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Cairns et al.

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[54] COOLING-GAS CIRCULATORS FOR NUCLEAR-REACTOR POWER STATIONS

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[58] **Field of Search** ..... 415/160, 161, 162, 163; 417/360, 423, 410, 429; 103/97; 230/114 H

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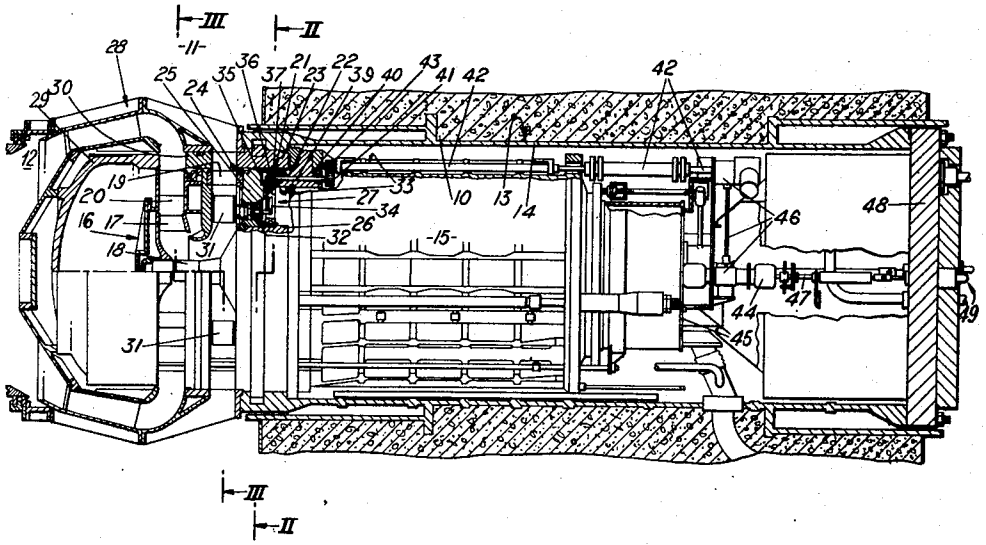
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[57] **ABSTRACT**

A circulator for pressurized gas in the cooling circuit of a nuclear-reactor power station is of a kind having an electric motor mounted in a wall-mounted pressure vessel, and a motor-driven blower in the gas space at the inner end of the vessel and including guide vanes pivotally mounted in a gas passage of the impeller casing and adjustable to vary gas flow through the cooling circuit. Vane-adjusting gearing is afforded protection from the gas in the gas space by disposing said gas passage adjacent to the inner end of the vessel and mounting the gearing to extend within the vessel and through the vessel's inner end.

2 Claims, 3 Drawing Figures



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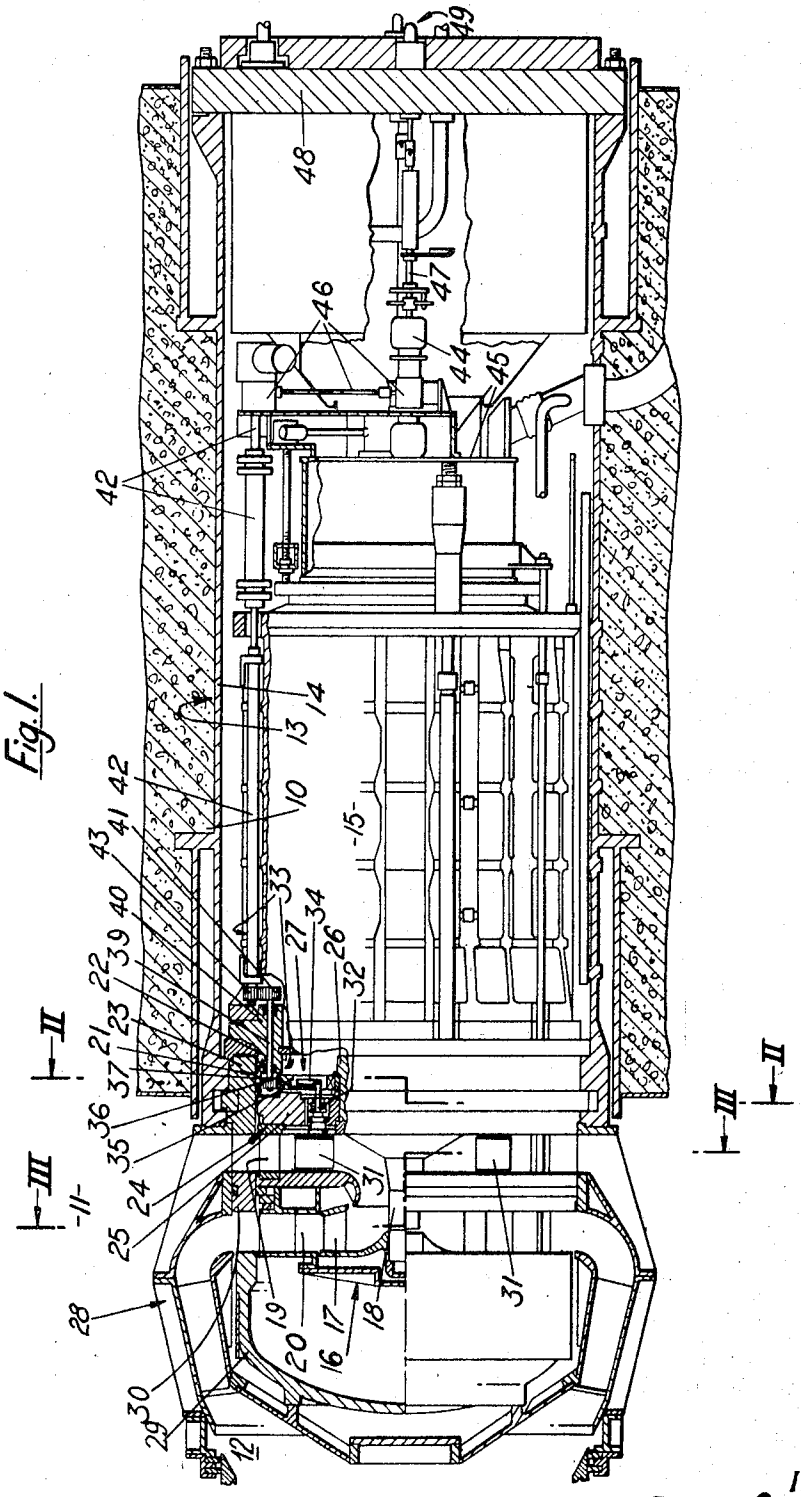
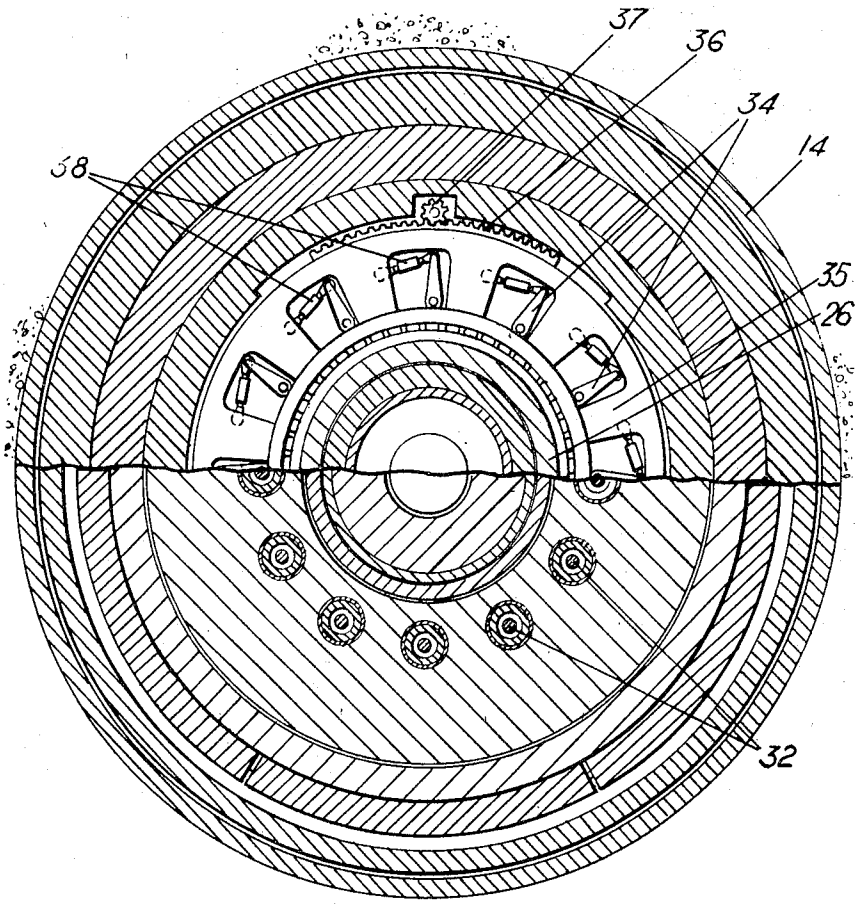


Fig. 1.

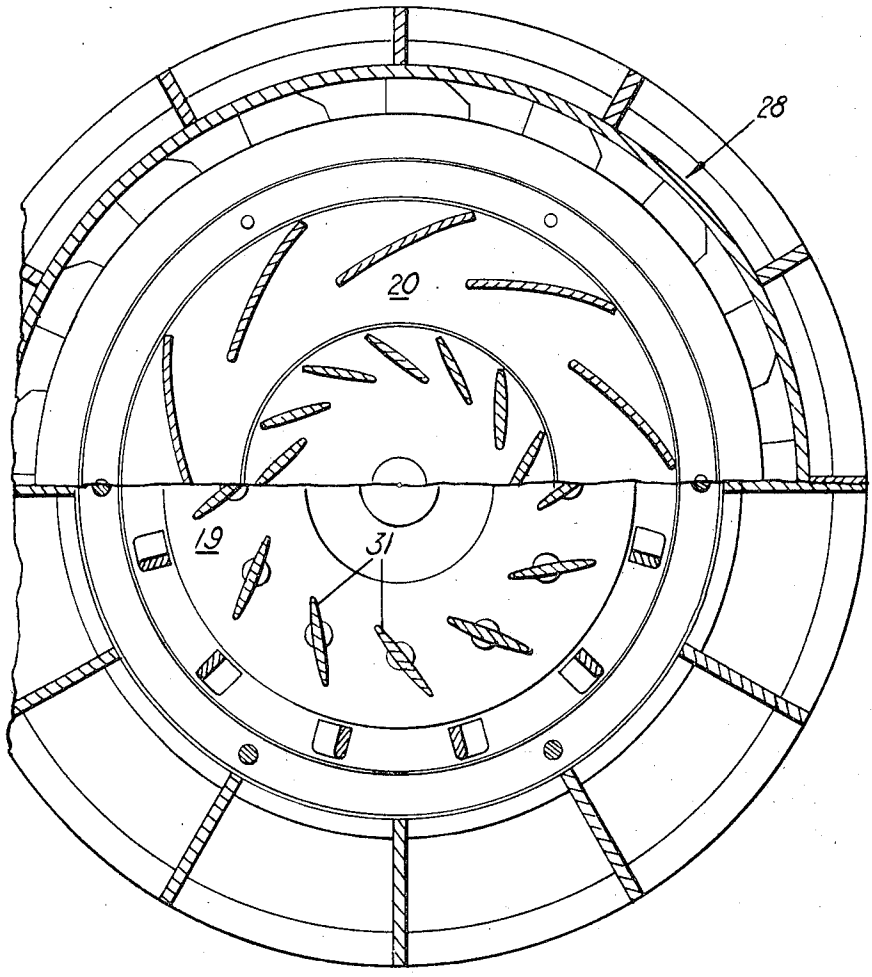
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Fig. 2.



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Fig. 3.



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COOLING-GAS CIRCULATORS FOR NUCLEAR-REACTOR POWER STATIONS

This invention relates to the circulation of cooling gas in the pressure vessel of a nuclear-reactor plant. More particularly, the invention is concerned with a known gas circulator comprising a tubular housing located in an opening in the wall of the pressure vessel to receive cooling gas from the pressure vessel, a motor in the housing, a wall closing the inner end of the housing to minimize the diffusion of oil mist or vapor from the housing into the pressure vessel, and a blower in the pressure vessel drivingly connected to the motor. With the motor thus immersed in the cooling gas, the need for a dynamic gas seal for the motor shaft is avoided.

In this known gas circulator the blower includes an impeller adjacent to the inner end wall of the housing and guide vanes in the inlet passage mounted on spindles for angular adjustment. Vane control means in the pressure vessel are operatively connected to the vane spindles. The vane control means include meshed toothed wheels on spindles, and bearings for the spindles. The toothed wheels and the bearings cannot be lubricated as they are in the pressure vessel and lubricant would contaminate the cooling gas. This presents a problem, especially as the control means are required to operate in a high-temperature gas flow. It has hitherto been proposed to meet the problem by making the components of specially selected materials.

The problem is now met by having (a) the impeller's inlet passage adjacent to the inner end wall of the housing, (b) the vane spindles extending through said end wall, and (c) the vane control means in the housing and operatively connected to the vane spindles. With the vane control means in the comparatively favorable environment of the motor housing, they may be formed of conventional materials and may be lubricated as required.

Preferably, said gas passage is annular and radially directed, and said vane means consist of a peripheral series of vanes pivotally mounted in said passage.

An embodiment of the invention will now be described by way of example with reference to the accompanying drawings in which:

FIG. 1 is a sectional side view of a circulator mounted in an opening in the concrete wall of a power station;

FIG. 2 is a cross-sectional view of the circulator on the line II—II of FIG. 1; and

FIG. 3 is a cross-sectional view of the circulator on the line III—III of FIG. 1.

Referring to the drawings:

In a power station of the aforesaid kind having the nuclear core cooled by pressurized gas, a number of main circulators for the pressurized gas are mounted as a peripheral series in the thick concrete wall **10** of a circular concrete building which houses the core and defines a gas space **11** of a cooling-gas circuit communicating with the core. The manner of mounting the circulators in the concrete wall **10** is the subject of copending Pat. application Ser. No. 766,199. The circulators withdraw gas from a heat exchanger through the gas space **11**, and deliver the gas inwards to an annular plenum chamber **12** within the building and delivering gas to the core. Each circulator comprises a horizontal cylindrical pressure vessel **13** mounted in a through opening in the wall so that the cylinder **14** lines the through opening, an electric motor **15** mounted end-for-end in the vessel, and a centrifugal blower **16** located in the gas space **11** and carried by the inner end of the motor **15**. The blower's impeller **17** is keyed to an extension **18** of the motor shaft, and the impeller casing includes annular radially

extending inlet and outlet passages **19** and **20** respectively. The inner end of the motor casing includes (a) a cylindrical periphery **21** which is a sliding fit in the cylindrical bore **22** of a carrier ring **23** secured within the inner end of the cylinder **14**, and (b) an annular end wall **24** closing the inner end of the cylinder **14** and composed of a center **25** and a hub **26**. The periphery **21** and end wall **24** together define an annular housing **27** within the motor casing. The impeller casing is secured to the center **25**, with the inlet passage **19** adjacent to the center. Annular ducting **28** aligned with the passages **19, 20** of the impeller casing and discharging into the plenum chamber **12** is secured to the inner end of the cylinder **14**. Isolating means for the vessel includes a cover **29** and a bridging ring **30** which cooperate with the carrier ring **23** to seal the inner end of the cylinder **14** from the chamber **12** and gas space **11**. The isolating means are the subject of copending Pat. application Ser. No. 766,211.

A peripherally spaced series of vanes **31** are pivotally mounted in the annular inlet passage **19**. Rotary spindles **32** on the vanes extend through the center **24**, and their inner ends in the housing **27** are rotatable by actuating means **33** to adjust the vanes angularly and thereby vary the gas flow through the cooling circuit. The spindle-actuating means **33** consist of radial arms **34** on the ends of the vane spindles **32**, a ring **35** oscillatably mounted on the hub **26** and having an upper rim portion **36** in the form of a rack, a rotary pinion **37** engaging the rack **36**, and links **38** connecting the ring **35** with the outer ends of the arms **34** so that rotation of the pinion **37** effects adjustment of the vanes. A drive for the pinion **37** consists of a stub shaft **39** carrying the pinion and rotatable in a boss **40** on the motor casing, a toothed wheel **41** on the end of the stub shaft, an axially extending driving shaft **42** rotatably mounted on top of the motor casing and having at its inner end a toothed wheel **43** meshing with the toothed wheel **41** on the stub shaft, and an electric motor **44** carried by a casing **45** on the rear end of the circulator motor **15** and connected to the outer end of the driving shaft **42** through gearing **46**. Operation of the vena motor **44** effects adjustment of the angularity of the vanes **31** and corresponding variation in the gas flow through the cooling circuit. An auxiliary drive shaft **47** connected to the vane motor shaft extends through the vessel's outer end closure **48** for hand actuation as at **49** outwith the vessel so that the vanes **31** may be adjusted without using the vane motor **44**.

The spindle-actuating means **33**, being thus protectively housing in the closed pressure vessel **13**, are subjected to relatively low temperatures, say about 50° C. as compared with about 300° C. in the cooling circuit, and can be oil-lubricated.

We claim:

1. A gas circulator comprising a tubular housing located in an opening in the wall of the pressure vessel of a nuclear-reactor plant to receive cooling gas from the pressure vessel; a motor in the housing; a wall closing the inner end of the housing; a blower in the pressure vessel including an impeller, and guide vanes in an inlet passage adjacent the inner end wall and mounted on spindles for angular adjustment, the spindles extending through the inner end wall; and vane-control means located in the housing and operatively connected to the vane spindles.

2. A gas circulator according to claim **1**, wherein the vane-control means include an oscillatable toothed ring, and the inner end wall of the housing is spaced inwards from the inner end of the motor frame so that the wall and frame form a gear chamber, and the wall is composed of a center portion and a hub portion and the oscillating toothed ring is mounted on the hub portion for oscillation in the chamber.

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