

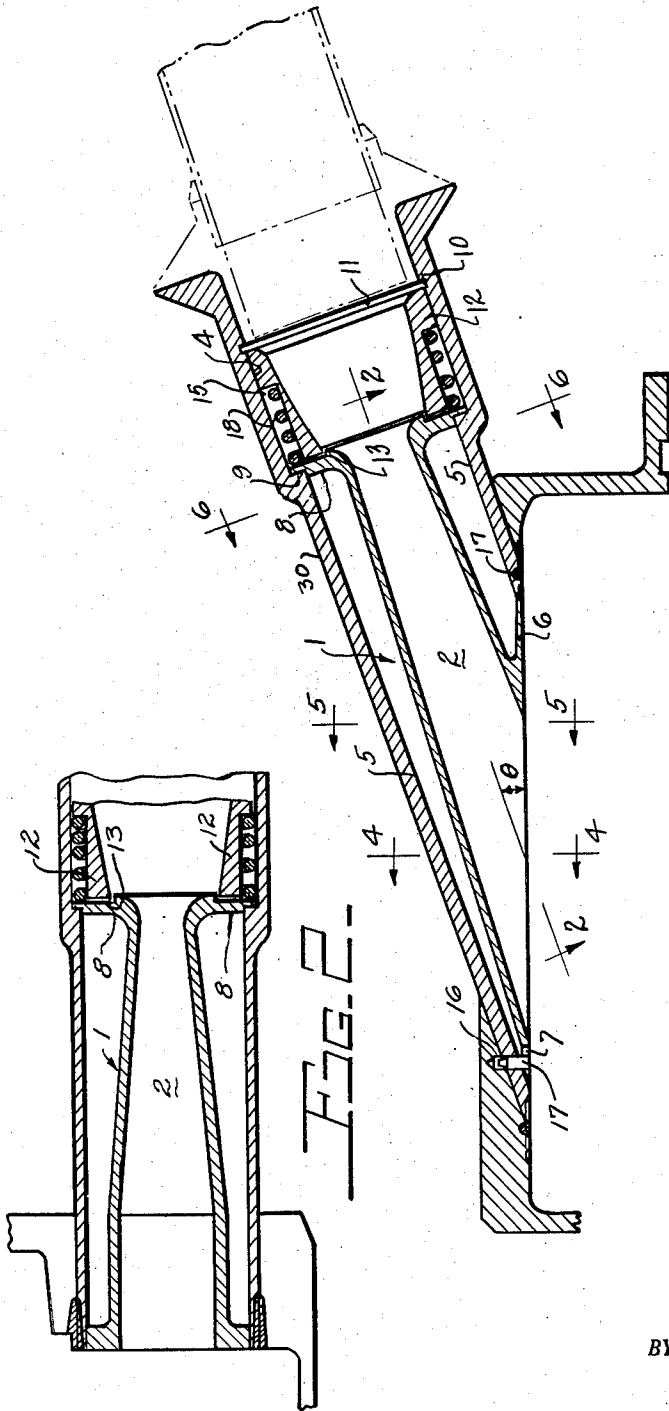
March 24, 1959

O. A. WIENOLA
INSERT TURBINE NOZZLE

2,879,029

Filed July 1, 1954

3 Sheets-Sheet 1



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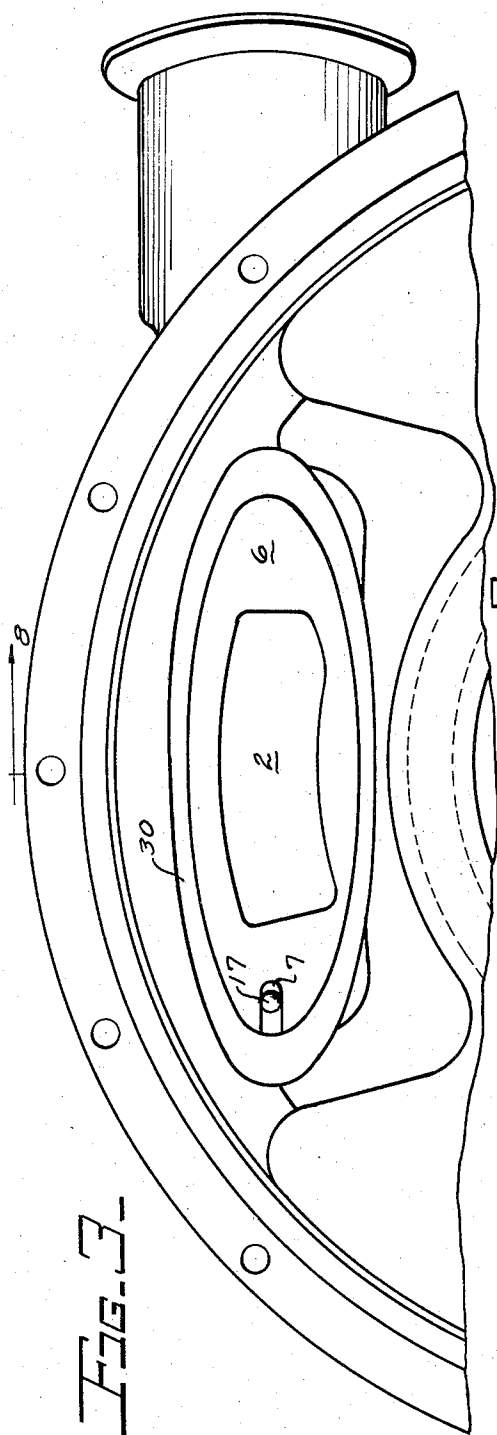


FIG. 7-

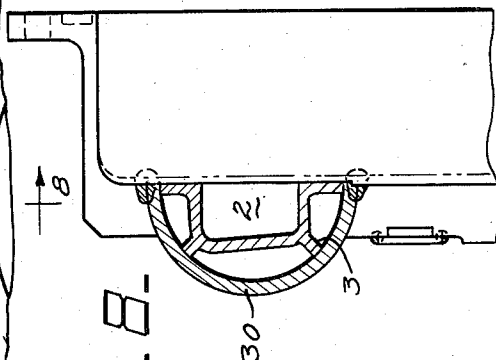


FIG. 8-

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FIG. 6.

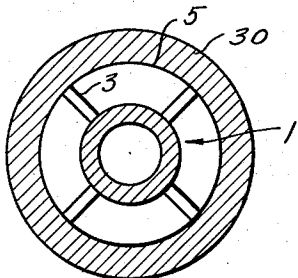


FIG. 5.

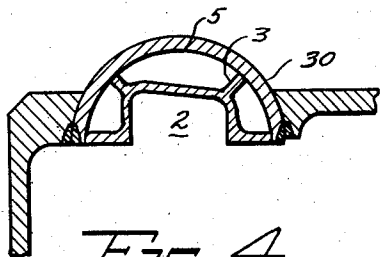
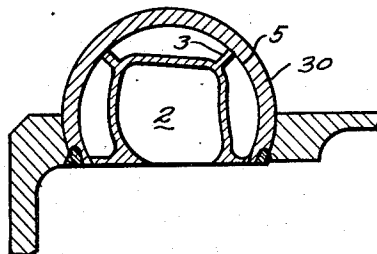


FIG. 4.

FIG. 7.

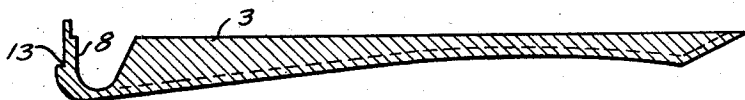
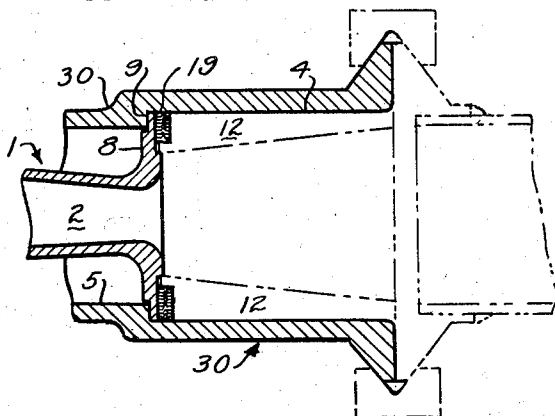


FIG. 9.



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INSERT TURBINE NOZZLE

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Application July 1, 1954, Serial No. 440,878

5 Claims. (Cl. 253—78)

This invention relates to an improved turbine nozzle that is simple to fabricate, easy to install or remove, and yet retains maximum efficiency characteristics. The novel turbine nozzle presented herein, moreover can be readily sealed and is adapted to accommodate itself to thermal effects with full retention of efficiency and the nozzle orientation is foolproof and positive. The improved turbine nozzle is used in a housing having a stepped bore and is fabricated as an investment casting.

The care and maintenance of turbine nozzles has long been a problem since defective nozzles clearly result in an impairment of turbine efficiency and it is essential for operating economy that there be a ready way of repair or replacement of defective nozzles. The inventive nozzles structure presented herein was developed to meet such problem and it does so effectively as may be clearly seen from the invention apparatus as described herein. Moreover, the fact the novel nozzle is easily sealed while providing thermal expansion presents a further advantage.

An object of the invention is to provide a new and improved turbine nozzle.

A further object of the invention is to provide an improved turbine nozzle that may be inserted in its housing with positive retention characteristics yet be readily removed for maintenance or replacement purposes.

An additional object of the invention is to provide an improved insert turbine nozzle which is made in the form of a casting for use in combination with a housing having a stepped bore.

Another object of the invention is to provide an improved nozzle assembly which enables a continuous ready seal for the nozzle unit while being fully capable of accommodating thermal expansion.

Other objects and advantages of the invention will become readily apparent to those versed in the art from the following description taken in conjunction with the accompanying drawings wherein:

Fig. 1 shows a longitudinal cross section of the improved novel nozzle assembly which is the subject of this invention.

Fig. 2 is a transverse cross section of the nozzle taken on line 2—2 of Fig. 1.

Fig. 3 shows the nozzle as inserted in the housing viewing it from the outlet side.

Figs. 4—6 show views taken on lines 4—4, 5—5, and 6—6, respectively, of Fig. 1.

Fig. 7 is a partial sectional view of the investment casting per se.

Fig. 8 is a view taken on line 8—8 of Fig. 3 and Fig. 9 is a modification of the novel turbine nozzle unit shown in Fig. 1.

As shown in the drawings the novel insert turbine nozzle which is the subject invention is presented as shown in a practical embodiment comprising a nozzle member 1 formed as an investment casting having an expanding bore outwardly to the delivery end thereof, the bore 2 expanding from a circular cross section at its inlet end to a substantially rectangular cross section of gradually increasing size at its outlet end.

Radial fins 3, four in number, are located equidistantly about the periphery of the nozzle, formed integral therewith and outwardly thereof. These fins extend longitudinally of the nozzle and have their edges machined to fit in a cylindrical bore of a nozzle housing 30. Since for effi-

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cient purposes the nozzles in a turbine are usually arranged to discharge at an acute angle to the plane of the turbine blades associated therewith, the nozzle is cast so that the central axis thereof forms an acute angle with the face of the discharge outlet on the nozzle.

The nozzle housing 30 is arranged to have a circular bore which has an intermediate step forming chambers 4 and 5 of respectively decreased diameter and the central axis of the nozzle housing is arranged to conform to the central axis of the nozzle, the radial vanes 3 on the nozzle being machined to fit the chamber 5 of the circular bore. It is noted the provision of the stepped bore in the housing is a simple machining operation.

The outlet of the nozzle 1 has an extended flange 6 thereabout with a slot 7 in one portion thereof. The flange 6 is shaped to match the bore of chamber 5 at the outlet end thereof. The slot 7 is to insure proper orientation of the nozzle in the housing 30. The nozzle bore tapers from the outlet to the inlet end thereof approaching a circular construction at its inlet end which flares outwardly to form a stepped flange 8 to cooperate with the step 9 formed in the stepped bore of the nozzle housing 30 where the housing bore increases at the inlet end. An annular recess 10 is formed in the inner wall of the nozzle housing 30 to receive a snap ring 11 therein. A sleeve element 12 fits within the enlarged bore section 4 of the housing, the inner extremity engaging the snap ring which limits its movements and the outer end loosely seats in a stepped portion 13 in the inner face of the inner flange 8 on the nozzle opposite the previously referred to stepped face portion. At a section spaced from the snap ring end of the sleeve, the outer diameter of the sleeve 12 is reduced to form a step 15 and a coil spring 18 encircles such reduced portion to abut the step 15 so formed in the sleeve at one end and to abut the nozzle inner flange at the other end at 13 to bias the sleeve against the ring 11 and the inner flange of the nozzle 1 against the step 9 in the nozzle housing 30.

It is noted that the radial vanes 3 have a sliding fit in the housing section 5 so that the turbine nozzle 1, per se may be slid into the bore 5 of the housing and as the flange 8 slides in the bore 4 of the housing it abuts the step 9 and at the same time the nozzle outer flange 6 is brought flush with the housing outlet opening. A recess 16 is formed in the wall of chamber 5 of the housing bore to serve as an orientation device, the slot 7 aligning therewith and a dowel pin 17 is inserted through the slot 7 into the recess in the housing to maintain the proper orientation of the nozzle. The coil spring 18 and sleeve 12 are then inserted in housing bore 4 and limited in movement by insertion of snap ring 11 which abuts the sleeve, the spring 18 biasing against the sleeve biases the flange 8 of the turbine nozzle against the step 9 in the housing. As can be readily seen, this provides a ready seal between the flange 8 of the turbine nozzle and the chamber 4 of the housing bore at all times. Where there is expansion of the nozzle upstream due to thermal effects the expansion is unhampered due to the yielding spring, and due to the particular orientation of the turbine nozzle with its radial vanes and flange 6 having a sliding fit within the housing, the expansion downstream is unhampered. Thus thermal expansion effects are readily accommodated while a seal is maintained at all times between the nozzle and the housing.

Figs. 4—6 show the details of the assembly of the turbine nozzle to the housing showing the close fit of the vanes 3 of the nozzle to the bore 5 of the housing, as well as the expansion of the bore of the nozzle from a circular to a substantially rectangular cross section at the outlet whereby a high degree of efficiency will result.

Fig. 9 shows a modification of the novel turbine nozzle.

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zle assembly wherein a spring-like yieldable gasket 19 is employed in place of the coil spring 18 and serves the same purpose in a manner which is obvious, providing an effective seal while permitting thermal expansion.

It will be readily obvious from the simple nature of the nozzle disclosed herein and its easy mode of insertion and replacement that the invention provides a distinct advance in the art with a considerable economy while enabling maximum efficiency in use.

While a particular practical embodiment of the invention has been disclosed herein, many modifications thereof will be readily apparent to those versed in the art and such is deemed to be within the scope of the invention as defined by the claims.

I claim:

1. An insert turbine nozzle assembly in combination with a stepped housing having bores of two different diameters and open at the ends thereof, said nozzle assembly comprising a continuous wall defining a passageway extending longitudinally of said housing in the smaller bore of the housing, the longitudinal axis of the passageway defining an acute angle with the plane of the outlet end of said passageway, flange means on said continuous wall at the outlet end thereof cooperating with and sealing the portion of said housing having the smaller bore, other flange means on the inlet end of said continuous wall arranged in abutting relation to the stepped portion of the housing formed between the bores of different diameters and having a stepped portion adjacent the step of said stepped housing, removable abutment means mounted in said larger bore of said housing in spaced relation to said other flange means, sleeve means interposed between said other flange means and said removable abutment means, and means to maintain the sleeve means in engagement with said stepped portion and having a second stepped portion in spaced relation to said first named stepped portion forming a reduced portion therein and a coil spring circumferentially disposed relative to said reduced portion between said last named stepped portion and said other flange means in biased relation to said other flange means whereby the assembled relation of said nozzle to said housing is maintained with provision for thermal expansion of said nozzle.

2. An easily replaceable insert turbine nozzle assembly in combination with a stepped housing having a stepped bore forming an enlarged section and a reduced section comprising a continuous wall defining an expanding passageway to the outlet and having a substantially rectangular cross section throughout at least the major portion thereof, a plurality of circumferentially spaced radial vanes integrally positioned on said continuous wall extending outwardly thereof in slidable engagement with the reduced section of said stepped housing, extended flange means integrally formed on the outlet end of said continuous wall in sealing slidable relation to said reduced section of the housing, a flange integrally disposed in peripheral relation on said continuous wall at the inlet end thereof retained in resilient abutting engagement with the stepped bore of said housing, an annular removable ring member seated in an annular recess in said housing bore in spaced relation to said flange, a sleeve member having a reduced portion forming an abutment interposed between said ring member and said flange in abutting relation on said flange, and spring biasing means disposed around said sleeve member in abutting relation between said abutment and said flange to bias said flange against the stepped bore of the housing whereby an assembled relation of said nozzle to the housing is insured with accommodation for thermal expansion.

3. An insert turbine nozzle comprising a casting having a passageway longitudinally thereof, the cross section of said passageway expanding from a substantially circular cross section at the inlet end to a substantially rectangular cross section at the outlet end, the longitudinal axis of the passageway being inclined to form

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an acute angle to the plane defined by the outlet end of said passageway, a flange on said casting at the outlet end for sealed sliding relation to a housing for said casting, fins on said casting extending therefrom, the points of the extremities of said fins defining a circle whereby said fins may serve to maintain a predetermined alignment of the nozzle in a housing, and means on the inlet end of said casting to limit the movement of said nozzle on insertion in the housing.

4. In combination, a stepped housing having bores of two different diameters, a replaceable insert turbine nozzle disposed in the bores of the housing, said nozzle comprising a continuous wall defining an expanding passageway longitudinally of said nozzle, said nozzle having an inlet end and an outlet end, the longitudinal axis of the passageway defining an acute angle with the plane of the outlet end of the nozzle, a flange on the outlet end of said nozzle sealing one end of the smaller bore of the stepped housing, said continuous wall having outwardly extending fins in slidable, supporting engagement with the smaller bore of the housing in nested relation thereto, a peripherally extending flange integral with the inlet end of said wall defining said passageway, said flange being stepped to either side thereof, the step on the side nearest the outlet end of the nozzle being arranged to seat on the stepped portion of the housing to limit movement of the nozzle outwardly, and biasing means acting against the step on the side of said flange nearest the inlet end of the nozzle to maintain the assembled sealed relation of the nozzle to the housing comprising a resiliently mounted sleeve element removably held in continual engagement with said peripherally extending flange to maintain continuous contact between said flange and said stepped portion regardless of thermal conditions.

5. In combination, a stepped housing having bores of two different diameters, an easily removable insert turbine nozzle disposed in the bores of the housing, said nozzle comprising a continuous wall extending from one end to the other of the nozzle defining an expansion passage thereby, said nozzle having an inlet end and an outlet end, said passage varying in cross-section from a substantially circular cross section at the inlet end to a substantially rectangular cross-section at the outlet end, the longitudinal axis thereof being at an acute angle to the plane of the outlet end, an outwardly extending flange on said outlet end of the nozzle to seal one end of the smaller bore of the housing, a slot in said flange to orient said nozzle in fixed relation to the housing, a flange on the inlet end of said nozzle stepped on either side thereof, the stepped portion on the side of the flange nearest the outlet end of the nozzle seating on the stepped portion of the housing, a biasing element engaging the stepped portion on the side of the flange nearest the inlet side of the nozzle to resiliently maintain the nozzle in its sealed relation with the housing comprising a resiliently mounted, intermediately disposed element and a releasably positioned ring element retaining said resiliently mounted element in contacting relation to the stepped portion of said housing and maintaining said contacting relation independently of variations in thermal expansion of said nozzle, and equidistantly spaced ribs integrally formed about the outer face of said continuous wall to slidably cooperate with said housing to facilitate the insertion and mounting of said nozzle therein.

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