April 3, 1934. D. P. OGDEN 1,953,540

HIGH TEMPERATURE RESISTANT FAN

Filed Dec. 17, 1929 3 Sheets-Sheet 1

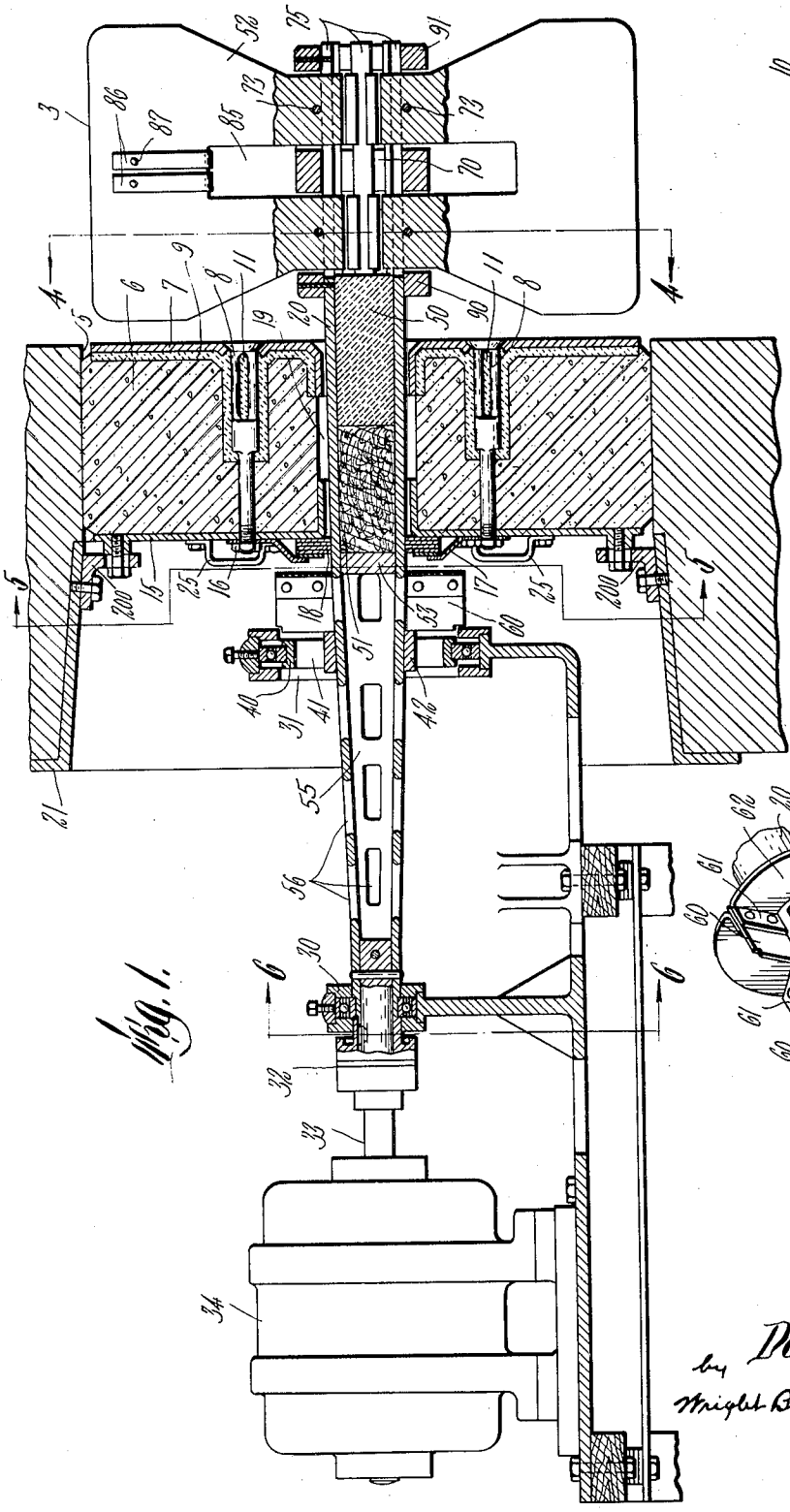


Fig. 1.

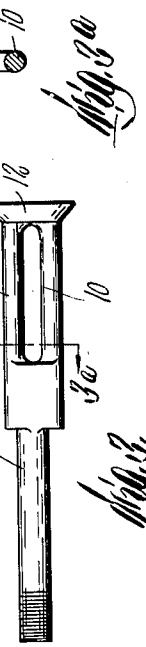


Fig. 3.

Fig. 3a.

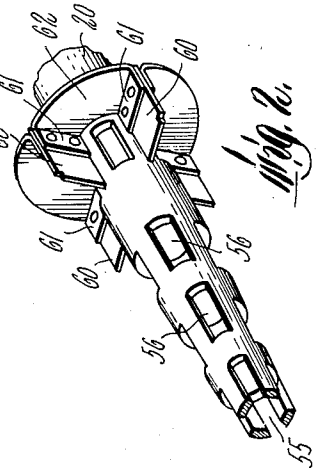


Fig. 2.

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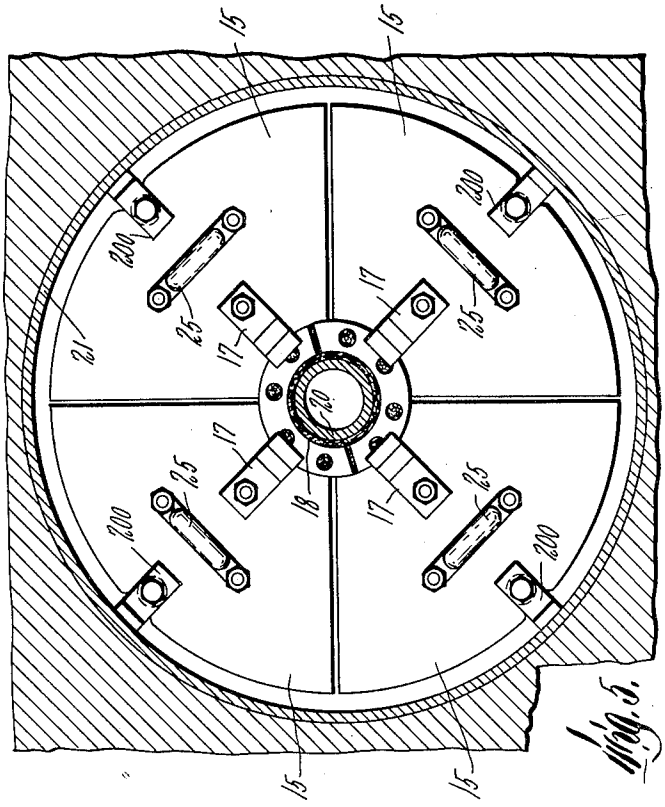


Fig. 5.

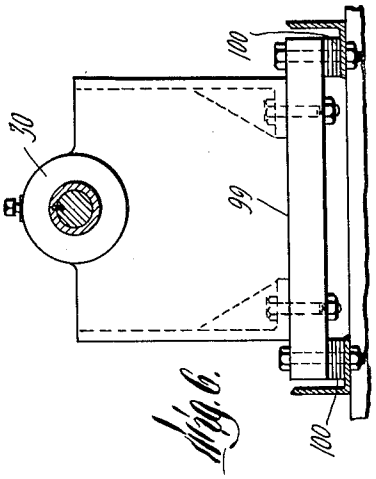


Fig. 6.

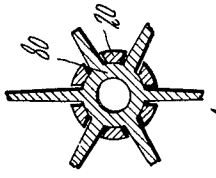


Fig. 8.

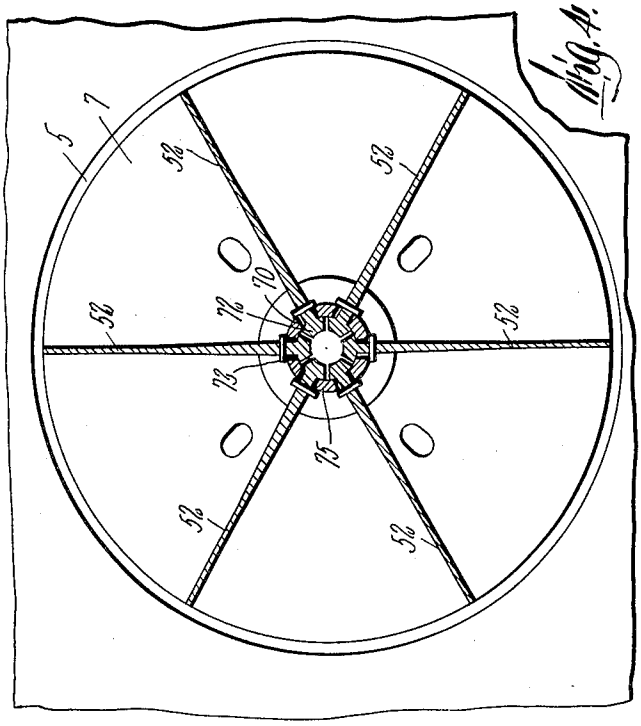


Fig. 4.

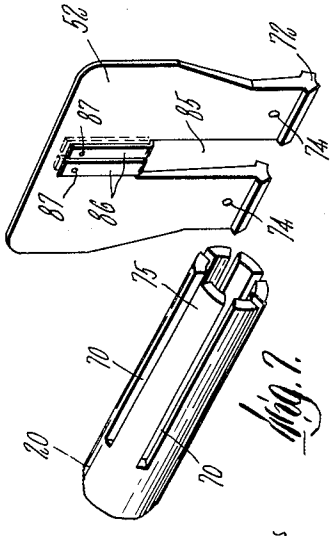


Fig. 7.

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HIGH TEMPERATURE RESISTANT FAN

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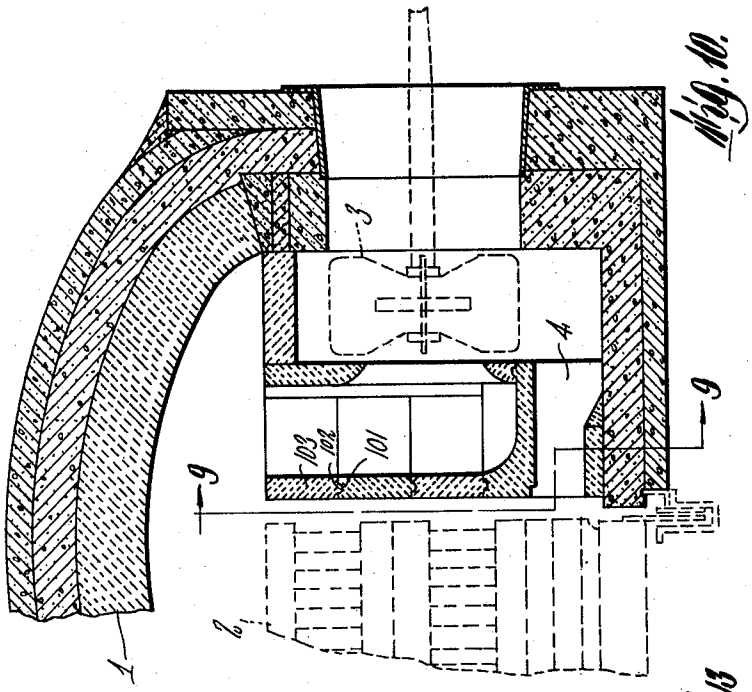


Fig. 10.

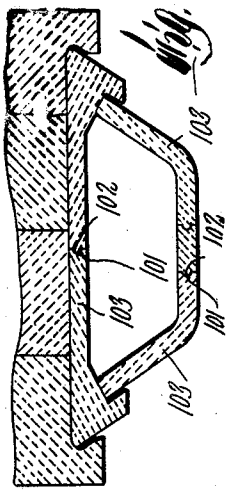


Fig. 11.

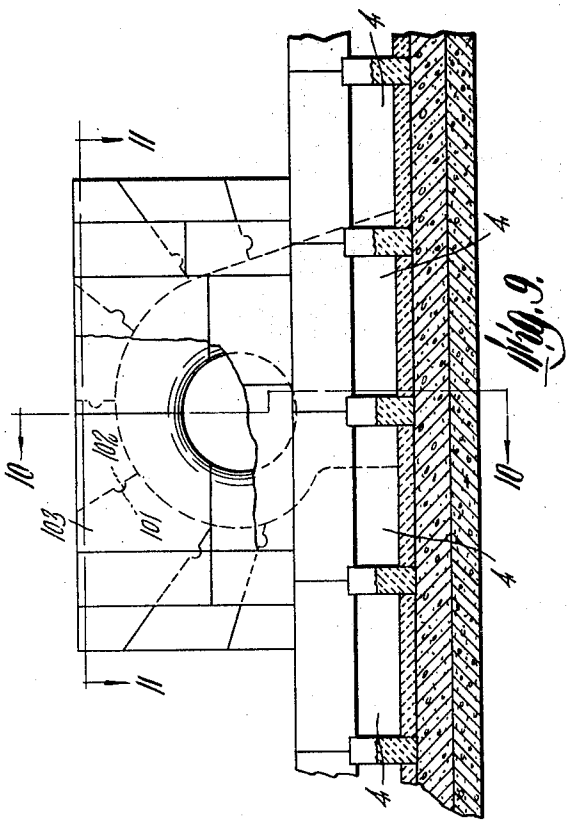


Fig. 9.

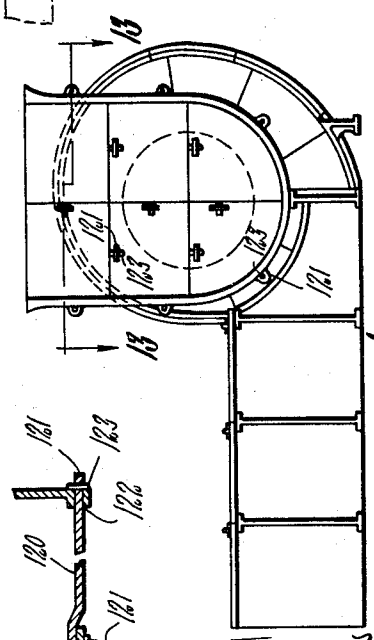


Fig. 12.

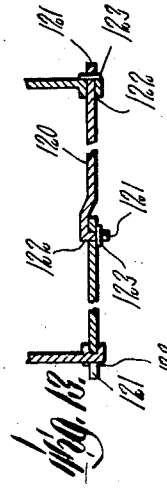


Fig. 13.

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Patented Apr. 3, 1934

1,953,540

UNITED STATES PATENT OFFICE

1,953,540

HIGH TEMPERATURE RESISTANT FAN

Dana P. Ogden, Ottawa, Ill., assignor of one-half to Ermin F. Plumb, Streator, Ill.

Application December 17, 1929, Serial No. 414,641

6 Claims. (Cl. 230—209)

This invention relates to fans particularly designed for use in connection with highly heated gases, such, for example, as are produced in kilns for the drying and firing of bricks or other ceramic material, or in other apparatus for heat treating where gases up to, say, about 2000° F. come directly in contact with fan parts. In order to withstand such high temperatures, the fan parts with which the hot gases contact, must be made of high temperature-resistant material, and for the rotating parts, heat-resistant alloys, such as those compounded largely of chromium and nickel, are most suitable. For somewhat lower temperatures specially treated iron or steel may be employed, such, for example, as the so called calorized iron, which has been packed in aluminum dust and heated for a considerable time. This calorized iron may be used for temperatures up to 1,400° to 1,600° F. The high temperature-resistant alloys usually contain between 10% and 35% chromium, a considerable proportion of nickel and some iron. A small carbon content aids in machining of this material. One alloy suitable for the higher temperatures, for example, comprises chromium, 30%; nickel 15% and iron 55%. It is usually impracticable to attempt to roll such alloys into sheet form and accordingly the fan of this invention is designed to be formed up from cast metal and assembled with a driving shaft with the necessity of only little and simple machining.

Provision is also made by which the rotating parts may be balanced for smooth running. Special means may also be provided for air cooling the fan shaft which also preferably is composed of the alloy or of the specially treated iron. The scrolls in which the rotating blades are positioned are also preferably built up from preformed units, either of high resistant metal or fire brick, since standard masonry, plastic fire brick, and other usual furnace construction materials are usually unsatisfactory in that pieces are liable to break off under the extreme conditions of use and fall into and wreck the rotating fan.

Improved means for closing off the scrolls through which the fans are inserted and removed, also form part of this invention.

For a more complete understanding of this invention, reference may be had to the accompanying drawings in which

Figure 1 is a view partly in side elevation and partly in vertical section through the fan, a part of the scroll being omitted.

Figure 2 is a perspective of a portion of the fan shaft.

Figure 3 is a side elevation of a securing bolt for the lining of the scroll plug.

Figure 3*a* is a detail section on line 3*a*—3*a* of Figure 3.

Figures 4, 5 and 6 are sections on the correspondingly marked section lines of Figure 1.

Figure 7 shows in perspective a manner in which the fan blades are assembled on the fan shaft.

Figure 8 is a view similar to a portion of Figure 4, but showing a modification.

Figure 9 is a section on line 9—9 of Figure 10.

Figures 10 and 11 are sections on the correspondingly marked section lines of Figure 9.

Figure 12 shows in elevation a pre-formed metallic scroll.

Figure 13 is a section on line 13—13 of Figure 12.

Referring to Figure 10, at 1 is indicated a portion of a furnace or heat-treating mechanism of the continuous tunnel type through which is designed to be moved the material to be treated, herein shown as bricks or similar ware, as at 2, on cars which are supported on tracks (not shown) running lengthwise of the tunnel in the well known manner. In order that the hot gases may be caused to circulate about the ware to be treated, fans with which the hot gases come into direct contact are provided as shown, for example, in my Patent No. 1,768,486 granted June 24, 1930, for Continuous car tunnel furnace. These fans 3 are intended to be placed in suitable fan scrolls as shown by dotted lines in Figure 10, taking the gases into contact therewith substantially centrally and by centrifugal force causes these gases to pass out from the fan scroll as through the ports 4.

Figures 1 to 6 show the preferred fan construction which forms a portion of the subject matter of this invention. Referring to Figure 1, it will be noted that the fan scroll is provided with an opening 5 on its outer face which is normally closed by a plug 6. This plug, as shown, is made of suitable material such as reinforced concrete and in order that it may be protected from the high temperatures of the gases which are passed through the scroll, its inner face is shown as surfaced by a plate 7 of high temperature-resistant material such as the chromium alloys hereinbefore mentioned where temperatures up to, say, 2,000° Fahrenheit are to be handled, or specially treated iron, such as the so-called calorized iron, where gases of temperatures up to 1400° to 1600°

only are to be handled. As shown this plate is fixed as by means of specially constructed bolts 8 to the inner face of the plug 6 and against a refractory cement layer 9 in which spaced portions 10 of the bolts 8 are embedded. Portions 11 of this refractory cement extending between the portions 10 of the bolts hold the bolts securely against rotation or removal. These bolts 8 are provided with conical heads 12 for engagement in mating openings in the plate 7 and are preferably made of the high temperature-resistant alloy or specially treated iron. Their outer ends pass through a sectional sheet metal facing 15 on the outside of the plug 6 where nuts 16 are engaged therewith. These nuts 16 may also secure in position retaining rings 17, which act to hold a heat-resistant packing material such as asbestos at 18 over a central opening 19 through which extends a fan shaft 20. The facing plate 15 may be secured as by means of angle brackets 200 and suitable bolts on a facing 21 to the outside of the scroll. Suitable handles 25 may be secured to the facing plate 15 to facilitate removal of the plug from the fan scroll as when it is desired to remove the fan therefrom. The fan shaft 20 is shown as supported for rotation by a pair of bearings at 30 and 31, both of which are positioned outside of the fan scroll. The outer bearing 30 is shown as a ball bearing of the usual type outwardly of which the shaft 20 is provided with any suitable form of coupling, as at 32, for connection to a suitable driving source as the armature shaft 33 of a motor 34. The inner bearing 31 is shown as positioned exteriorly of a wheel rim 40 spaced by spokes 41 from a hub 42 having a centrally tapered opening engaging a mating tapered outer face of the shaft 20. This shaft 20, which extends through the plug 6, is filled with heat-resistant packing material in the inner portion which is exposed to the highest temperatures, being preferably filled with some such material as kieselguhr at 50 and the outer portion being filled with material such as asbestos as at 51. This packing material is held between the inner edge of the fan blades 52 and a suitable plug 53. Outwardly of the plug 53 the shaft 20 is shown as tapered and is left unfilled, having a hollow interior as 55 with which communicate openings 56 through the shaft wall. When the shaft is stationary and is at an elevated temperature, these openings cause a natural upward draft of air which tends to cool the shaft. When the shaft is rotating a current of air may be forcibly drawn through this portion of the shaft and for this purpose inwardly of the bearing 31 it is shown as provided with a plurality of fan blades 60. As shown best in Figure 2, the outer edges of these blades which extend to the inner edge of the hub 42 are riveted between end flanges 61 of a circular series of segmental plates 62 surrounding the shaft. These plates 62 act not only to fix the blades 60 in position, but also shield the outer portions of the shaft against heat passing by the packing 18 and act to confine the air set in motion by the fan to that coming through the outer portion of the shaft and passing between the spokes 41 of the inner bearing wheel. Thus during the rotation of the fan there is set up a positive air draft which tends to cool the shaft.

The manner of assembling the blades with the fan shaft is shown best in Figure 7. These blades are preferably cast, particularly when made of high temperature-resistant alloy, since it is very difficult if not impossible to satisfactorily produce roll shapes of this material. The inner end of the shaft 20 is machined on its inner face and is provided with a plurality of slots 70 extending back from its inner end. Each of the fan plates as 52 has at its inner end a segmental bead 72 which fits against the inner wall of the shaft 70 when the adjacent portion of the blade is placed within a slot 70 in the position shown in Figure 4. These beads 72 of the several blades together substantially fill the circumferential space closely adjacent to the inner wall of the shaft so that each plate supports its adjacent plates against moving inwardly. The blades may be further secured in position by driving tapered keys 73 through openings 74 therein positioned so that the keys engage against the outer face of the shaft portions 75 between the slots 70. If desired the fan blades may be cast together in one piece, being centrally joined by a hub portion 80 (see Figure 8) which is shaped to engage within the shaft 20, the blades projecting outwardly through the slots 70. As shown each blade is provided with a slot 85 therethrough extending outwardly from its inner edge. Through this slot may be positioned U shaped pieces 86 which may be secured over the outer edges of the slots 85 and engage in opposite sides of the blade as by rivets 87. By a proper selection of the weight of these U shaped members inequalities in the weights of the several blades of a fan may be compensated for so that the fan when completed may be in substantial rotative balance. This is of particular importance where fans having vanes of substantial weight such as cast metal are employed and also where they are subjected to the severe operating conditions occasioned by direct contact therewith of the hot gases. The fan blades may be further secured in position on the shaft by internal and external collars 90 and 91 secured to the shaft at either side thereof as shown in Figure 1. It will be noted that the entire bearing support for the fan is positioned outside of the scroll and in order that the fan assembly may be removed as a unit from the scroll readily through the opening 5, the bearings and driving motor are shown as supported on a single bed 99 outside of the furnace, which bed can be unbolted and pulled rearwardly as desired, preferably cushioning material being positioned beneath the bolts as at 100 to absorb vibration. This assembly of the fan blades and shaft is not claimed herein but forms the subject matter of divisional application Serial No. 529,733 filed April 13, 1931, now Patent No. 1,909,885 granted May 16, 1933 for Fan.

The scrolls within which the fans are designed to operate are preferably formed of pre-molded units interlocking with each other as the usual masonry building materials are liable to break down in service, falling into the fan and causing damage thereto. These fan scrolls may be made of pre-formed masonry units, each shaped in accordance with its place in the scroll and preferably interengaging as through grooves 101 and projections 102 in mating elements 103 as illustrated in Figures 9 and 10. Space may be economized where this is desirable by forming the scroll in pre-formed units of the high temperature-resistant alloy. Where this is done the units may be cast, mating units being formed to interengage each other. As shown, for example, in Figure 13 each unit as 120 may be provided with a tongue portion 121 engageable through an opening 122 in a mating unit and held in position in that unit as by means of a key 123 inserted through an opening in its pro-

jection and engaging the face of the mating unit. This scroll construction is also not claimed herein but forms subject matter of a divisional application Serial No. 529,734 filed April 13, 1931 for Fan scroll.

From the foregoing description of certain embodiments of this invention, it should be evident to those skilled in the art that various changes and modifications might be made without departing from the spirit or scope of this invention as defined by the appended claims.

I claim:

1. A mechanism of the class described comprising a fan scroll, a fan in said scroll, a shaft for said fan extending outwardly of said scroll, means outwardly of said scroll for rotating said shaft, said shaft extension being hollow, and means outside of said scroll for causing air to pass through said hollow extension to cool the same.

2. A mechanism of the class described comprising a fan scroll, a fan in said scroll, a shaft for said fan extending outwardly of said scroll, means outwardly of said scroll for rotating said shaft, said shaft extension being hollow and unobstructed and having lateral openings leading from said hollow portion, and means outside of said scroll for drawing air through said lateral openings and through said shaft.

3. A mechanism of the class described comprising a fan scroll, a fan in said scroll, a shaft for said fan extending outwardly of said scroll, said shaft extension being hollow and having lateral openings leading from said hollow portion, means outwardly of said scroll for rotating said shaft, and fan blades on said shaft outside of said scroll for drawing air through said hollow shaft and openings when said shaft is being rotated.

4. A mechanism of the class described comprising a high temperature-resistant fan scroll having an opening, a removable plug for closing said opening, a fan of high temperature-resistant material in said scroll, a hollow shaft for said fan extending through said plug, high temperature-resistant material in the hollow of said shaft within said plug, means independent of said fan for cooling said shaft outwardly of said plug, and means coupled to said cooled portion for rotating said shaft.

5. A mechanism of the class described comprising a fan scroll, a fan in said scroll, a shaft for said fan extending outwardly of said scroll, means outwardly of said scroll for rotating said shaft, said shaft extension being hollow, and means for drawing air through said extension and discharging it outside of said scroll.

6. A mechanism of the class described comprising a fan scroll, a fan in said scroll, a shaft for said fan extending outwardly of said scroll, means outwardly of said scroll for rotating said shaft, said shaft being hollow, a non-heat conducting packing in the hollow of said shaft adjacent to said fan, and means for drawing air through the hollow of said extension and discharging it outwardly of said scroll.

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