March 5, 1940. G. W. ELSEY 2,192,787

CASTING APPARATUS

Filed Aug. 23, 1937 3 Sheets-Sheet 1

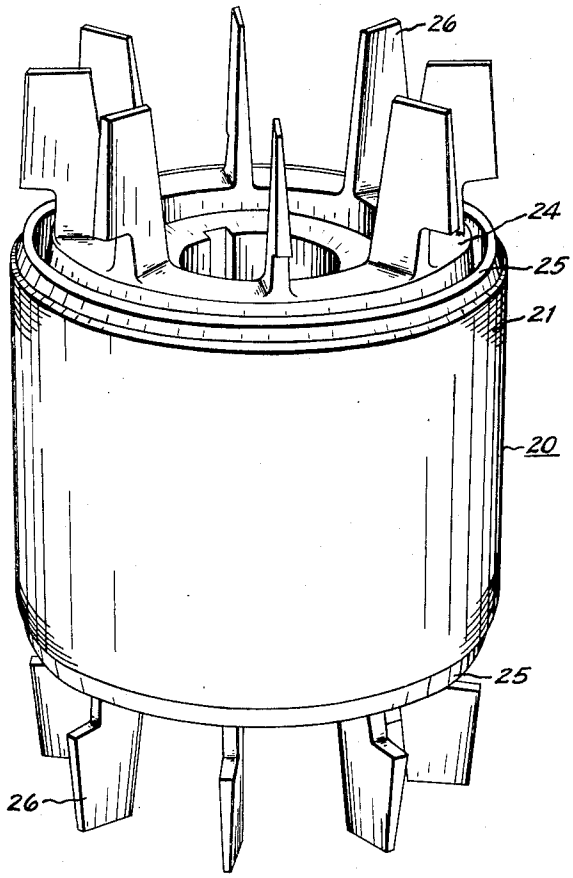


Fig. 1

INVENTOR
George W. Elsey
BY
Spencer Hardman & Fehr
his ATTORNEYS

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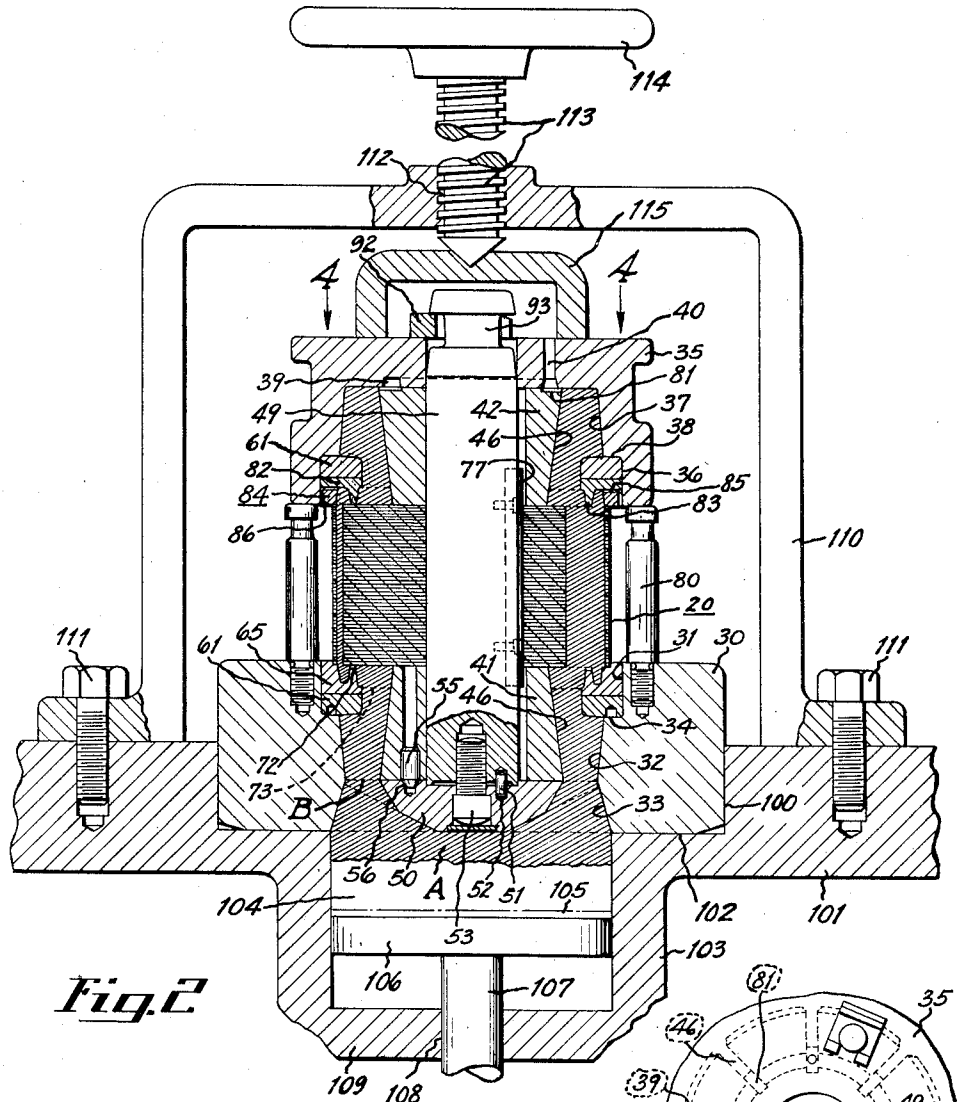


Fig. 2

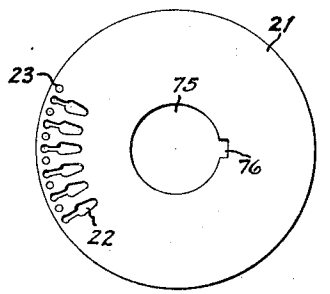


Fig. 3

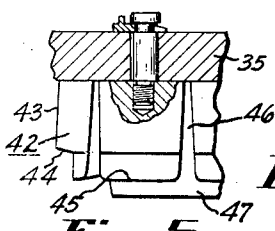


Fig. 5

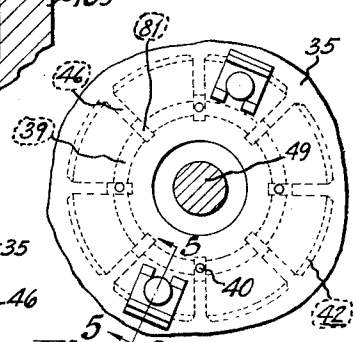


Fig. 4

Inventor
George W. Elsey

By

Spencer, Hardman & Fehr
his Attorneys

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CASTING APPARATUS

Filed Aug. 23, 1937 3 Sheets-Sheet 3

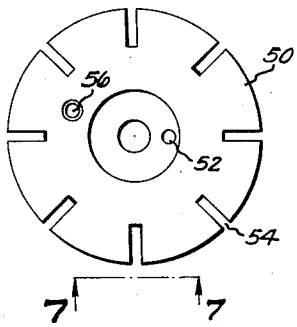


Fig. 6

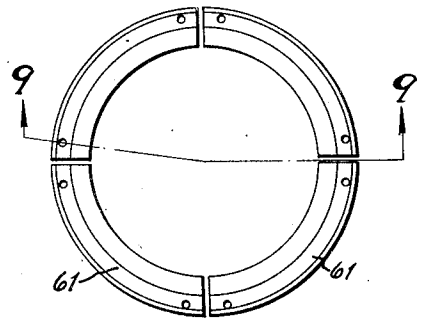


Fig. 8

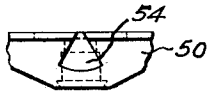


Fig. 7

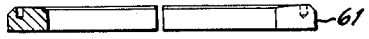


Fig. 9

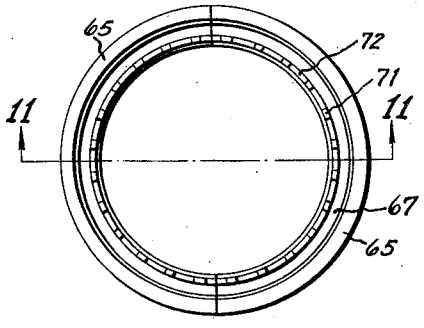


Fig. 10

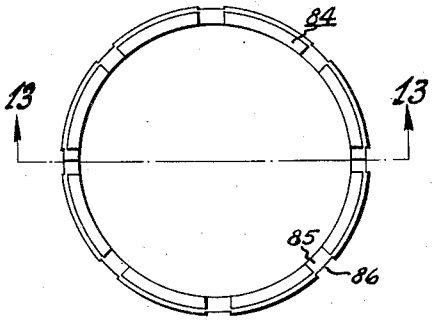


Fig. 12

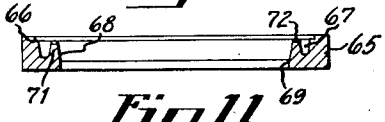


Fig. 11

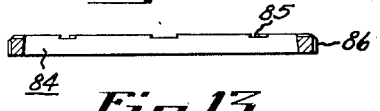


Fig. 13

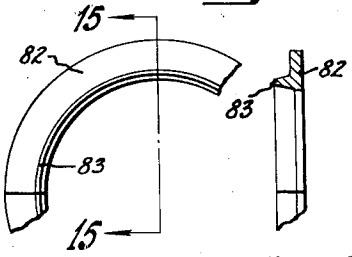


Fig. 14

Fig. 15

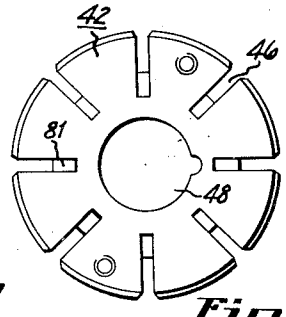


Fig. 16

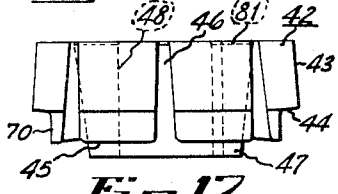


Fig. 17

INVENTOR
George W. Elsey
BY
Spencer, Hardman & Fehr
his ATTORNEYS

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UNITED STATES PATENT OFFICE

2,192,787

CASTING APPARATUS

George W. Elsey, La Grange, Ill., assignor to General Motors Corporation, Detroit, Mich., a corporation of Delaware

Application August 23, 1937, Serial No. 160,437

8 Claims. (Cl. 22—116)

This invention relates to casting apparatus, and more particularly to a mold for die casting.

An object of this invention is to provide a mold for die casting that is void of unnecessary complicated parts and easy to assemble and disassemble in use.

Another object of this invention is to provide a mold for simultaneously die casting fan blades, two conductor windings and spaced end rings for squirrel cage induction motor rotors without machining.

Another object of this invention is to provide a mold for die casting that is provided with means for venting the mold, which means does not permit the escape or waste of an appreciable amount of metal.

Another object of this invention is to provide a mold for die casting the fan blades, conductors and space end rings for squirrel cage induction motor rotors, which serves in clamping the rotor laminations in place during the casting operation.

Further objects and advantages of the present invention will be apparent from the following description reference being had to the accompanying drawings wherein a preferred embodiment of the present invention is clearly shown.

In the drawings:

Fig. 1 is a perspective view of a completed rotor.

Fig. 2 is a vertical sectional view showing a rotor formed by the mold embodying the present invention.

Fig. 3 is a plan view of one of the rotor laminations.

Fig. 4 is a view taken on the line 4—4 of Fig. 2.

Fig. 5 is a sectional view taken substantially on the line 5—5 of Fig. 4.

Fig. 6 is a plan view of a plate member used in the mold.

Fig. 7 is a fragmentary end view of the plate end member looking in the direction of arrows 7—7 of Fig. 6.

Fig. 8 is a plan view of a lower ring spacing member.

Fig. 9 is a view taken on the line 9—9 of Fig. 8.

Fig. 10 is a plan view of a lower end ring forming member.

Fig. 11 is a sectional view taken on line 11—11 of Fig. 10.

Fig. 12 is a plan view of an upper ring spacing member.

Fig. 13 is a sectional view taken on line 13—13 of Fig. 12.

Fig. 14 is a fragment of an upper end ring forming member.

Fig. 15 is a sectional view taken on line 15—15 of Fig. 14.

Figs. 16 and 17 are plan and side views respectively of a fan blade forming member.

Referring to Figs. 1 and 3 the magnetic core 20 of an inductor motor comprises a plurality of laminations 21 having relative deep conductor receiving openings 22 and shallow conductor receiving openings 23. In order to cast squirrel cage windings into the conductor receiving openings the core 20 is positioned in a suitable mold formed in such a manner that the openings will be entirely filled with conductor portions united by spaced end rings 24 and 25, with fan blades 26 formed integral with the end rings 24.

In the casting operation, a mold is provided which comprises a base member 30 formed with a cylindrical wall 31 and an opening including conical walls 32 and 33, the walls 31 and 32 being separated by an annular ledge or shoulder 34. An upper mold member 35 is provided and is preferably of cup-shaped formation. The upper mold member is formed with a cylindrical wall 36 and a tapered wall 37 which are separated by an annular ledge or shoulder 38. The closed end of the member 35 is provided with an annular channel 39 and a plurality of spaced openings 40 communicating with the channel 39 to provide outlets for air or gas that flows through the mold during the casting operation.

The tapered portions 32 and 37 of the members 30 and 35, respectively, receive lower and upper fan blade forming members or inserts 41 and 42 respectively. Each of the inserts has a tapered portion 43 complementary to the tapered portions 32 and 37 of members 30 and 35 respectively. These inserts are formed with concentric ledges 44 and 45 on different levels, which form an annular wall 70 see Fig. 17, and are provided with tapered notches indicated at 46. Each member 41 and 42 is provided with a tapered boss 47 and a through central opening 48 to receive a shaft 49.

The lower end of the shaft 49 carries a plate member 50. This plate is properly positioned on the shaft by a projection or pin 51. The pin is carried by the shaft and fits into a recess 52 in the plate. The plate is secured to the shaft by a screw 53. The plate 50 is also provided with radial extending notches 54 which correspond with notches 46 in the member 41. The member 41 is adapted to rest upon the plate 50 and it is important that the notches 54 of the plate 50 register with the notches 46 of the insert 41. This is accomplished by providing the member 41 with

a projection or pin 55 which extends into a second recess 56 in the plate 50.

The assembly comprising the shaft 49, plate 50 and the member 41 is inserted in the base member 30. When the assembly is positioned in the base member the tapered portion 43 will fit snugly with the taper 32 and the peripheral edge of the ledge 44 will be flush with the shoulder 34 to form an annular channel between the cylindrical wall 31 and a wall 70. This channel is adapted to receive a plurality of segmental members 61, illustrated in Figs. 8 and 9. The members 61 close that portion of the notches 46 about the wall 70 which communicate with the channel. The members 61 are so positioned in the channel that the spaces between adjacent segmental members will not be opposite any of the notches 43, thus preventing molten metal from entering the channel during the casting operation.

A pair of semi-circular members 65 rest upon the segmental members 61. These members 65, see Figs. 10 and 11, are provided with a cylindrical portion 66, a groove 67, a tapered portion 68 which terminates into a cylindrical portion 69. The cylindrical portion will fit about the cylindrical wall 70 formed by the ledges 44 and 45 of the member 41 so that the upper end of the portion 69 will be flush with the outer edge of the smaller ledge 45. The partitions 71, formed on the members 65 have a plurality of spaced shallow notches 72 which cooperate with the lowermost lamination to provide jet like openings. The tapered portion 68 cooperates with the boss 47 of the member 41 to form an inner annular channel 73.

A stack of laminations 21, comprising the rotor core, has each lamination provided with a central opening 75 therethrough that fits over the shaft 49. A key-way 76 is also provided in each of the laminations to fit over a skewed-feather 77. The feather imparts a twist or a circumferential displacement to the stack of laminations 21. The stack of laminations rest upon the ledge provided between the cylindrical portion 66 and over the groove 67 of the member 65, so that the openings 22 and 23 will communicate with the channels 73 and 67 respectively. The length of the rotor core is regulated by sizing posts 80 carried by the base member 30.

The upper member 35 of the mold is adapted to receive the insert 42 which is similar in construction to the insert 41, with the exception that the member 42 is provided with shallow notches 81. These notches extend from the notches 46 inwardly so that they communicate with the annular groove 39 to allow air or gas that flows from the mold through the channel 39 and thence through the openings 40. The upper insert 42 is removably secured within the member 35 by studs or projections carried thereby and which extend through suitable openings provided in the closed end of the member 35. The studs are provided with grooves to receive U-washers which operate to firmly hold the member 42 against the closed end of the member 35 as clearly illustrated in Fig. 5. When the insert is secured to the member 35 the lower ledge 44 of the insert 42 will be flush with the shoulder 38 providing an annular groove between the wall 70 of the insert 42 and the cylindrical wall 36 of member 35. This groove is adapted to receive a second set of segmental members 61 and a set of semi-ring members 82, shown in Figs. 14 and 15. The members 82 are provided with a ridge 83 tapered on both sides and are assembled adjacent the segmental members 61. The ridge is adapted to rest firmly upon the uppermost lamination of the rotor core and provide a channel between the boss 47 and the ridge connecting with the inner conductor receiving opening 22. A second set of semi-circular members 84 is also adapted to rest on the upper lamination. These members 84 are provided with shallow radial notches 85 and vertical notches 86. These notches provide outlets for air and gas that flows through the mold as clearly shown in Fig. 2. The members 84 and the ridge 83 cooperate to form an annular channel coinciding with the outer conductor receiving openings 23.

When the elements 42, 61, 82 and 84 are assembled in their proper relation to each other, in the upper member 35, the assembly comprising said elements is fitted over the upper end of the shaft 49 the smooth surfaces of the members 84 and the ridges 83 will engage the uppermost lamination of the rotor core to form spaced inner and outer end ring channels. The upper member 35 is then secured to the shaft 49, by a C-washer 92 which fits into the groove 93 provided in the shaft 49 to provide the mold proper.

With the mold properly assembled, the base member 30 of the mold is placed into an opening 100 of a support 101 and rests upon a ledge portion 102 that is integral with the support. A cylindrical wall 103 formed integral with the support provides a cylinder 104 for the accommodation of molten metal and has a piston 106 slidably supported therein. The piston is adapted to force molten metal from the cylinder 104 through the openings 54 of the plate and the slots 46 of the member 41 upon movement of the piston in an upward direction. The piston has a shaft 107 secured thereto and extends through an opening 108 in a wall 109 of the cylinder chamber. The shaft is adapted to transmit the actuating pressure to the piston.

A U-shaped frame member 110 is secured to the support 101 by bolts 111 and extends over the mold. A threaded aperture 112 in the yoke of the frame member 110 has a screw 113 threaded therein. A hand wheel 114 secured to the end of the screw is provided for manually forcing a clamping member 115 against the member 35 to hold the member 35 firmly against the post 80 and hold the assembled parts of the mold in place.

In operation, a quantity of molten metal is placed in the cylinder 104 over an asbestos disc 105 indicated by dot and dash lines above the piston 106. Then upon fast upward movement of the piston 106 in the cylinder 104, as viewed in Fig. 2 the molten metal is forced through the notches 54 of plate 50, notches 46 of insert 41 into the channel up through the conductor receiving openings 22 and the corresponding notches 46 in the upper insert 42. At the same time molten metal is also forced through the jet like openings 72 into the channel 67, and up through the small conductor openings 23 to the upper outer channel. As the molten metal is forced through the mold the air passes out from the mold in two paths from the chamber 35. One of the paths for the escape of gas or air is through the shallow grooves 81, annular channel 39 and openings 40. The other path for the escape of air is from the outer ring channel through the notches 85 and 86 provided by the ring members 84.

After the metal that has been forced into the mold has cooled sufficiently to become set, the disc 105 will adhere to the excess metal. The

mold may be disassembled, by the steps of loosening the screw 113, removing the clamping member 115 after which the mold is removed from the opening 100. Then the C-washer is removed from the groove 93. By the use of a hammer or other suitable means, the shaft 49 is forced from the mold which causes the plate 50 to sever the excess material and the disc 105, indicated by the letter A, along the dotted lines B which is the end of each lower fan blade formed by the notches 46. The advantage of the narrow opening is apparent at this time since the excess metal which solidifies below the plate 50 is easily broken away from the fan blades when the shaft 49 is forced from the mold. After the shaft 49 and plate 50 are removed from the mold, the upper member 35 is lifted from the rotor and the rotor from the base member 30. The arcuate members 61 and the semi-ring members 84 are removed from the fan blades to permit the members 65 and 82 to be lifted from the end rings formed by these members. Since the base member 30 is removable from the support 101, the complete mold may be removed for disassembly after loosening the screw 113. This permits the placing of another assembled mold over the cylinder 104 to be filled while the filled mold is being disassembled. Another advantage of the segmental members is apparent at this time since the members can be easily removed.

While the embodiment of the present invention as herein disclosed, constitutes a preferred form, it is to be understood that other forms might be adopted, all coming within the scope of the claims which follow.

What is claimed is as follows:

1. A device for casting conductors, end rings and fan blades in a rotor having conductor openings therein, comprising in combination; a mold comprising two parts between which the rotor is secured, said mold parts each having an annular recess to which one end of the rotor is exposed, said mold parts also having spaced radial fan blade forming slots communicating with the recesses; a set of removable segmental members supported in the annular recess of each mold part, each end of the rotor being engaged by a set of segmental members, said segmental members having flanges for forming two concentric ring channels communicating with the conductor openings at each end of the rotor, means providing cross passages through the flanges in one set of segmental members to connect the ring channels thereof, the construction being such that the conductor openings in the rotor are in direct communication with all the fan blade forming slots and the concentric ring channels and cross passages of the segmental members provided by the two mold parts.

2. A device for casting conductors, end rings and fan blades in a rotor having conductor openings therein, comprising in combination; a mold comprising two parts between which the rotor is secured, said mold parts each having an annular recess into which an end of the rotor projects, said mold parts having longitudinal spaced radial fan blade forming slots communicating with the recesses; and a set of removable segmental members supported in the recess of each mold part, each end of the rotor being engaged by a set of segmental members, said segmental members having projections for forming concentric ring channels communicating with the conductor openings at each end of the rotor, one of the channels being spaced radially from the fan blade forming slots, means providing radial notches in the projections in one set of segmental members to connect the ring channels thereof all ring channels and fan blade slots being interconnected; and means connected with one of the ring channels for introducing molten metal.

3. A device for casting conductors, end rings and fan blades in a rotor having conductor openings therein, comprising in combination; a mold comprising two parts between which the rotor is secured, said mold parts including supporting members, each of which is provided with an internal annular shoulder, and a removable insert carried by each mold part having a plurality of annular ledges on different, levels, said inserts also having spaced longitudinal radial slots extending through at least one of the ledges, one of the ledges of each insert providing shelf portions coextensive with the shoulders of the mold parts to provide annular recesses facing the end of the rotor; a set of preformed segmental members supported in the recesses, each end of the rotor being engaged by a set of segmental members, each set of said segmental members being grooved and cooperating to provide two concentric ring channels both ring channels communicating with the conductor openings at each end of the rotor, and the inner ring channel communicating with the fan blade forming slots, means providing cross passages in one set of segmental members for interconnecting the ring channels therein, whereby all ring channels and conductor openings are interconnected.

4. A device for casting end rings and fan blades in a laminated rotor having conductor openings therein, comprising in combination; a mold comprising two parts between which the rotor is secured, said mold parts including supporting members each of which is provided with an internal annular shoulder, and an insert carried by each mold part having a plurality of concentric ledges and arranged on different levels, said insert having a plurality of fan blade forming slots, the outermost ledge of each insert providing shelf portions coextensive with the shoulders of the mold parts to provide annular grooves between the supporting members and the inserts which grooves normally face the ends of the rotor; and a set of preformed segmental members supported in each of the grooves of each mold part, each end of the rotor being engaged by a set of segmental members said segmental members having flanges forming a pair of concentric ring channels communicating with the conductor openings at each end of the rotor, one of the ring channels at each end of the rotor communicating with the fan blade forming slots, while the other ring channel at one end of the rotor is separated from the said slots, means providing cross passages in one set of segmental members to connect the concentric ring channels therein; and means connecting all ring channels and slots with a single pouring means.

5. A device for casting conductors, end rings and fan blades in a rotor having conductor openings therein, comprising in combination; a mold comprising two parts between which the rotor is clamped, said mold parts each having an annular recess to which one end of the rotor is exposed, said mold parts also having spaced longitudinal fan blade forming slots; and removable segmental members supported within the annular recesses, said segmental members having flanges to provide concentric ring channels at each end of the rotor with the inner

channels having communication with the fan blade forming slots and the conductor openings, means providing radial notches in one set of segmental members to connect the ring channels whereby all slots and channels are interconnected and means for clamping mold parts against the rotor in fluid tight relation whereby casting metal introduced into the mold parts will flow into the fan blade forming slots, concentric ring channels and conductor opening to form an integral casting therein.

6. A device for casting conductors, end rings and fan blades in a rotor having conductor openings therein, comprising in combination; a mold comprising two parts between which the rotor is secured, said mold parts each having a recess to which one end of the rotor is exposed, said mold parts also having spaced radial extending fan blade forming slots; a set of removable sections provided with flanges supported within the recesses, said sections when assembled in the recesses cooperating to form concentric ring channels at each end of the rotor with the inner channels having communication with the fan blade forming slots and the rotor conductor openings, means providing radial notches in one set of removable sections to inter-connect the ring channels thereof, said fan blade slots, ring channels and conductor openings being in communication such that molten metal will form an integral casting therein.

7. A device for casting conductors, spaced end rings and fan blades in a rotor having conductor openings therein, comprising in combination; a mold comprising two mold parts between which a rotor is secured, each mold part having an annular recess facing one end of the rotor, there being spaced longitudinal radial fan blade forming slots communicating with each recess; and a set of preformed segmental members substantially filling the recess of each mold part, each end of the rotor being engaged by a set of segmental members, each set of said segmental members providing an inner and an outer ring channel communicating with the conductor openings at each end of the rotor the inner channels at each end of the rotor being directly connected with the slots and the conductor openings; and means providing passages in one of segmental members cross connecting the inner and outer ring channels thereof to permit molten metal introduced into the mold to flow into all of the ring channels, conductor openings and slots to form an integrally connected casting filling the same upon a single pouring operation.

8. A mold for making spaced end rings on a rotor having conductor openings therein, comprising; an upper mold part and a lower mold part between which a rotor is supported, each mold part having an annular recess; a set of segmental members assembled into the recess of the upper mold part the disposition of said segmental members in the recess being such that the members will form concentric ring channels in communication with the conductor openings at the uppermost end of the rotor; a second set of grooved segmental members assembled into the recess of the lower mold part forming concentric ring channels in communication with the conductor openings at the lowermost end of the rotor; means providing cross passages in the second mentioned grooved members to connect the ring channels formed therein, the ring channels provided by the upper and lower mold parts being in direct communication by the conductor openings of the rotor supported between the mold parts such that introduction of molten metal will form spaced end rings on the rotor integrally connected by conductor bars in the rotor openings.

GEORGE W. ELSEY.