in the housing. The arrows indicate the paths provided through the motor structure for the ventilating air. It will be understood that the housing and stator element are otherwise of the same construction and design as explained in connection with Figs. 2 and 3.

What I claim as new and desire to secure by Letters Patent of the United States, is:—

1. A high speed machine for grinding or the like comprising in combination a supporting member having but one bearing formed integrally therewith on one end thereof, a spindle rotatably mounted therein, the other end of said supporting member being hollowed out to form a cup-shaped motor housing having its interior surface formed concentric with and surrounding said spindle, an electric motor stator removably secured within said housing and in engagement with the interior surface of said housing, and an electric motor rotor removably mounted on one end of said spindle interiorly of said housing in operative relation to said stator, the other end of said spindle being formed to support a grinding tool.

2. A high speed machine for grinding or the like comprising in combination a supporting member having but one bearing formed integrally therewith on one end thereof, a spindle having its mid-portion rotatably mounted in said bearing and arranged to have its thrust taken up by said bearing in both axial directions, the other end of said supporting member being hol-

lowed out to form a cup-shaped motor housing having its interior surface formed concentric with and surrounding said spindle, an electric motor stator removably secured
5 within said housing and in engagement with the interior surface of said housing, and an electric motor rotor removably mounted on

one end of said spindle interiorly of said housing in operative relation to said stator, the other end of said spindle being formed 10 to support a grinding tool.

In witness whereof, I have hereunto set my hand this 30th day of June, 1915.

JOHN B. WIARD.