

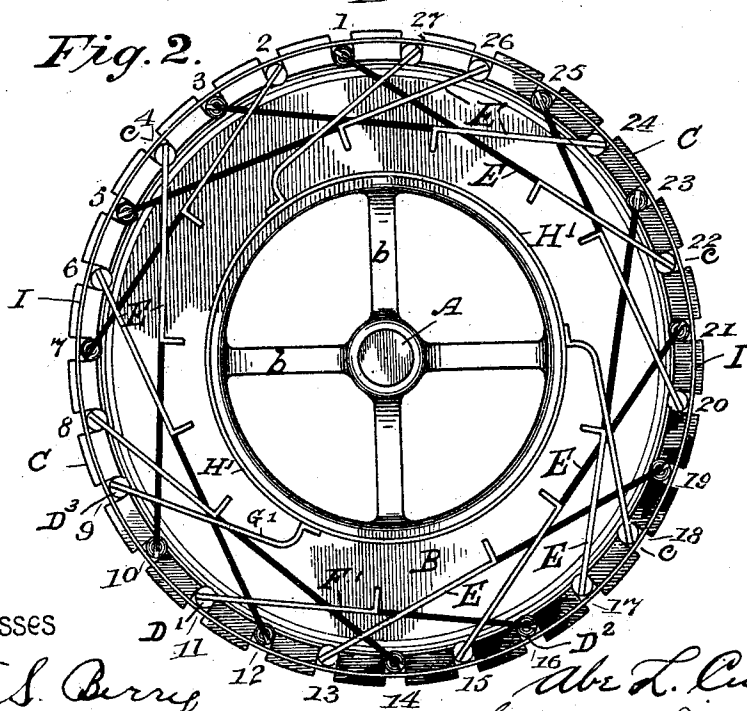
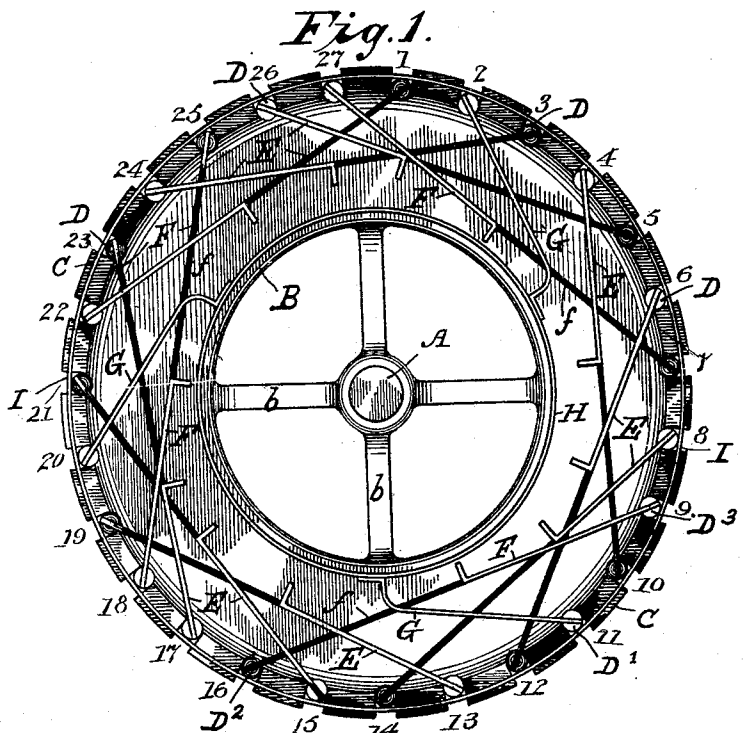
(No Model.)

3 Sheets—Sheet 1.

A. L. CUSHMAN.
ARMATURE FOR INDUCTION MOTORS.

No. 555,851.

Patented Mar. 3, 1896.



Witnesses

F. S. Barry
A. Burroughs.

Inventor

Abr L. Cushman
By his Attorney J. S. Thurston

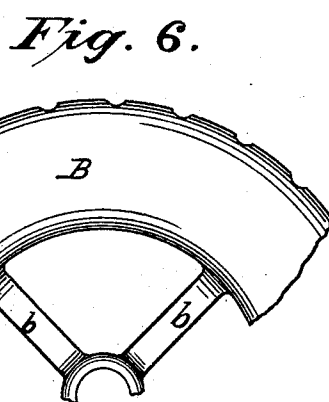
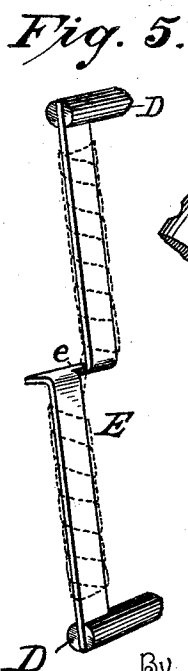
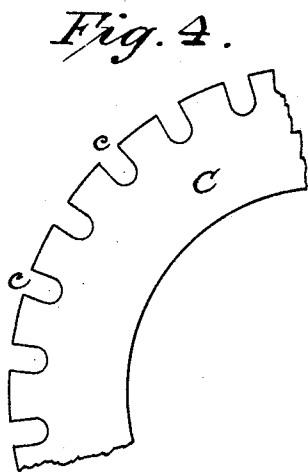
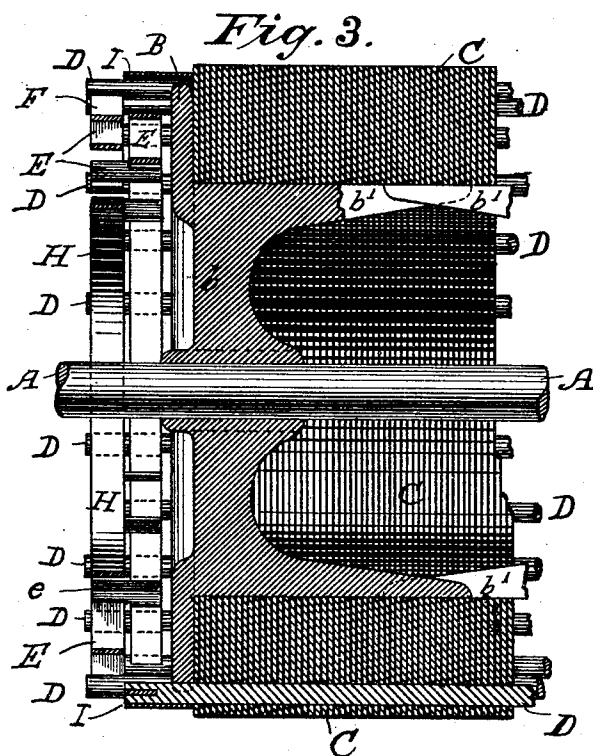
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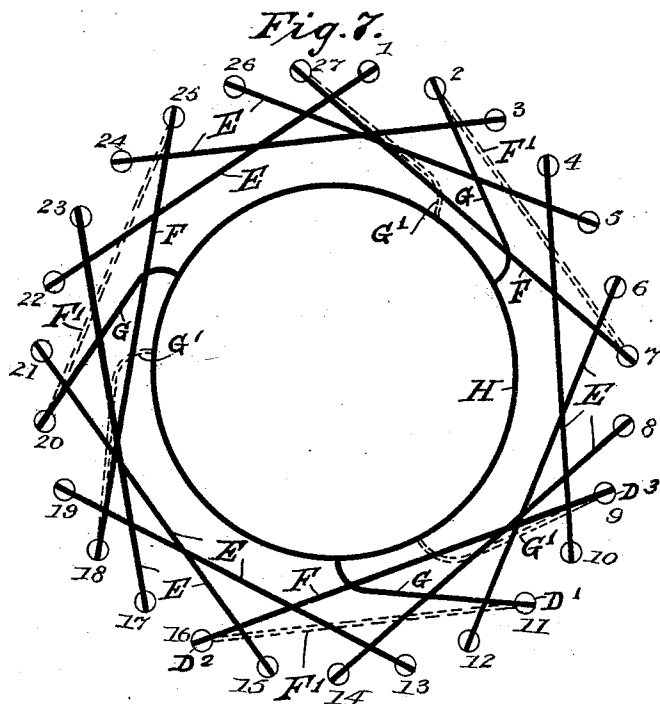
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UNITED STATES PATENT OFFICE.

ABE L. CUSHMAN, OF CONCORD, NEW HAMPSHIRE, ASSIGNOR OF ONE-HALF TO BENJAMIN A. KIMBALL, OF SAME PLACE.

ARMATURE FOR INDUCTION-MOTORS.

SPECIFICATION forming part of Letters Patent No. 555,851, dated March 3, 1896.

Application filed August 13, 1894. Renewed August 28, 1895. Serial No. 560,825. (No model.)

To all whom it may concern:

Be it known that I, ABE L. CUSHMAN, a citizen of the United States, residing at Concord, in the county of Merrimac and State of New Hampshire, have invented certain new and useful Improvements in Armatures for Induction-Motors; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

My present invention relates especially to armatures for induction-motors, its objects being, first, to enhance the starting-torque; second, to prevent drawing excessive currents, and, third, to obviate the necessity of switches of any kind, which are often employed to cut out the resistance after synchronizing speed is reached. It is obvious that where the poles of the armature are at regular intervals upon its periphery and are the same in number as are represented in the field of the motor, there can be no starting-torque, and, on the other hand, if the poles of either are prime to those of the other, the motor will draw excessive currents. These difficulties I readily overcome by my improved method of windings, (to be hereinafter explained,) and right here I will state that these results are wholly due to the windings and their connections and not to any specified number of coils employed, this being immaterial so long as the number used is such as may be connected up in a manner to establish unsymmetrical poles upon the periphery of the armature, which results in giving the desired starting-torque without the aid of either resistance-coils or a commutator. Hence my invention may be said to consist broadly in an armature having the novel windings comprising short-circuit coils wound in series and independent windings in multiple and having unsymmetrical polarities.

To carry my invention into effect, I employ an armature in which the coils consist of copper bars placed in longitudinal grooves formed for the purpose in the periphery of the laminated core, some of which bars are closed in pairs, which I term "independent closed-circuit coils," while others are short-circuited in series by rings at opposite ends

of the armature. For convenience in construction these bars (which are too thick to make it practical to bend them at the end of the core) are connected by cross-bars at their ends, and short-circuited by suitable rings, to which they are connected by short bars, as will be illustrated in the accompanying drawings.

I attain the above-mentioned objects by reason of the separate and distinct classes of windings, some being connected at opposite ends irregularly and close-circuited by a ring at each end of the armature, and others in multiple and irregular pairs, each of which pairs forms an independent closed circuit insulated from the core and from the said connected closed-circuited coils, and resting part between the coils of one and part between those of another of the connected closed-circuited coils, thus producing what I term "fractional poles," as the poles are never directly opposite to each other, neither are they ever at regular intervals.

My improvements will be fully set forth in the following specification and claims, and clearly illustrated in the accompanying drawings, forming a part of same, of which—

Figure 1 shows my improved armature in end elevation, Fig. 2 being a similar view showing the opposite end. Fig. 3 is a broken longitudinal sectional elevation of same. Figs. 4, 5, and 6 are details; and Fig. 7 is an elevation showing the bars in end view, as when detached from the laminated core, with the independent and short-circuit connections of both ends, those at one end being in full lines and those at the other in dotted lines, so as to more clearly illustrate the most essential features or elements of my invention.

Upon the arbor A, I mount two perforated disks B, which may be formed with spokes *b* and having laterally-inward-projecting arms *b'* for supporting the core, and preferably made of sufficient length to overlap, as shown in Fig. 3. Between the disks and upon the arms *b'* I mount a laminated core C, which is grooved longitudinally, as at *c*, (seen in detail, Fig. 4,) for the reception of a series of coils or bars D. The bars or coils D are not, however, connected in series, as may be seen by

tracing them out in Fig. 7, no two adjacent coils being connected. The coils are uneven in number, the independent coils being connected at the ends by bars E, and the short-circuit coils by bars F and by bars G to a ring H, at each end of the armature, the bars E F G and the short-circuit rings H being wound with some suitable insulating material, as shown by dotted lines in Fig. 5, and to further guard against contact of the bars E F one with the other they are preferably made with an offset *ef*, as clearly illustrated in Fig. 5, so that a portion of each bar, while being parallel with the remainder, is, however, on a different plane, thus permitting one to pass another without contact. On this account the coils D are cut in two lengths, those connecting with one end of the bars E F not requiring to be as long as those to be connected with their opposite end, as shown in the drawings.

The bars or coils D are insulated from the laminated core and are secured thereon by retaining-bands I at each end, said bands being also insulated from the bars.

By consulting Fig. 7 the relation of the independent and the short circuits each to the other may be easily determined, as the letters of reference in this view for convenience when relating to the bars E F at the back end will be E' F' and the coils or bars D being numbered consecutively 1 2 3, &c., each series of short-circuited coils or either independent closed-circuit coil forming a given winding may be easily traced. Thus one of the bars, which in said Fig. 7 is drawn in full lines and lettered G, will be seen to attach at the forward end of the armature to the ring H and to that coil or bar which is lettered D¹¹, said bar being connected on the back end by the bar F' with that coil or bar lettered D¹⁶ which is connected on the front by the bar F with that coil or bar lettered D⁹, connected at the other end by the bar G' with the ring H', as is more clearly shown in Fig. 2. The bars E connect those coils or bars which form independent circuits only.

Armatures constructed on the principles here described give most satisfactory results for the reason that the poles of the armature

will always be fractional in relation to the field-magnets, and for large motors without necessarily changing the phasical system this result will be even more marked for the reason that more coils are required, and hence there can be a greater number of bars or coils between any two or more that form a circuit.

Having described the construction of my improved armature, what I claim is—

1. In an armature for induction-motors, a laminated core and separate and distinct windings consisting of multiple closed-circuit coils, and short-circuit coils closed in series, all arranged in such relation one to the other as to produce unsymmetrical polarities upon said armature.

2. An armature for induction-motors having a laminated core provided with a series of grooves running longitudinally therein, said grooves being wound with multiple closed-circuit windings and short-circuit coils closed in series, assembled in such numbers and relation one to another as to cause the poles to be unsymmetrical, substantially for the purpose described.

3. As a means for enhancing the starting-torque of induction-motors, an armature having the short-circuit multiple windings and short-circuit coils closed in series, arranged in such numbers and relation one to another as to cause unsymmetrical polarities.

4. An armature for induction-motors having some of its coils connected irregularly at opposite ends and in closed circuit with short-circuit rings at each end of the armature, and others in multiple and irregular pairs, each pair of the latter forming an independent closed circuit resting part between the coils of one and part between those of another of the short-circuit coils closed in series, said coils being arranged in such numbers and relation, one set to another, as to produce unsymmetrical polarities upon said armature.

In testimony whereof I affix my signature in presence of two witnesses.

ABE L. CUSHMAN.

Witnesses:

J. B. THURSTON,
CARRIE E. EVANS.