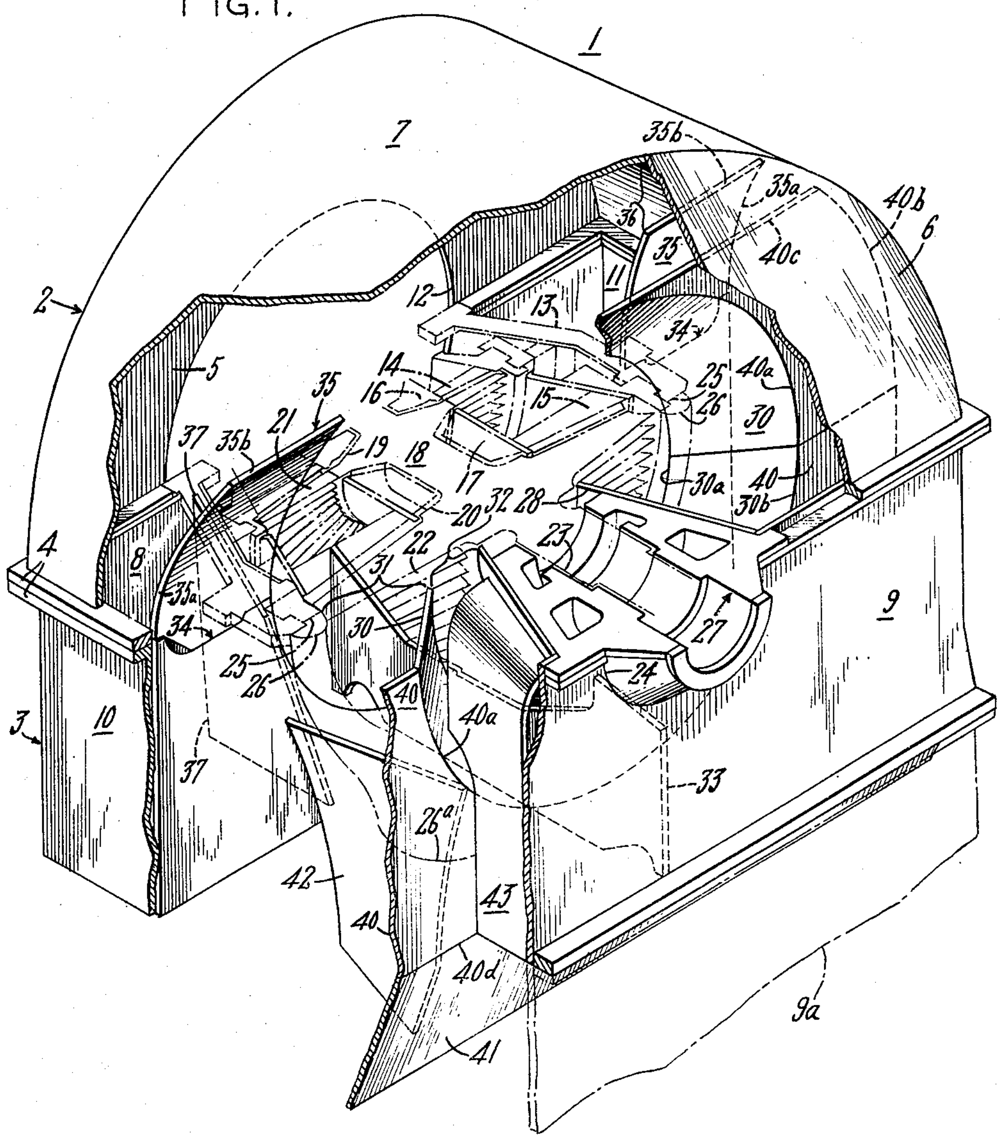
Sept. 22, 1964 J. HERZOG 3,149,470

LOW PRESSURE TURBINE EXHAUST HOOD

Filed Aug. 29, 1962 3 Sheets-Sheet 1

FIG. 1.



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LOW PRESSURE TURBINE EXHAUST HOOD

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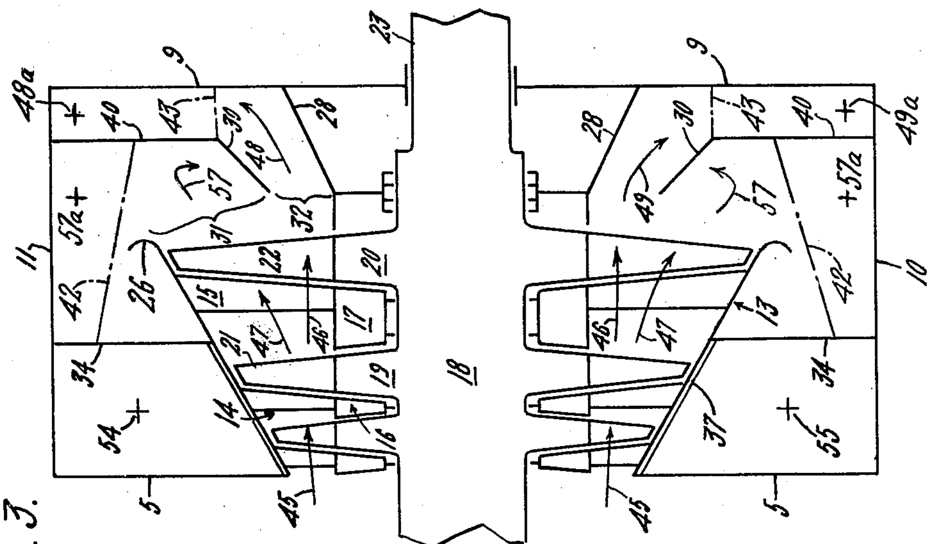

FIG. 3.

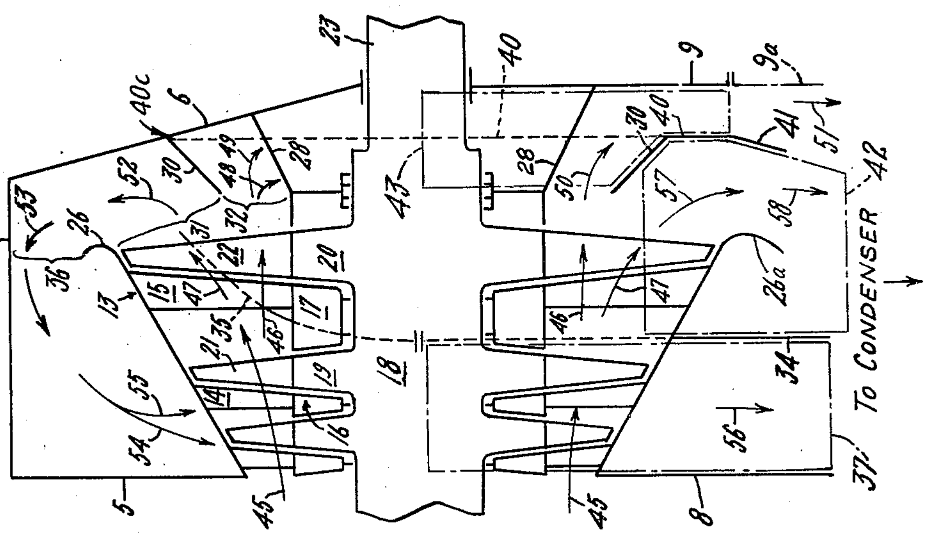

FIG. 2.

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LOW PRESSURE TURBINE EXHAUST HOOD

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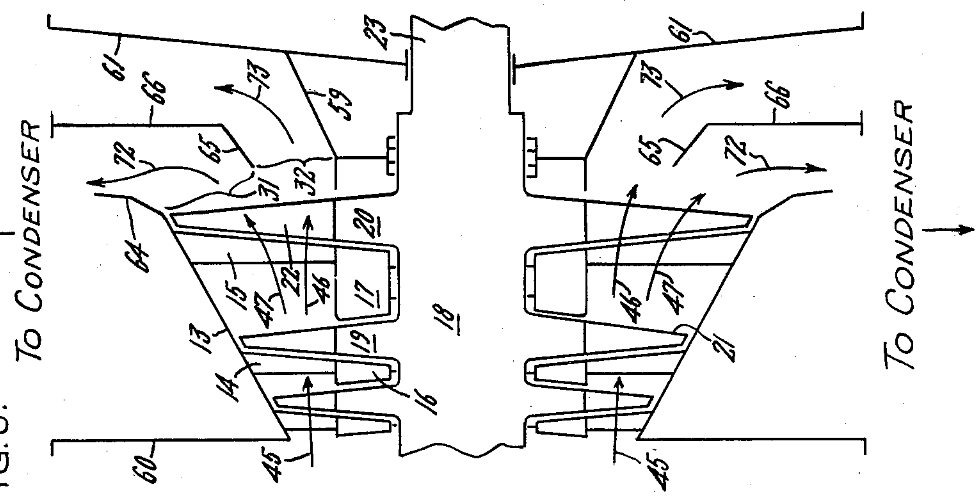

FIG. 5.

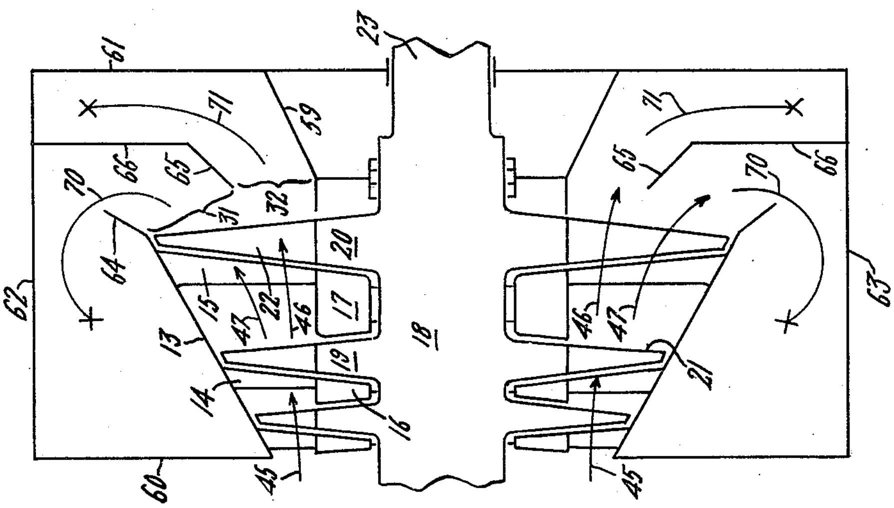

FIG. 4.

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LOW PRESSURE TURBINE EXHAUST HOOD

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Filed Aug. 29, 1962, Ser. No. 220,312
12 Claims. (Cl. 60—64)

This invention relates to an improved turbine exhaust casing or "hood" for an axial-flow turbine. More particularly, the invention relates to improvements in discharge hoods for low-pressure steam turbines exhausting to condensers disposed below or on either side of the turbine rotor.

The efficiency of a steam turbine power plant may be improved by lowering the exhaust pressure at the turbine outlet. Such turbines often discharge to a condenser which is maintained at a relatively constant subatmospheric pressure. Connected between the turbine outlet and the condenser is an exhaust hood which, since its outlet is connected to the constant condenser pressure, determines the turbine last-stage outlet pressure.

The efficiency of the exhaust hood is affected by the local flow distribution within the hood. Eddies and vortices give rise to losses which cannot be recovered. Increased velocities of the fluid between inlet and outlet of the hood are undesirable, since they result in an increase in the static pressure difference between inlet and outlet of the hood. Since the outlet of the hood is connected to a constant condenser pressure, an increased static pressure difference can thus only result in a higher last-stage pressure and reduced efficiency of the turbine.

It is well known that a diffusing passage will serve to reduce the velocity head of a fluid passing through the passage and increase its static pressure head. It has been recognized that an exhaust hood with diffusing passages leading from the turbine is desirable in order to aid in reducing the static pressure drop through the hood. However, diffusing passageways are difficult to obtain in a hood of small dimensions, where the hood must also turn the fluid at right angles to the direction at which it issues from the last-stage axial-flow turbine buckets. Hoods of this type are termed "downward-exhaust," when they turn the motive fluid downward to a condenser beneath the last-stage turbine section, or "side-exhaust," when the fluid is turned in diametrically opposite directions toward condensers on either side of the last-stage turbine section. Space is usually limited in power plant stations and the hood must turn the fluid efficiently without excessive losses and without occupying undue space. A diffusing hood, although relatively simple to obtain by greatly increasing the size of the hood and contouring the flow walls in a known manner, would offer considerable advantages if it occupied a volume no larger than present-day non-diffusing type hoods.

When a fluid is turned through a bend, centrifugal force causes the static pressure to increase at the outer radius. Since the total pressure (static pressure plus velocity head) remains substantially constant, the local fluid velocity must increase near the inner radius of the bend. This unequal distribution of velocities causes the average kinetic energy to increase. If the velocity at

the inner radius increases, continuity considerations then demand that the local cross-sectional area through the flow stream decrease to compensate for the increased velocity. After the bend, there follows a straightening of the streamlines with a tendency for the local cross-sectional area to increase, which results in flow separation from the walls, with accompanying losses in the form of vortices. Also, an increased average velocity results, as noted above, in a greater static pressure difference between inlet and outlet. It would be desirable to reduce the effects caused by turning the motive fluid through a substantially 90° turn, which effects lead to flow separation and decreased hood efficiency.

Accordingly, one object of the present invention is to provide an improved exhaust hood for an axial flow turbine which turns the fluid substantially at right angles from the turbine outlet, with reduced losses and with correspondingly reduced pressure drop in the hood.

Another object of the present invention is to provide an improved hood of the type described which turns the motive fluid downward while reducing flow separation and other losses, and which incorporates diffusing passages therein in a minimum of space.

Still another object of the invention is to provide an improved side-exhaust hood discharging fluid at right angles from the turbine rotor with reduced losses and pressure drop.

Still another object of the invention is to provide an improved hood for an axial-flow turbine which, in a minimum of space, provides a more efficient turning of the motive fluid to a direction normal to the turbine axis and which, because of the incorporation of diffusing passages therein, and because of improved arrangement in the flow guiding portions of the hood, serves to increase the efficiency of the hood and to lower the turbine outlet pressure.

Briefly stated, the invention is practiced by providing a substantially frusto-conical flow-dividing wall at the turbine outlet which divides the flow into radially inner and outer annular flow portions. These portions are further subdivided by additional flow-guiding walls, which form a number of parallel diffusing passages leading toward the hood outlet.

The organization and operation of the invention, together with further objects and advantages thereof, may best be understood by reference to the following description taken in connection with the accompanying drawings in which:

FIG. 1 is a perspective view, partly broken away and in section to show the structural features of a single-exhaust steam turbine hood adapted to discharge downward to a condenser,

FIG. 2 is a schematic elevation view of the hood of FIG. 1 in simplified form,

FIG. 3 is a schematic plan view of the hood of FIG. 1,

FIG. 4 is a schematic elevation view of a modified hood adapted for double-exhaust to either side of the turbine,

FIG. 5 is a schematic plan view of the side exhaust hood of FIG. 4.

Referring now to FIG. 1 of the drawing, a turbine exhaust hood shown generally at 1, is arranged to exhaust downward to a condenser (not shown). The exhaust hood comprises an upper half **2** and a lower half **3** secured together along midline flanges **4**. The outer casing walls of the upper half **2** comprise a back vertical end wall **5**, a front sloping end wall **6**, and a semi-cylindrical wrapper **7** enclosing the upper half of the hood chamber between end walls **5** and **6**. The outer casing walls for the lower half **3** of the hood comprise a back vertical end wall **8**, a front vertical end wall **9**, and vertical side walls **10, 11**.

The back end walls **5, 8** of the outer casing define a circular opening **12** into which extends a turbine casing **13**. The turbine parts are shown in phantom lines to distinguish them from the hood. Turbine casing **13** is substantially frusto-conical with its larger end extending into the hood and is also split into upper and lower halves. Extending radially inward from its inner wall are several stages of stationary nozzles **14, 15**, supporting diaphragms **16, 17** respectively. Also shown are portions of the turbine rotor **18**, which rotor includes a number of turbine wheels **19, 20** carrying rotating blades **21, 22** respectively. The turbine rotor includes a shaft portion **23** extending through an opening **24** provided in the front end walls **6, 9**.

The turbine thus described is of the conventional axial-flow type comprising the final or exhaust stages of a steam turbine designed for exhausting steam to a condenser at sub-atmospheric pressure. The turbine casing **13** ends at **25**, short of the front end walls **6, 9**, at which point the steam from the last stage blades **22** issues as an annular flow from casing **13**. A peripheral steam guide **26** is attached to turbine casing **13** at the outlet and provides a contoured diverging lip from casing **13**. Steam guide **26** (FIG. 1) is of semi-circular cross-section around most of the periphery of casing **13** at the top and sides thereof. However, at the lower portion designated **26***a*, the steam guide lengthens considerably and provides a much flatter or less convex surface extending downward toward the outlet of casing **13**.

Disposed in opening **24** in the front end walls, and cooperating with the shaft portion **23** of the turbine rotor, is a bearing cone shown generally as **27**. This provides several functions, such as serving as a support for the bearing elements (not shown) for shaft portion **23**, and for supporting suitable steam seals (not shown) to prevent the leakage of steam around shaft portion **23**. Bearing cone **27** has an annular outer wall portion **28** which is frusto-conical in shape and which extends into the hood toward the outlet of turbine casing **13**. The end of the frusto-conical wall **28** forms close clearances with turbine rotor **18**. Thus, a continuous annular inner boundary wall is provided by portions of diaphragms **16, 17**, turbine wheels **19, 20** and bearing cone wall **28**. The radially inner portion of steam from the turbine casing **13** will be guided by this inner boundary wall until it is deflected by front end walls **6, 9**.

In accordance with the invention, a substantially frusto-conical flow dividing member **30** is disposed in the path of exhaust steam from the last-stage buckets **22**. Its smaller open end **30***a* faces the turbine buckets **22** and its larger end **30***b* faces the end walls **6, 9**. The diameter of small end **30***a* is intermediate that of the root diameter and tip diameter of last stage buckets **22**. The flow dividing frusto-conical wall **30** is arranged to divide and deflect the steam in a manner later to be described in detail. It will be apparent immediately, however, that the flow-divider **30** divides the annular gas flow into a radially outer annular flow portion designated by bracket **31** and a radially inner annular flow portion designated by bracket **32**.

The lower half **3** of the hood casing is divided from front to back by a longitudinal plate **33** which serves primarily as a stiffener against the inward pressures exerted by the atmosphere against end walls **8, 9**. The lower half **3** is also divided transversely by vertical plates **34** which are spaced from the rear wall **8**, and which also engage the side walls **10, 11** and the turbine casing **13** around its lower periphery. These serve to resist inward pressure against side walls **10, 11**. The vertical plates **34** are aligned with curved mating flow-guiding walls **35** attached in the upper part of the hood, and extending both upward and forward. These engage the wrapper **7** on their sides **35***a*, but terminate short of the wrapper **7** on their top sides **35***b*. Thus, an opening is left across the top of the hood as designated by bracket **36** for a portion of the exhaust steam to flow toward the back end wall **5**.

Extending roughly longitudinally between the back end wall **8** and plate **34** on either side of casing **13** are two warped plates **37** (only one is shown in FIG. 1) which, by virtue of their warped shape, provide a pair of diffusing exhaust passageways defined between walls **8, 10, 34, 37** on either side of the hood in the lower part thereof. These diffusing passageways expand downwardly toward the condenser, being smaller at the top (near flanges **4**) and larger at the bottom, so as to provide a smoothly diffusing passageway. Steam is guided down into these diffusing passageways by the plates **35** which are aligned with plates **34** beneath.

Extending across the upper half **2** and lower half **3** of the outer casing in a transverse direction is a further plate **40** (made in upper and lower halves) which defines a central opening **40***a* into which is secured the edge of the larger end **30***b* of frusto-conical flow divider **30**. Thus, plate **40** serves to support the cone **30**. The plate **40** extends transversely to engage the side walls **10, 11** on either side, and thereby to serve as an additional transverse stiffener against the pressure exerted on walls **10, 11** by the atmosphere. The upper half of plate **40** which is attached in the upper hood casing **2** engages wrapper **7** along its side **40***b* for a portion of its length, and then engages the sloping front end wall **6** along its edge **40***c* across the top of the casing. Thus, the radially inner portion **32** of the motive fluid is contained solely in the front part of hood **1** by the plate **40**, end walls **6, 9**, and portions of the wrapper **7** and side walls **10, 11**.

The lower edge **40***d* of plate **40** is connected to a sloping transverse plate **41** which diverges away from the front end wall **9**. Therefore, another diffusing passage is formed between plate **41** and the phantom extension **9***a* of end wall **9**. The other downward extending plates, forming continuations of walls **8, 10, 11** have been omitted in FIG. 1.

There are several additional flow guiding plates, which also serve as stiffening members between walls. These flow guiding plates smooth out what would be the natural flow of the steam otherwise, serve to prevent or reduce turbulence, and assist in defining the multiple diffusing passages in the lower part of the hood. One such plate is the warped plate **42** extending roughly longitudinally between plate **37** and plate **40**. This serves mainly as a streamlined stiffener, along with a similar plate (not shown) on the other side of the hood. Another flow guiding plate **43** extends between conical walls **30, 28** and also between vertical walls **40, 9**. Again, this acts to reduce turbulence of steam, while stiffening the entire structure.

A better understanding of the operation of the various flow passages formed by the walls of the hood may be had by reference to FIGS. 2 and 3 of the drawing, which are schematic elevation and plan views respectively of the hood of FIG. 1. Elements in FIGS. 2 and 3 are designated with the same reference numerals as those in FIG. 1.

First in FIGS. 2 and 3, it will be observed that the flow enters the turbine casing as designated by arrows **45**. As it expands, it is further designated by the radially inner and outer arrows **46, 47** respectively.

Looking at FIG. 2, in the lower half of the hood, the radially inner portion of the flow leaving blades **22** (see arrow **50**) is guided by the cone **30** into the downwardly extending passages formed between baffle **43** and the corresponding baffle (not shown) on the other side of the hood. Longitudinal plate 33 further separates this portion into right and left hand flow portions.

In the upper half of the hood, the radially inner portion of the flow subdivides as indicated by arrows 48, 49 and flows downward on either side of cone 28, filling the radially outer portions of the vertical passages formed by walls 40, 9, 11, 43 and 40, 9, 10, 43. This is more clearly shown by arrows 48, 48a, 49, 49a in FIG. 3.

The upper hood flow 48a, 49a merges with the other portions of the flow 50 from the radially inner flow annulus and the combined streams 48a, 49a and 50 flow downward as indicated by arrow 51 in the diffusing passage formed between walls 41, 9a.

Still referring to FIG. 2, the radially outer portion of the flow (bracket 31) in the upper half of the hood curves upward around steam guide 26 and deflector plate 35 through approximately 270° as indicated by the arrows 52, 53. Passing toward the back of the hood, the flow subdivides into portions indicated by arrows 54, 55 and flows downward on either side of the turbine casing 13. These flows do not re-merge, but pass downward through the two parallel diffusing passages on either side of the hood (formed between walls 8, 34, 10, 11 and 37). The flow on the near side is indicated by arrow 56 of FIG. 2. These two parallel downward flows are represented by arrows 54, 55 in FIG. 3.

In the lower half of the hood, as shown in FIGS. 1 and 2, it is seen that the part of the radially outer flow of steam contained in the circumferential arc between baffle 42 and central plate 33, and the similar passage formed between plate 33 and a baffle 42 (not shown) on the far side of plate 33, turns downward as indicated by arrow 57 in FIG. 2, between the boundaries formed by extended steam guide portion 26a and the plates 40, 41. Due to the opening out of the passage to wall 34 beyond steam guide 26a, the steam continues downward and further diffusion takes place. Another portion of steam from the radially outer portion flows to either side and downward in the vertical passages between walls 34, 42, 40, 10, and 11, shown by crosses 57a in FIG. 3. The combined downward flow is indicated by arrow 58.

Thus it will be seen that the invention provides multiple diffusing flow paths in parallel between various portions of the turbine exit annulus and the rectangular discharge opening facing downward to the condenser.

Reference to FIGS. 4 and 5 of the drawing shows a modified form of the invention in which the exhaust hood is adapted for double flow or side exhaust to condensers (not shown) on either side of the turbine. The reference numerals for the turbine and its casing are identical to those in FIGS. 2 and 3.

The side-exhaust hood outer casing, shown in the elevation view of FIG. 4, comprises spaced vertical end walls 60, 61. Turbine casing 13 extends into the hood from the rear end wall 60. The other end of turbine casing 13 is spaced from the front end wall 61 as previously. Top and bottom walls 62, 63 respectively (FIG. 4) close off the space above and below the turbine hood between end walls 60, 61. A frusto-conical bearing cone wall 59 and a steam guide 64 which may be constructed in a manner to the previously mentioned bearing cone wall 28 and steam guide 26 form inner and outer boundaries for the annular flow of steam issuing from the last-stage turbine bucket 22. This steam is divided into radially outer and radially inner circumferential flow annuli 31, 32 as before, by a frusto-conical flow divider 65. The flow dividing cone 65 is supported at its larger end by a transverse plate 66. As seen in FIG. 4, plate 66 engages top and bottom walls 62, 63 at the top and bottom of the hood casing.

In the plan view of FIG. 5, the wall portions of 66 are modified and extend normal to the axis. They are spaced from outer walls 60, 61 so as to form a diffuser. As for the radially outer flow portion 31, the outlet passage increases in cross-sectional area beyond steam guide 64 and also provides some diffusing action.

The operation of the modified side-exhaust version of FIGS. 4 and 5 is similar to that of the single exhaust version of FIGS. 1 through 3. In FIG. 4, the radially outer portion 31 of the steam is deflected away from the turbine rotor by cone 65 and then turns to flow into the plane of the drawing toward the side exhaust as indicated by arrows 70. Similarly, the radially inner portion 32 is turned away from the turbine rotor by the cone 59 and end wall 61 and then flows into the plane of the drawing, as indicated by arrows 71. In FIG. 5, the flow takes place toward each side as indicated by arrows 72, 73 from the radially outer and radially inner flow annuli respectively.

The operation of the cone and plate combination in both the downward exhaust and the side exhaust version is as follows. In flows which are sharply curved, centrifugal effects are appreciable and local pressure and velocity distributions vary greatly. These local variations cause increases in the static pressure difference between inlet and outlet of the hood. The cone and plate combination serves to divide the sharply curving fluid into two portions. The static pressure difference between inner and outer radii of the bend is likewise divided into two smaller static pressure differences. These static pressure differences are developed separately in the radially inner and radially outer flow portions, which aids in preventing flow separation.

Explained in another way, it can be said that the flow dividing cones 30, 65 subdivide the flows while the supporting plates 40, 66 "crowd" the radially outer portion of the fluid toward steam guides 26, 64 in FIGS. 3 and 5 respectively to reduce flow separation.

In addition to furnishing an important flow guiding function, the cone 30 and plate 40 which divide the flow from the turbine into radially inner and outer portions, also provide an important structural function. Whereas many previous hoods have employed struts and braces to support the hood against the forces of the atmosphere, the hood being at subatmospheric condenser pressure, it will be observed from FIG. 1 that the plate 40 acts as a transverse bracing member between side walls 10, 11 and also stiffens the slanting front wall 6. The various other flow guiding plates which provide diffusing passages and steam guides also serve as structural members. Like plate 40, the plates 34, 35 also act as a transverse brace between side walls 10, 11, the warped plates 37, 42, 43 serve as longitudinal bracing members between the aforementioned transverse walls 8, 34, 40 and 9; and the longitudinal plate 33 braces end wall 8 against end wall 9. Thus, the exhaust hood is braced from the interior by plates which also serve important flow guiding functions without the need for large numbers of struts or columns which have been used for mechanical support in previous low pressure hoods.

It is within the scope of the invention to further increase the efficiency of the hood by subdividing the flow from the turbine outlet into more than two radial portions. This would require an additional cone and plate combination adjacent the one shown in FIG. 1. It is also within the scope of the invention to employ a single contoured bell-shaped member in place of the cone and plate.

Certain aspects of the invention are not limited to particular details of the constructions illustrated, and it is contemplated that modifications other than those shown and described will occur to those skilled in the art. Therefore, it is intended that the appended claims shall cover all such modifications as fall within the true spirit and scope of the invention.

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

1. In an exhaust hood for a turbine of the type having an axial flow rotor discharging motive fluid from an

annular turbine casing outlet enclosed within exhaust hood walls toward at least one radially directed exhaust flow passage defined between a pair of longitudinal wall portions and a pair of transverse wall portions, said transverse wall portions being disposed upstream and downstream from the turbine outlet respectively and extending substantially normal to the turbine rotor axis, the improvement comprising:

a hollow annular flow dividing member disposed inside the hood coaxial with the turbine rotor and having a smaller open end facing the turbine outlet and being of such a diameter as to divide the flow from the turbine casing outlet into radially inner and radially outer annular fluid portions, said annular member being constructed so as to diverge toward a larger open end with substantially radial flow dividing walls, a portion of said radial flow dividing walls being substantially parallel to and spaced between said transverse wall portions and also extending radially to engage said longitudinal wall portions to maintain separation of the inner fluid portion from the outer fluid portion in the radially directed flow passage.

2. In a turbine exhaust hood of the type having an axial flow turbine rotor discharging motive fluid from a turbine casing outlet enclosed within exhaust hood walls toward at least one radially directed exhaust flow passage defined between a pair of opposed longitudinal wall portions and a pair of transverse wall portions, said transverse wall portions being disposed upstream and downstream from the turbine outlet and extending substantially normal to the turbine rotor axis, the improvement comprising:

a substantially frusto-conical member disposed inside the hood coaxial with the turbine rotor and having its smaller end facing the turbine outlet, and being of such a diameter as to divide the flow from the turbine casing outlet into radially inner and radially outer annular fluid portions, and to deflect said radially outer portion away from the turbine rotor axis, and

a radial flow-dividing wall extending outward from the larger end of said frusto-conical member, a first portion of said flow dividing wall being substantially parallel to and spaced between said transverse wall portions and extending to engage said opposed longitudinal wall portions so as to maintain separation of the inner fluid portion from the outer fluid portion in said radially directed flow passage.

3. The combination according to claim 2 wherein said first exhaust flow passage extends downwardly from the hood, and wherein said radial flow dividing wall engages the downstream transverse wall across the top of the hood, and including means defining a second diffusing exhaust flow passage extending downward around the turbine casing upstream of said first flow passage, and

flow guiding means directing a part of the radially outer fluid portion from the top of the hood into said second exhaust flow passage.

4. In a turbomachine, the combination of:

an outer discharge hood comprising first and second spaced end walls and opposed longitudinal wall portions extending between said end walls,

a turbomachine casing extending into said hood from an opening defined in the first end wall and terminating short of the second end wall and having an annular outlet,

an inner frusto-conical member convergently extending into said hood from said second wall and terminating adjacent the annular outlet of said casing to define an inner boundary for the flow of motive fluid toward said second end wall,

means defining a first exhaust flow passage extending radially from said hood and arranged to receive motive fluid issuing from the annular casing outlet toward the second end wall, said opposed longitudinal wall portions serving as part of said flow passage defining means,

and a hollow annular flow dividing member having a smaller open end facing the annular casing outlet and of such a diameter as to divide the flow therefrom into radially inner and radially outer annular fluid portions, said member also diverging toward a larger open end with substantially radial walls, portions of said radial walls being parallel to and spaced from said end walls and extending to engage said opposed longitudinal wall portions so as to maintain separation between said inner and outer annular fluid portions as the fluid flows radially from the hood in said first exhaust flow passage.

5. In a turbomachine, the combination of:

an outer hood casing comprising a vertical rear wall and a spaced substantially vertical front wall, and a third wall extending between said end walls on the top and sides thereof to define a hood chamber,

a turbine casing extending into said hood chamber from an opening defined by the rear end wall and terminating short of the front end wall,

means providing an inner frusto-conical member convergently extending into said hood chamber from said front wall and terminating at the turbine casing outlet to define an inner boundary for the flow of motive fluid toward said front wall,

a turbine rotor disposed in said turbine casing and having a shaft portion extending within inner frusto-conical member,

spaced walls defining vertical downward diffusing flow passages on either side of said turbine casing near the upstream end thereof,

a hollow annular flow-dividing member having a smaller open end facing the turbine casing outlet and of such diameter as to divide the flow from the turbine outlet into radially inner and radially outer annular fluid portions, and to deflect said radially outer portion away from the turbine rotor axis, said member also diverging toward a larger open end with substantially radial walls, said radial walls extending to engage the third wall on either side of the hood and to engage the front wall across the top of the hood so as to maintain separation between the inner and outer fluid portions at the top and sides of the hood, and

a plurality of flow-guiding walls so constructed and arranged as to guide all of the radially inner fluid portion to flow downward between said radial wall portion of said annular member and said front wall; to guide the part of the radially outer fluid portion from the lower part of the turbine casing to flow downward on the other side of said radial wall portion of said annular member; and to guide the part of said radially outer fluid portion from the upper part of the turbine casing to flow upward and backward in the hood to discharge downward from the hood casing through said diffusing passages.

6. In a turbomachine, the combination of:

an outer hood casing comprising front and rear spaced end walls, and top and bottom walls extending between said end walls to define a hood chamber,

a turbine casing extending into said hood chamber from an opening defined by the rear end wall and terminating short of the front end wall,

means providing an inner frusto-conical wall convergently extending in said hood chamber from the front end wall and terminating adjacent the turbine casing outlet to define an inner boundary for the flow of motive fluid toward said front wall,

a turbine rotor disposed in said turbine casing and having a shaft portion extending within said inner frusto-conical wall,

and a hollow annular flow dividing member having a small open end facing the turbine casing outlet and of such a diameter as to divide the flow from the turbine outlet into radially inner and radially outer annular fluid portions, said member also diverging toward a larger open end with substantially radial walls,

a plurality of spaced walls defining exhaust flow passages extending from either side of said turbine hood casing,

said annular flow dividing member having its top and bottom radial wall portions engaging the top and bottom walls of said hood casing and having its side radial wall portions extending between and spaced from said exhaust flow passage walls, whereby the local static pressure increases developed when turning the fluid away from the turbine rotor axis are developed separately within the radially inner and outer fluid portions while the radial wall portions of the flow dividing member maintain separation between the inner and outer fluid portions.

7. An exhaust hood for an axial flow elastic fluid turbine defining multiple parallel flow paths communicating between the annular discharge opening from the last stage turbine rotor to a rectangular exit opening disposed in a plane spaced transversely from the axis of the turbine and normal to the plane of the annular turbine discharge opening and communicating with a condenser, said hood comprising a transverse end wall **5**, **8** extending outwardly from the turbine casing **13** and spaced upstream from the last stage bucket wheel **20**, a second transverse end wall **6**, **9** spaced axially down-stream from the last stage bucket wheel **20**, a semi-cylindrical top wall **7** connecting said end walls **5**, **8**, **6**, **9** in the upper half of the hood, spaced sidewalls **10**, **11** cooperating with the end walls **8**, **9** and forming substantially flat downwardly extending walls to define a downwardly facing rectangular discharge opening to the condenser, a transverse wall **40** spaced axially between the last stage bucket wheel **20** and the end wall **6**, **9**, the wall **40** defining a central circular opening with a frusto-conical baffle member **30** having its outer periphery secured to the periphery of the opening in said wall **40** and with the inner periphery of the conical member **30** spaced axially adjacent the annular row of turbine buckets **22** to subdivide the annular discharge passage therefrom into an inner annular flow portion **32** and a concentric outer flow portion **31**, a transverse wall **34** spaced axially between the walls **8** and **40** in the lower half of the hood, spaced baffle plates **37** extending between the walls **8**, **34** in the lower half of the hood to define downwardly extending diffusing passages communicating with the upper half of the hood, a pair of curved baffle plates **35** extending into the upper half of the exhaust hood and forming upward continuations of the transverse plate **34** in the lower half of the hood, a longitudinal brace and baffle plate member **33** in the lower half of the hood extending axially from the upstream end wall **8** to the downstream end wall **9** in the lower half of the hood, vertical baffle plate members **43** spaced at opposite sides of the central longitudinal plate **33** to define vertical passages to receive the lower half of the inner annular flow portion **32**, baffle members **43** also cooperating with transverse wall **40**, end wall **9**, and side walls **10**, **11** to define vertical passages communicating with the upper half of the inner annular flow portion **32**, a pair of longitudinally disposed warped baffle plate members **42** extending between the transverse walls **34**, **40** and spaced transversely from central baffle **33** to form parallel downwardly extending passages communicating with the lower half of the outer annular flow portion **31** in the lower half of the hood, baffles **42** cooperating also with the outer sidewalls **10**, **11** and the transverse walls **34**, **40** to define parallel downwardly extending passages communicating with the upper portion of the outer annular flow portion **31** in the upper half of the hood, and an annular flow guide member **26**, **26*a*** secured to the end of the turbine casing surrounding the annular discharge opening therefrom, the lower guide plate portion **26*a*** cooperating with a downwardly extending portion **41** of transverse plate **40** to define a diffusing passage communicating with the lower half of the annular outer flow portion **31** in the lower half of the hood.

8. A radial discharge hood for an axial flow turbine discharging elastic fluid through a turbine casing discharge annulus comprising:

a first transverse wall portion disposed downstream from the turbine discharge annulus,

a second transverse wall portion disposed upstream of the turbine discharge annulus and having an opening therein accommodating the turbine casing,

a third transverse wall portion disposed between the first wall and the discharge annulus and having an opening therein coaxial with the annulus,

fourth and fifth opposed longitudinal wall portions engaging opposite edges of each of said first, second and third transverse wall portions to define upstream and downstream radially directed hood discharge duct portions, at opposite sides of said third wall portion, and

a hollow frusto-conical flow-dividing member disposed with its larger end in said third transverse wall opening and its smaller end disposed to divide the flow from said casing discharge annulus into concentric inner and outer annular fluid portions,

whereby the third transverse wall portion maintains separation of the inner annular fluid portion in the downstream discharge duct portion from the annular outer fluid portion in the upstream discharge duct portion.

9. A turbine discharge hood according to claim 8 and including an annular bearing housing having one end supported by said first transverse wall portion and having its other end disposed coaxially adjacent said third wall opening, and a plurality of longitudinally extending flow guiding plates extending substantially radially between the first and third walls to guide the fluid in subdivided parts of the downstream discharge duct portion, said flow guiding plates having radially inner end portions attached to said bearing housing to support said housing from said first and third transverse wall portions.

10. The combination according to claim 8, wherein said longitudinal wall portions are vertical and said discharge duct portions are directed downwardly, and including a semi-cylindrical top wall engaging said first, second, and third transverse wall portions and closing off the top part of the hood.

11. The combination according to claim 8, wherein said longitudinal wall portions are horizontal, and the hood defines upstream and downstream discharge duct portions at either side of the third transverse wall extending horizontally in opposite directions.

12. An exhaust hood surrounding an elastic fluid turbine casing containing an axial flow rotor having a fluid discharge annulus, said hood comprising:

a first transverse wall spaced axially downstream from the rotor discharge annulus,

a second transverse wall extending outwardly from the turbine casing and disposed upstream from the rotor discharge annulus,

a third transverse wall spaced axially between the rotor discharge annulus and said first wall,

longitudinally extending walls connected to portions of the peripheral edges of said first, second, and third transverse walls, and cooperating therewith to define first and second discharge chambers surrounding the turbine axis the walls forming said discharge chambers defining at least one hood discharge opening from each chamber,

said first transverse wall supporting a first frusto-conical member converging inwardly through said first discharge chamber and having a smaller end portion spaced coaxially adjacent the inner circumference of the rotor discharge annulus,

said third transverse wall having a circular opening coaxially spaced from said first frusto-conical member and a second hollow frusto-conical flow-dividing member with its outer edge secured to the circumference of said circular opening in the third transverse wall and converging axially toward the rotor discharge annulus with its smaller end disposed to divide the flow from the rotor into concentric inner and outer annular fluid portions,

said first and second frusto-conical members forming therebetween an annular flow path directing all of the inner annular fluid portion into the first discharge chamber, and

said second frusto-conical member directing all of the

outer annular fluid portion into said second discharge chamber, whereby said inner and outer annular fluid portions are maintained completely separate all the way from the rotor discharge annulus to the discharge openings from said first and second discharge chambers by said third transverse wall.

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