PUBLISHED | **H. NEUMANN ET AL** | **Serial No.**
MAY 25, 1943. | MEANS FOR INFLUENCING THE CONDITIONS OF FLOW, PARTICULARLY FOR POWER PLANTS IN AIRCRAFTS | **373,622**
Filed Jan. 8, 1941
BY A. P. C. | 8 Sheets-Sheet 1

Fig. 1

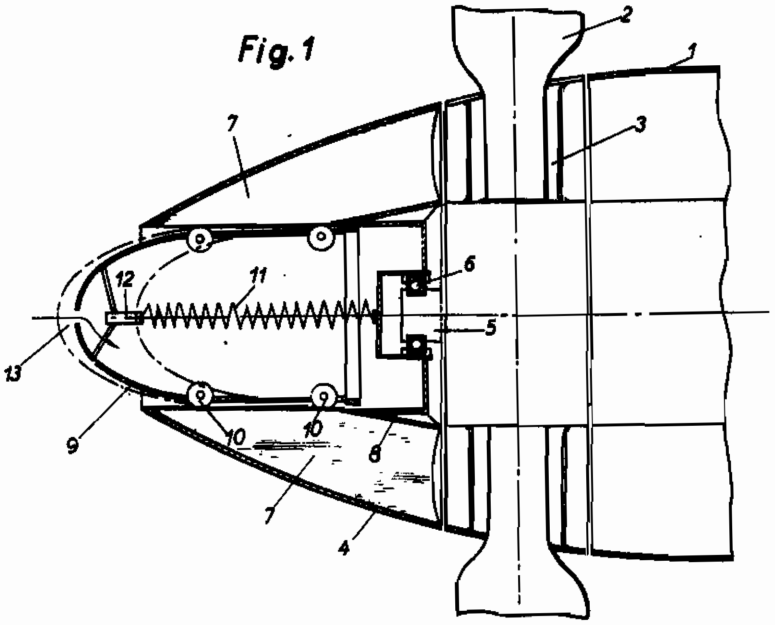
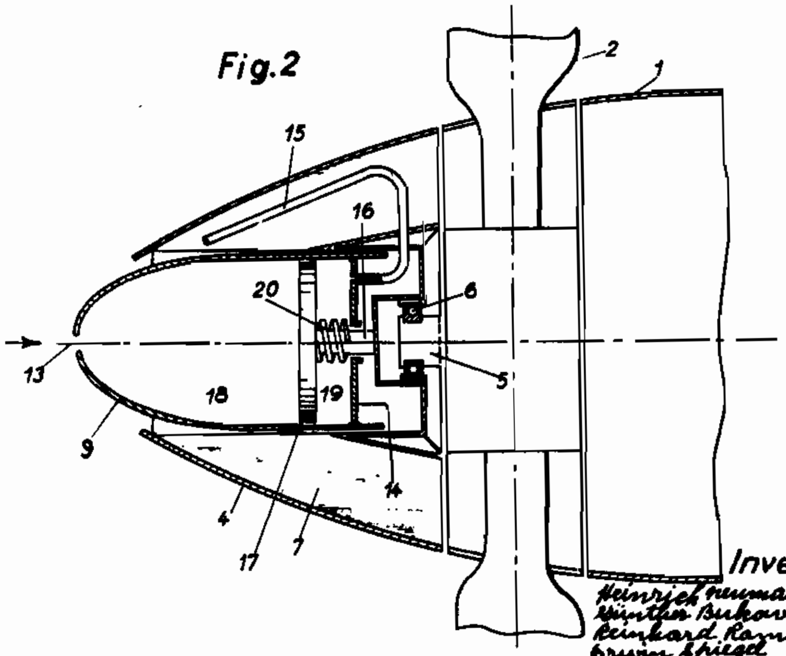


Fig. 2



Inventors
Heinrich Neumann.
Günther Bukowski
Reinhard Ramshorn
Erwin Spiegel
Hans Tonn by
Knight Attys.

PUBLISHED MAY 25, 1943. BY A. P. C.

H. NEUMANN ET AL
MEANS FOR INFLUENCING THE CONDITIONS OF FLOW,
PARTICULARLY FOR POWER PLANTS IN AIRCRAFTS
Filed Jan. 8, 1941

Serial No. 373,622

8 Sheets-Sheet 2

Fig. 3

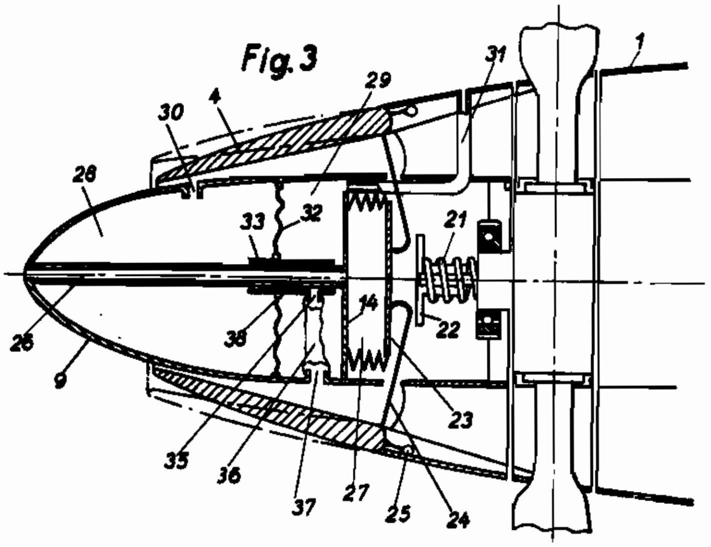
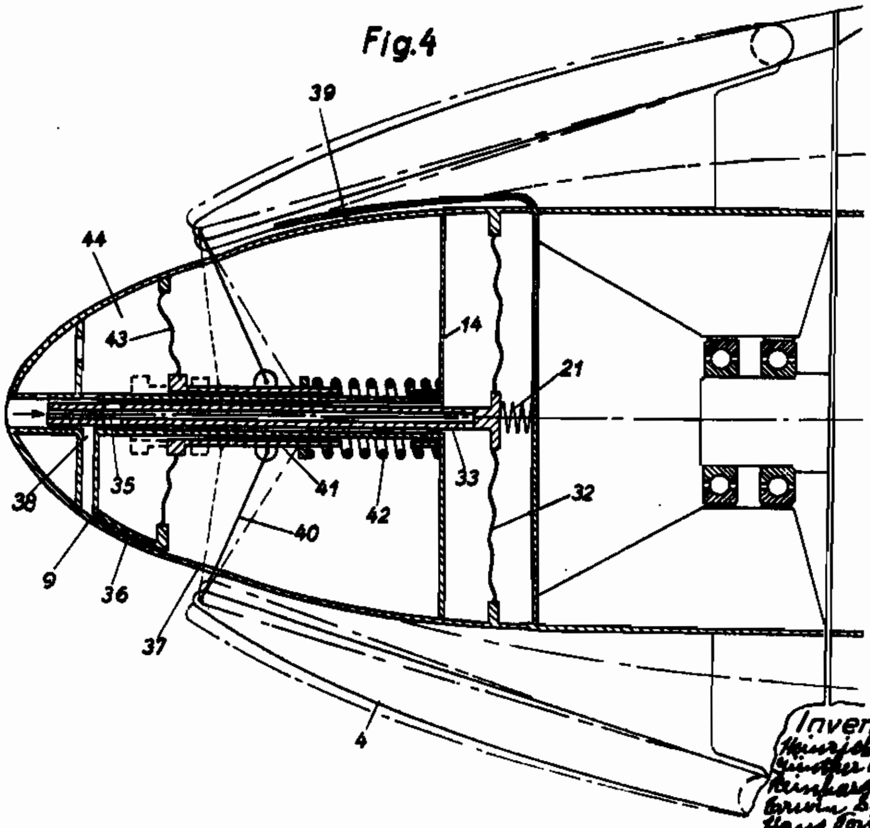


Fig. 4



Inventors.
Heinrich Neumann
Günther Gutkowski
Reinhard Kamshorn
Erwin Spiegel
Hans Togon
by Knight attys.

PUBLISHED
MAY 25, 1943.
BY A. P. C.

H. NEUMANN ET AL
MEANS FOR INFLUENCING THE CONDITIONS OF FLOW,
PARTICULARLY FOR POWER PLANTS IN AIRCRAFTS
Filed Jan. 8, 1941

Serial No.
373,622
8 Sheets-Sheet 3

Fig. 5

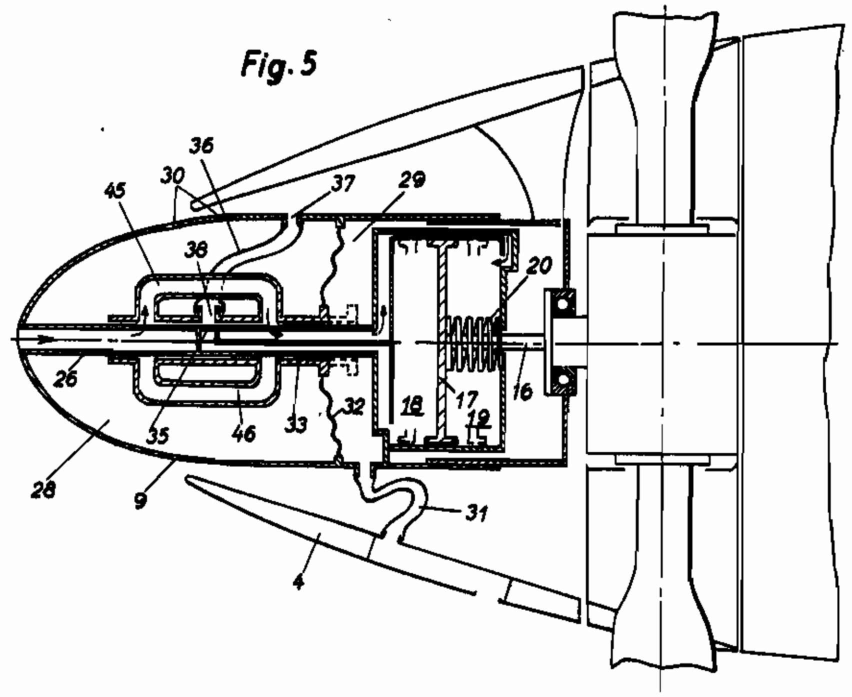
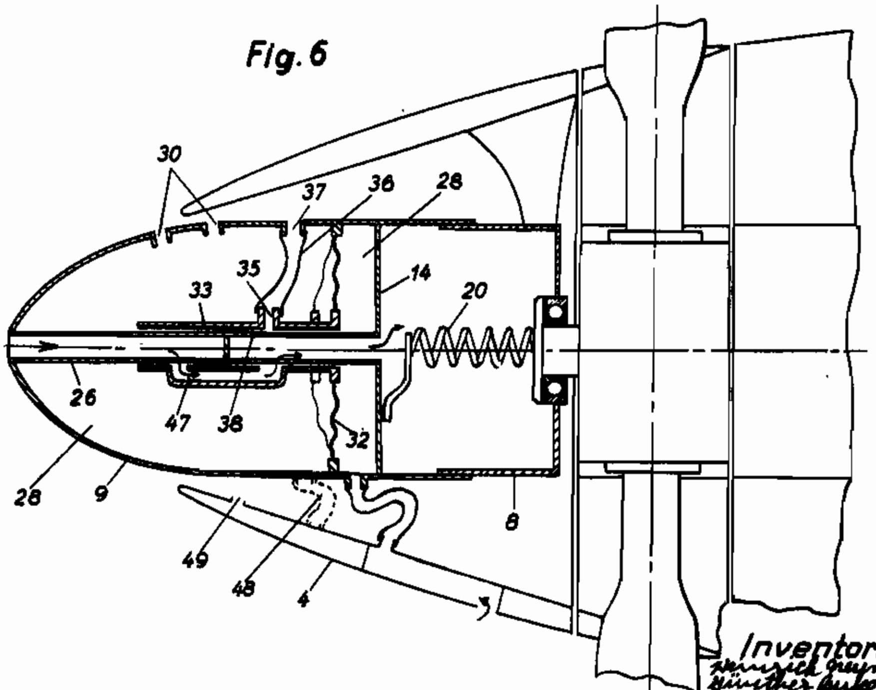


Fig. 6



Inventors
Heinrich Neumann
Günther Bukowski
Reinhard Langhorn
Erwin Spiegel
Hans Zorn
by Knight atty.

PUBLISHED
MAY 25, 1943.
BY A. P. C.

H. NEUMANN ET AL
MEANS FOR INFLUENCING THE CONDITIONS OF FLOW,
PARTICULARLY FOR POWER PLANTS IN AIRCRAFTS
Filed Jan. 8, 1941

Serial No.
373,622

8 Sheets-Sheet 4

Fig. 7

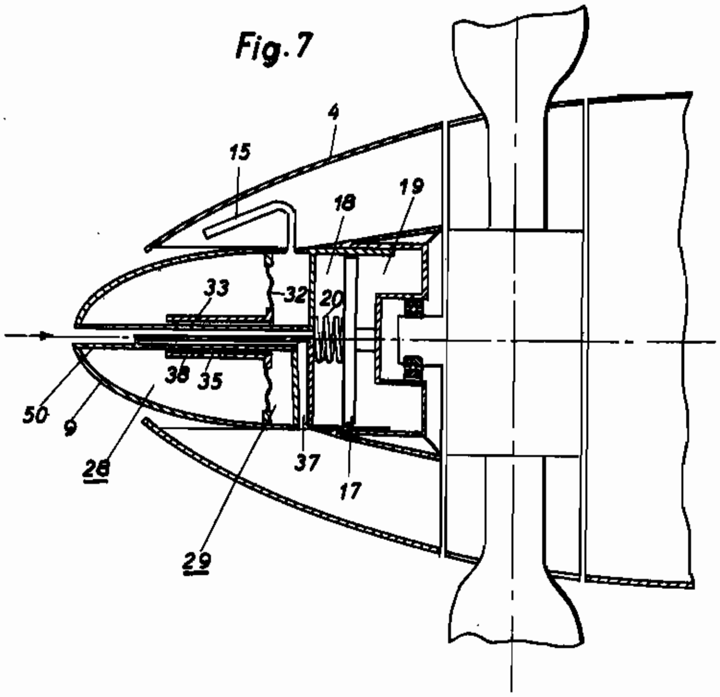
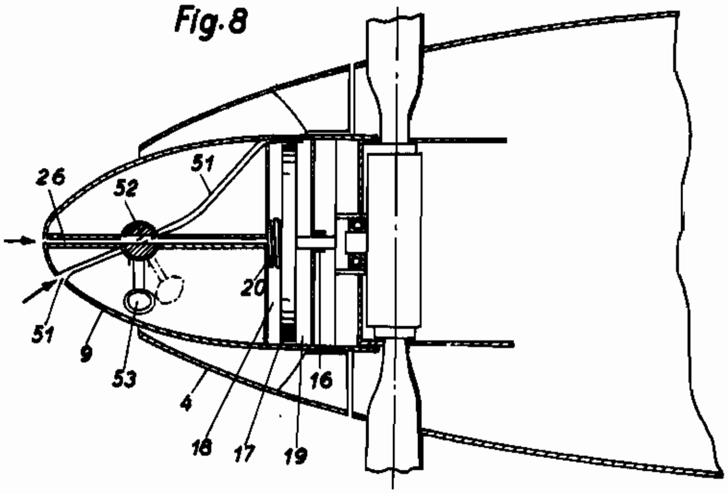


Fig. 8



Inventors
Heinrich Neumann
Günther Bukowski
Reinhard Lamshorn
Erwin Spiegel
Hans Tor
by Knight Bros attys.

PUBLISHED
MAY 25, 1943.
BY A. P. C.

H. NEUMANN ET AL
MEANS FOR INFLUENCING THE CONDITIONS OF FLOW,
PARTICULARLY FOR POWER PLANTS IN AIRCRAFTS
Filed Jan. 8, 1941

Serial No.
373,622

8 Sheets-Sheet 5

Fig. 9

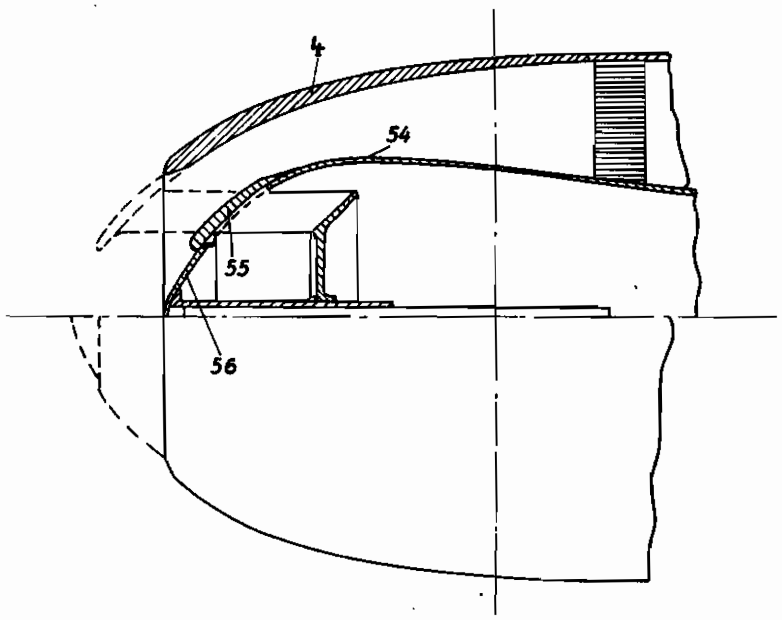
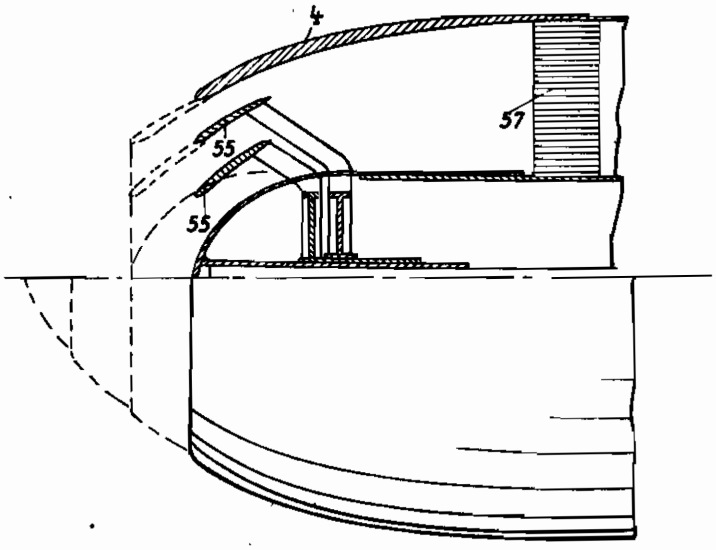


Fig. 10



Inventors
Heinrich Neumann
Günther Bukowski
Reinhard [illegible]
Erwin Spiegel
Hans [illegible]
by Knight attys.

PUBLISHED
MAY 25, 1943.
BY A. P. C.

H. NEUMANN ET AL
MEANS FOR INFLUENCING THE CONDITIONS OF FLOW, PARTICULARLY FOR POWER PLANTS IN AIRCRAFTS
Filed Jan. 8, 1941

Serial No.
373,622

8 Sheets-Sheet 6

Fig. 11

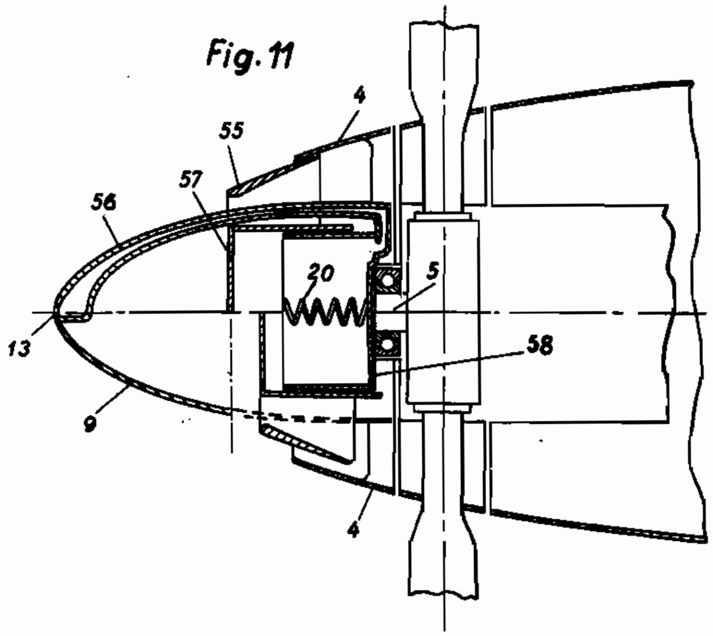
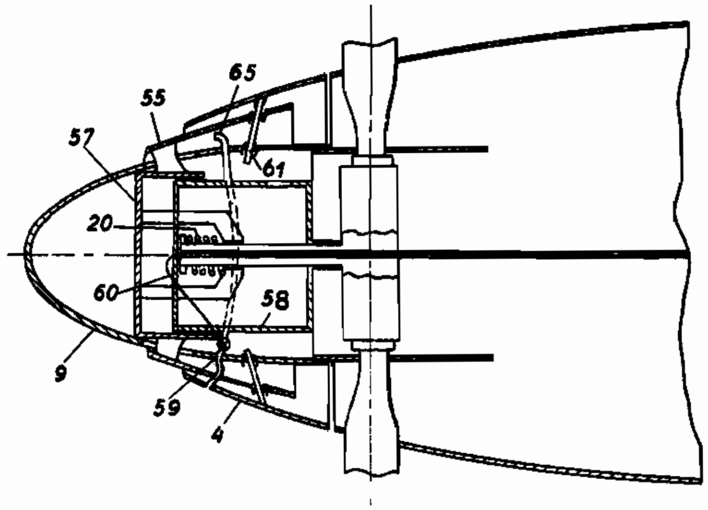


Fig. 12



Inventors
Heinrich Neumann
Günther Bukowski
Reinhard Ramshorn
Erwin Spiegel
Hans Vogt
by Knight Atty.

PUBLISHED
MAY 25, 1943.
BY A. P. C.

H. NEUMANN ET AL
MEANS FOR INFLUENCING THE CONDITIONS OF FLOW,
PARTICULARLY FOR POWER PLANTS IN AIRCRAFTS
Filed Jan. 8, 1941

Serial No.
373,622

8 Sheets-Sheet 7

Fig. 13

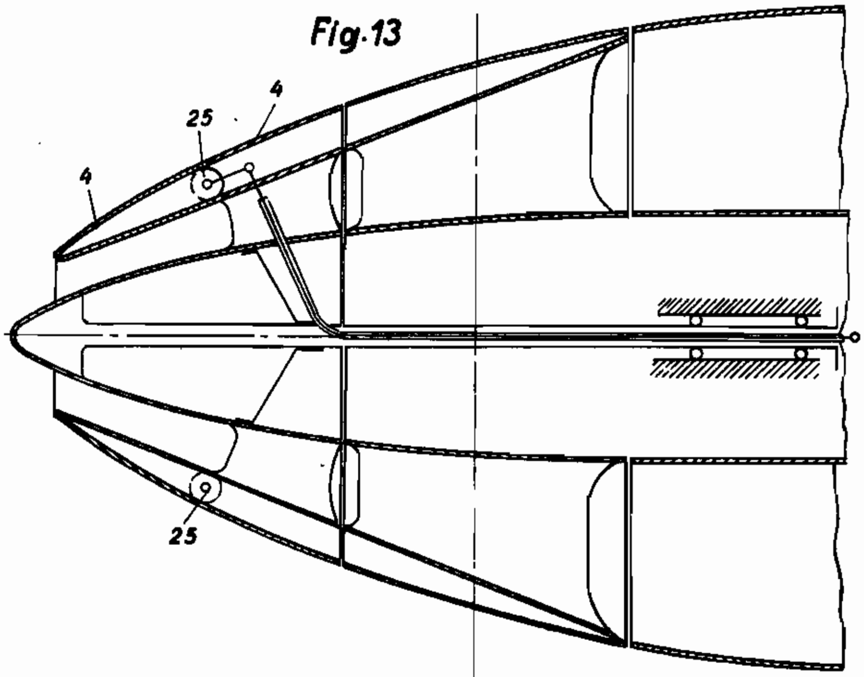
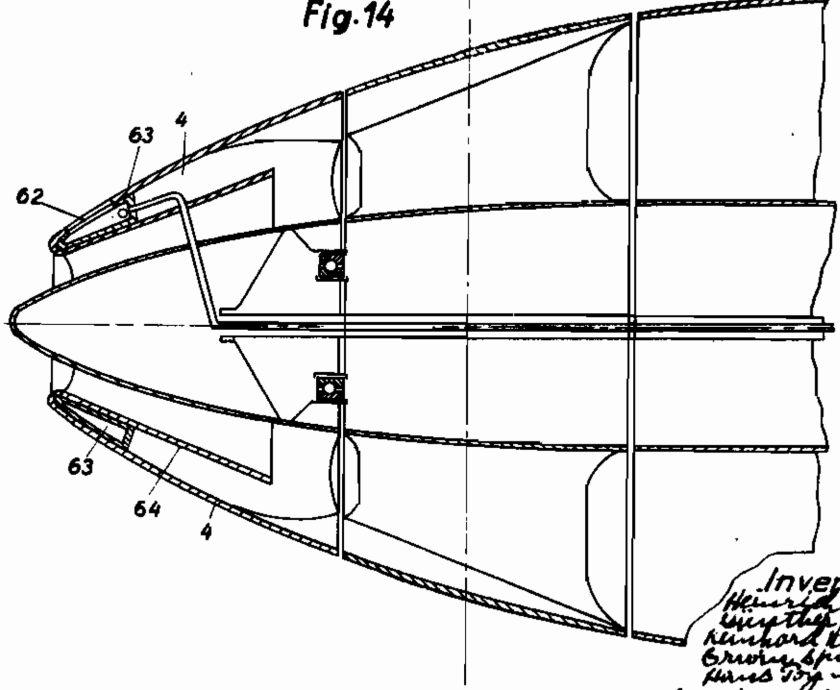


Fig. 14



Inventors
Heinrich Neumann
Günther [illegible]
Reinhard [illegible]
Erwin Spiegel
Hans [illegible]
By Knight Attys.

PUBLISHED
MAY 25, 1943.
BY A. P. C.

H. NEUMANN ET AL
MEANS FOR INFLUENCING THE CONDITIONS OF FLOW,
PARTICULARLY FOR POWER PLANTS IN AIRCRAFTS
Filed Jan. 8, 1941

Serial No.
373,622
8 Sheets-Sheet 8

Fig. 15

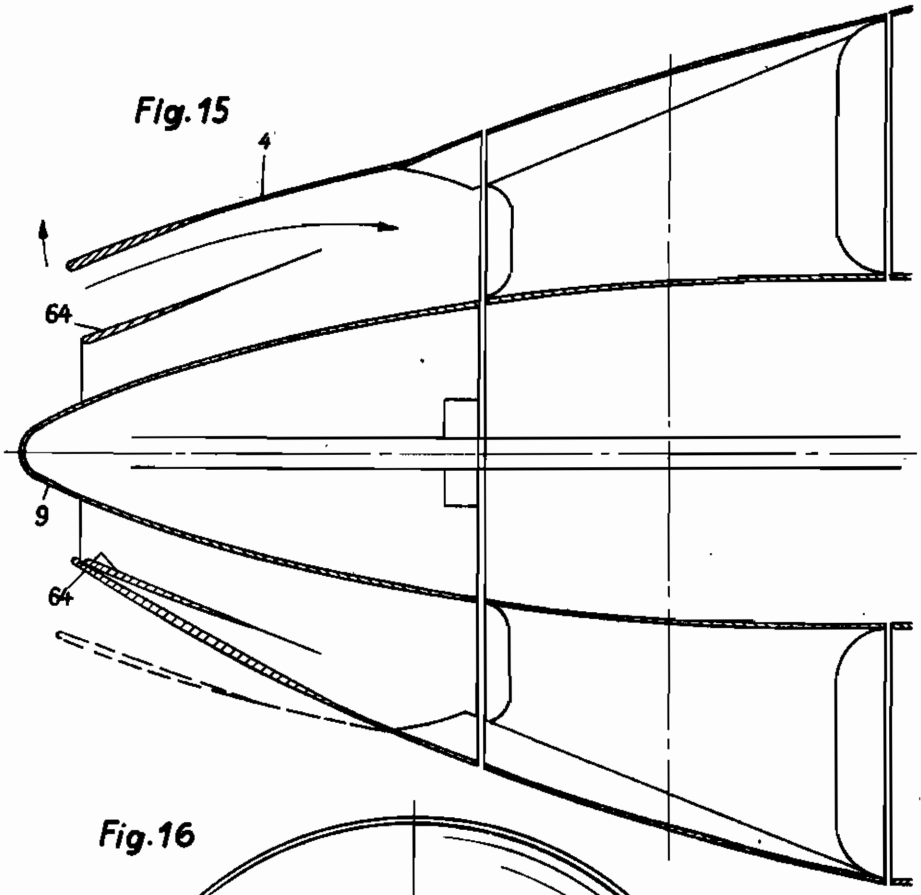
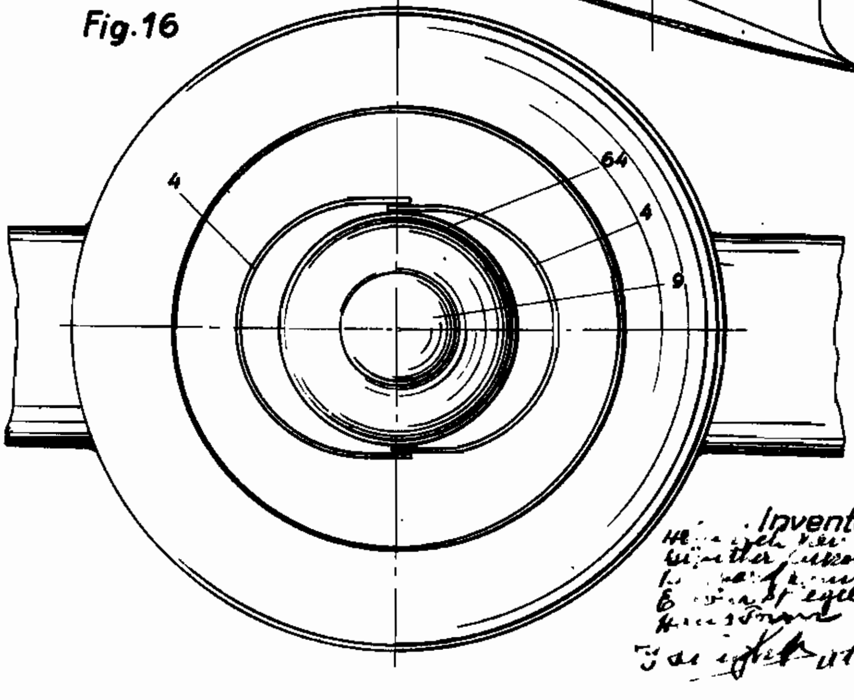


Fig. 16



Inventors

Published May 25, 1943 **Serial No. 373,622**

ALIEN PROPERTY CUSTODIAN

MEANS FOR INFLUENCING THE CONDITIONS OF FLOW, PARTICULARLY FOR POWER PLANTS IN AIRCRAFTS

Heinrich Neumann, Günther Bukowski, Reinhard Ramshorn, Munchen, Erwin Spiegel, Berlin-Charlottenburg, and Hans Tonn, Berlin-Treptow, Germany; vested in the Alien Property Custodian

Application filed January 8, 1941

The regulation of the air passage through the fairing of covered bodies, particularly of faired air-cooled power plants of aircrafts, hitherto has been effected by regulating the quantity of air flowing through the fairing by the provision of inlet and outlet port areas capable of being controlled. The conditions of flow in the upstream region of the fairing and in the encompassing air stream have not been taken into account.

The invention has found that with faired bodies of the type mentioned it is of essential importance to take into consideration, eventually by regulating the inlet and outlet cross-sections of the fairing, the outside conditions of flow by intentionally influencing, according to the invention, at least the airflow encompassing the fairing by regulating its direction and velocity. This knowledge is based on the following considerations:

The conditions of flow at the upstream side of a body, e. g. a faired power plant, through and over which air is passing, are depending upon the flow of air therethrough and the flight speed. The regulation of the air passing through, which on its part is depending upon the dynamic pressure prevailing anterior to the body and the reaction pressure back of the body i. e. of the pressure drop within the body, has been effected hitherto only by varying the inlet and outlet cross-sectional areas.

The reactions due to changes in the amount of air passing through the body on the upstream side of the airflow and on the airstream encompassing the faired body are so remarkable that with increasing flight speeds a close study of these problems is indispensable. The proportion of the loss in efficiency met with bodies through and over which the air is passing at velocities of e. g. more than 500 kms p. h. is scarcely 20% in the interior of the body of faired air-cooled power plants in comparison with the losses outside the body. From the preceding is resulting the necessity, just in the case of a small amount of air flowing through faired bodies of the kind described i. e. when keeping the quantity of the cooling air passing through the body within economical limits, to pay the utmost attention on the conditions of flow of the encompassing airstream and at the upstream side of the fairing.

The airflow anterior to a body of the kind described above, with a fairing of known form and eventually with means for controlling the flow of air through the body for limiting the cooling air passage, shows a region of slowed down flow setting up itself in front of the body. This region of flow has the form of a body of revolution along the limit surface of which is moving the outer airflow. The more the adjustment is for a smaller amount of air passing through the body and the higher the flight speed, the steeper the contour of this body of revolution is ascending against the outline of the faired body. Hence it follows that to the outer airflow moving along the body of revolutions (boundary line of flow) before encompassing the faired body is imparted a very marked angular deviation. This will cause in the outer airflow on the faired body a crowding of the lines of flow i. e. a local increase of velocity and lateral forces. These lateral forces are in the main responsible for the high loss in power for surmounting the drag.

These losses are avoided, according to the invention, by designing and arranging the fairing in such a manner, that the velocity of the airflow encompassing the fairing is influenced as to its amount and direction and this in such a way, that up to its largest cross-section no accelerations of the airflow increasing the velocity of the air encompassing the body considerably above the flight speed are occurring i. e. the angular deviation of the airflow is intentionally kept small.

In case the velocity of the throughflowing air is slowed down in front of the inlet cross-section of the fairing, the conditions of flow at the upstream side of the body are improved, according to the invention, in such a way that the boundary line of flow of the slowed down airflow by correspondingly outlining the fairing and eventually its regulating parts parts is flattened early enough that the air passing over the edge of the inlet port of the fairing shows a course without accelerations i. e. a continuous course. The flattening of the boundary line of flow can be effected by a streamlined displacement body capable of being displaced into the upstream region in the direction of axis of the fairing anterior to the port area of the fairing, in the following called "aerodynamic body." Further it is possible to flatten the boundary line of flow by designing the fairing or parts of it capable of being controlled axially and/or as to their diameter in proximity to the inlet port area relatively to the aerodynamic body or by producing a branched off partial stream attuned to the velocity character of the throughflowing air for flattening the boundary line of flow, so that the said boundary line of flow encompassing the throughflowing air and the partial stream is displaced outwardly i. e. flattened in accordance with the intensity of the partial stream. The branching of a partial stream can be effected on the displacement body or in the vicinity of the border of the inlet port of the fairing by a corresponding subdivision in such a way that nozzle-like conduits are produced, the cross-sectional area of which is larger at the inlet of the branched off partial stream than their outlet cross-sectional area.

Owing to the flattening of boundary line of flow the angle between the oncoming outer air and the fairing to be encompassed is reduced to such a degree that the lateral forces in the outer air flow diminish i. e. the depression zone in the vicinity of the border of the inlet opening is declining.

A further development of the invention is procuring the possibility of influencing the conditions of flow at the upstream side of the fairing by outlining the fairing in such way and by placing the inlet port area for the throughflowing air at such a distance in front of the fairing into the upstream region of flow, that due to the geometrical form the angles between the oncoming airflow and the fairing resp. the angular variation on the way covered by the airflow is kept small and thus no sudden accelerations of the airflow encompassing the fairing from the branching point to the largest cross-section of the fairing are occurring. With fairings of the kind described a more and more declining zone of slowed down flow is produced anterior to the inlet port, the more the inflow velocity of the through flowing air into the fairing is attuned to the velocity of the encompassing airflow at the branching point.

A markedly forward extending fairing designed in accordance with these points of view, the inlet cross-section of which e. g. is dimensioned for an inflow velocity in accordance with the climbing speed can be improved e. g. by displacing the already mentioned aerodynamic body into the upstream part of airflow, so that with a higher flight speed in no case a slowing down of the oncoming airflow is occurring at the regulating point. In this manner the losses at the branching point of the throughflowing and the encompassing airflow can be reduced to a minimum owing to the tuning of the throughflow velocity to the velocity of the encompassing airflow.

As the amount of air passing through a faired body, particularly through faired air-cooled power plants must be controlled in dependence upon the engine performance whereas the inlet and/or outlet cross-sections of the fairing besides that must be regulated corresponding to the attitude of flight, particularly in the case of lower dynamic pressures during climbing and as the velocity of the upstream part of the airflow is varying according to flying attitude and performance, it is necessary to control the velocity of the air stream flowing against, over and through the fairing dependently on the flight speed, the performance conditioned throughflow of air and eventually on the attitude of flight. Controlling of faired bodies with a reduced velocity of the oncoming airflow can be done by displacing or the aerodynamic body into the oncoming airflow or the fairing relatively to aerodynamic body or by varying the dimensions of the superimposed, branched off partial stream in accordance with the operating conditions. The regulation can also be effected by a combination of a variation of the branched off partial stream with the adjustment of the aerodynamic body resp. of the fairing.

With faired bodies through and over which an airflow is travelling and in which the inflow velocity of the air flowing through the fairing is equal to the flight speed i. e. with bodies, with which the airflow in the upstream region is practically not slowed down, controlling may take place in such a manner, that the velocity of through-flowing air stream at the inlet port into the fairing, no matter the amount of air passing through, is approximately equal to the actual velocity of the encompassing airflow in all flying attitudes.

Some examples of construction with the essential parts of the invention are shown in the drawings, wherein;

Fig. 1 is a section through a power plant fairing provided with a tractor propeller,

Fig. 2 a section through a fairing with automatic control means,

Figs. 3–4 a section through a propeller cap, the inlet port area of which is automatically controlled in such a way that the velocity of the throughflowing air stream is the same as that encompassing the fairing,

Figs. 5–7 are other forms of embodiment in section,

Fig. 8 is a section through a fairing with an aerodynamic body capable of being controlled in accordance with the dynamic pressure during flight taking into consideration the different angles of attack.

Figs. 9–10 is a fairing in which the throughflow of air is controlled in stages.

Figs. 11–12 is a fairing with an undivided inlet port area and automatic control means,

Figs. 13–15 forms of embodiment of the regulating means of a fairing in section.

Fig. 16 is a front view of Figure 15.

The aircraft power plant (not represented), faired with the cowling **1**, is provided in the example of construction with a traction screw **2**, the roots of which are provided with a special fairing **3**, which may be shaped in the manner of a fan. On the propeller hub or a part of the propeller a fairing **4** is provided merging into the cowling **1**. The propeller hub fairing **4** is in the example of construction mounted for rotation on an extension **5** of the propeller hub casing by means of bearings **6**. The fairing **4** is provided interiorly with special ribs or webs **7** extending preferably radially in the direction of the axis of the fairing. Within the fairing at these webs **7** a special cup **8** is provided, which is preferably of annular form and tightened against the propeller hub, with which a streamlined body **9** is engaging, which latter can be displaced according to the circumstances through the orifice of the fairing **4** into the upstream region for influencing the encompassing and throughflowing airstream. The mounting of the body **9** is preferably on rolls **10** rolling on the edges of the webs **7**. Within of the body **9** a returning force in the form of a helical spring **11** is provided, which preferably compensates the frictional resistances of the body **9**. The value of the returning force can be varied by a particular adjustment device **12**. The body **9** is provided in the direction of flight with an aperture **13**, through which the dynamic pressure is permitted to enter. The dynamic pressure entering the body **9** through the aperture **13** will displace the body in the direction of flight. The displacement of the body **9** is effected automatically, i. e. only in accordance with the attitude of flight (dynamic pressure, angle of inclination and want of cooling air). The mode of operation is as follows:

With the climbing aircraft, the body **9** is abutting in its deepest position within the fairing **4** eventually on the bottom of the cup **8**. In this position to the spring eventually may be given a pretension. The pretension can be varied according to the different seasons to take into account the different outside temperatures. When climbing the dynamic pressure and hence the deviation of the encompassing airstream is not considerable, so that the body 8 is advanced only immaterially out of the fairing 4, a further undesired displacement of the body 9 during climbing being prevented owing to the inclined position of the aircraft. Thus it is always possible to adjust the desired inlet port area between the body 9 and the fairing 4 for the passage of the cooling air under the point of view, that the throughflow velocity is equal to that of the encompassing air, which latter is eventually equal to the flight speed.

The webs 7 are preferably acting as guiding surfaces within the fairing 4 and arranged at such an angle that with increasing throughflow of air within the fairing 4 the latter is preferably to rotate opposite the direction of rotation of the propeller. In this manner the delivery output of the fairing 3 of the propeller acting as blower is considerably increased, as the air supplied to this blower, is delivered under a certain angle, which is variable with the flight speed, the air density and the adjusted throughflow of air. In this manner behind the blower a course of flow approximately in the direction of axis is produced and eventually a reduction of the controlling path of the body 9 is obtained by the blower action of the fairing 4.

If the aircraft is passing into level flight and the flight speed is increased, then the dynamic pressure within the body 9 is likewise increasing, so that it is further displaced out of the fairing 4 into the upstream region of the fairing. The body 9 and the fairing 4 are so dimensioned that the boundary line of flow between the body 9 and the fairing 4 is flattened and that further the throughflow velocity of the air entering the fairing 4 is equal or approximately equal to the velocity of the airflow encompassing the fairing 4. When the aircraft is more or less diving the body 9 completely leaves the fairing 4 and the inlet port area can be completely or partly closed in order to reduce the total resistance still further, as in this attitude of flight the throughflow of air can be kept very small or completely cut-off.

The mounting of the body 9 by means of rollers 10 in the manner of a car results in a favourable guide and causes little friction losses. It is of course possible for the fairing 4 and the aerodynamic body 9 instead on a bearing 6 to be mounted for free rotation anterior to the propeller, or to drive the fairing through an interposed gearing oppositely to the direction of rotation of the propeller, eventually with a higher speed than the propeller in order to increase, as already mentioned, the action of the guiding surfaces 7.

Figure 2 shows an embodiment similar in its principles to Figure 1, however with the difference that the body 9 is adjusted automatically in accordance with the velocity of the through flowing air and the flight speed. For this purpose the body 9 is provided in the fairing 4 with a rear wall 14. With the rear wall 14 a conduit 15 is connected, in which may be inserted for an additional damping not represented throttle members or the like, to avoid oscillation. The conduit 15 can be extended up to the inlet port area and exposed to the total pressure of the through flowing air. The body 9 with the rear wall 14 is movably mounted on an extension 16. One end of the extension 16 is connected with a partition wall 17 subdividing the body 6 into two chambers, of which the chamber 18 is directly exposed to the dynamic pressure, whilst in the chamber 19 through the conduit 15 the total pressure of the throughflowing air is prevailing. The pressure in the chamber 19 can be counteracted by a special traction spring 20. The measuring point of the conduit 15 can be placed so that the return spring must not be too strong.

Owing to the fact that the body 9 is displaced into its upstream region by the difference between the dynamic pressure acting on it and the total pressure of the throughflowing air, the velocity of the throughflowing air is adjusting itself in all attitudes of flight approximately equal to the velocity of the airflow encompassing the fairing 4.

The following figures show the possibility of attuning the throughflow to the flight speed, with a further readjustment of the rate of throughflow.

Fig. 3 is representing a fairing, in which by means of a number of measuring points the inlet port area of the fairing is varied in accordance with the flight speed. In the example of construction the front part of the fairing, preferably consisting of resilient material or a plurality interengaging parts, are pivoted about the fulcrum 25 through the intermediation of the spring 21, the intermediate piece 22, the disc 23 and the arms 24. Owing to this pivoting motion the inlet cross-section is completely opened as represented by the position shown in dotted lines. With increasing flight speed an increasing dynamic pressure is produced anterior to the aerodynamic body 9 which is no longer movable in the direction of axis, prevailing through the conduit 26 also in the chamber 27 and acting in the sense of a diminution of the inlet cross-section on the disc 23 and hence on the spring 21. The disc 23 is tightened against the rear wall 14 of the fixed body 9 by a particular diaphragm joint. In order to obtain a far-reaching and automatic equalisation of velocity of the air flowing through the annular inlet opening to the velocity of the air flow encompassing the fairing part 4, the room enclosed by the aerodynamic body 9 is subdivided in two chambers 28 and 29. The chamber 28 is in communication with the inlet cross-section through one or more apertures 30 within the region of said inlet port area, whereas the other chamber 29 is in communication with the external airflow through special conduits 31. The subdivision of the aerodynamic body 9 is effected by the arrangement of a diaphragm 32, which is rigidly connected with the body 9 and a sleeve 33 slidable in the direction of axis. The sleeve 33 is provided with an opening 35, which is in connection with the inlet conduit 26 through a movable intermediate member 36 and an aperture 37.

In the case of overpressure in the chamber 29 relatively to the chamber 28 the sleeve 33 is displaced in the direction of flight by the diaphragm 32 i. e. when in comparison with the velocity of flow of the atmosphere the velocity of flow of the air passing through the fairing is too high. The sleeve 33 is finally brought into a position, in which the air can escape from the inlet conduit 26 through the apertures 39, 35, 37 and the intermediate member 36 into the inlet passage. In this position the pressure in the chamber 27 is diminishing. The disc 23 is now displaced by the spring 21 in the direction of flight, which causes a pivoting motion of the fairing part 4 with the help of the arm 24 about the fulcrums 25 with a view to enlarge the inlet port area. Owing to this enlargement of the throughflow cross-section the velocity of the throughflowing air is reduced and the pressure in the inlet conduit and in the chamber **28** increased. The sleeve **33** is then displaced in the direction of axis oppositely to the direction of flight and the aperture **28** is closed.

By properly designing the different control parts it is possible taking into consideration the controlling force of the spring **21** and the conditions of flow prevailing during operation and the pressures occurring in the different above mentioned chambers, to establish any desired ratio between the velocity of the air passing through the fairing and the velocity of the air encompassing the fairing. It is further possible to design the control parts for the regulation of the inlet port area so that the inlet velocity of the throughflowing air is approximately always equal to the velocity of the airflow encompassing the fairing **4** and tho latter eventually equal to the flight speed.

In Figure 4 the regulation of the interiorly arranged sleeve **33** is effected in a similar way as in Figure 3 by a diaphragm **32**, which is exposed on the one hand to the influence of the dynamic pressure anterior to the aerodynamic body **9** and on the other through the conduit **39** to the influence of the total pressure in the inlet cross-section. The diaphragm **32** can be simultaneously submitted under the influence of a spring **21**.

In order to control the dimensions respectively the position of the inlet, the fairing **4** can be given a variable cross-section or can be displaced, as shown in the example of construction of Figure 3, with the help of a linkage **40** pivotally connected to a sleeve **41**. The sleeve **41** is arranged slidably in the direction of axis and submitted simultaneously to the influence of a spring **42** acting in the direction of an enlargement of the inlet cross-section and to the influence of a further diaphragm **43**, which on its part is influenced by the pressure in the inlet cross-section and the dynamic pressure anterior to the aerodynamic body **9**, which also in this case cannot be moved. With an increasing dynamic pressure the pressure in the space **44** in front of the diaphragm **43** is increasing, so that with increasing flight speed the sleeve **41** is displaced in the direction of a variation of the inlet cross-section against the action of the spring **42**. If the velocity of the throughflowing air and hence the total pressure in the conduit **39** is too high, the sleeve **33** is displaced in the direction of flight. Thus a communication is established with the inlet conduit through the apertures **35**, **38**, the conduit **36** and the aperture **37**, so that the pressure in the cham- **44** is diminishing. The sleeve **41** is then again displaced in the direction of flight and the fairing **4** moved outwards through the linkage **40**. This will be followed by an enlargement of the inlet cross section and by reduction of the velocity of the throughflow in the inlet, so that also the pressure in the conduit **39** is diminished.

Instead of varying the inlet passage of the fairing **4** through the linkage **40**, in a similar way as in Figure 3, it is also possible to design the fairing **4** in such a manner that said fairing or eventually parts of it can be rotated for uncovering not represented inlet apertures. This form of construction permits short control paths. In this example of construction the diaphragm **32** is serving as readjusting device in case no equalisation of the throughflow velocity to the flight speed has been effected by the diaphragm **43**.

The arrangement represented in Figure 5 is so designed that the inlet cross section is automatically controlled, i. e. in dependence upon two measuring points, in order to make the regulation independent of altitude and speed of flight. This embodiment has further the advantage of responding immediately to any variation of the throughflow of air. In the example of construction of Figure 5 the body **9** is mounted in the fairing and movable in the direction of axis. The body **9** can be mounted as in the other examples of construction on an extension **16** and a wall **17** with the interposition of a returning force **20**, acting in the direction of an enlargement of the inlet cross section. The actual position of the body **9** and eventually also the cross sectional area is depending upon the pressures prevailing in each case in the chambers **18**, **19**. Both chambers **18**, **19** can be alternately put in communication with the conduit **26** opening in the region of dynamic pressure of the body **9**. The sleeve **33** provided with transfer passages **45** and **46** and rigidly connected with a diaphragm **32** is serving as controlling means. This diaphragm is adjusting the control sleeve in the direction of axis, in accordance with the pressure in the inlet conduit and the pressure in the atmosphere. The control sleeve **33** and the transfer passages **45**, **46** are so designed that according to the position of the sleeve the chamber **18** or **19** is in communication with the conduit **26**, whilst the other chamber **26** or **25** is in connection with the inlet conduit through the intermediate member **36** and the port **37**.

The spring **20** has the task to bring the fairing parts serving to vary the airflow anterior to and encompassing the fairing e. g. into a position, in which the position of the inlet respectively passage cross section is corresponding to the conditions of climbing. The tension of the spring is counteracted during the flight by the dynamic pressure. The control means can be so designed that either for regulating the cross sectional area only the spring tension and the dynamic pressure are used or that for a more complete equalisation of the throughflow velocity to the velocity of the encompassing airflow particular control members are provided, which can be designed according to the already described forms of embodiment, in order to effect the adjustment of the body **9** or of the fairing respectively particular parts of the fairing with the help of the pressure or the pressure drop within the body **9**. Further the example of construction of Figure 5 is corresponding in its action to that of Figure 3 only that instead of one measuring point **30** there are provided two or more measuring points in the example of construction of Figure 5 and not the fairing **4**, but the aerodynamic body **9** is movably mounted.

Figure 6 shows an example of construction with a likewise movable streamlined body **9** in a fairing **4**, similar to the example of construction of Figure 5. The dynamic pressure reaches through the conduit **28** the cup-like end member **8** and acts upon the rear wall **14**. This will effect the displacement of the body **9** into the upstream region of airflow against the action of the spring **20**. The inlet cross sectional area between fairing and aerodynamic body can be reduced by increasing the velocity of the branched-off throughflow as long as it will correspond to the velocity of the encompassing air flow respectively the flight speed. It is of course also possible to design the aerodynamic body 9 so that during its displacement the inlet cross sectional aera is not submitted to any further variation, but only the airflow anterior to the fairing, flowing through the fairing, and encompassing the fairing is influenced. This regulation is correspondingly by principle to the examples of construction of Figures 3 and 5, however with the difference that the control sleeve 33 in the position, in which the apertures 39 and 35 are in communication with the space, enclosed by the cup 8, simultaneously closes the transfer passage 47 serving to deliver air into this space. The aperture 35 of the sleeve valve 33 is connected through the intermediate member 38 and the aperture 37, as shown in the example of construction of Figure 5, with the space within the fairing 4. The diaphragm 32 corresponds in its action to that of Figs. 3 and 5. The chamber 28 can be connected, as shown by the conduit 48 in dotted lines, besides the two measuring points 39 with a further measuring point 49, which takes into account e. g. the marginal flow within the fairing.

The example of construction of Figure 7 does not differ essentially from the above examples of construction, so that the parts of same action have the same reference numerals. The difference consists only in the fact that for the readjustment the chamber 28 is exposed through the aperture 50 to the direct influence of the dynamic pressure and the chamber 29 to the influence of the pressure in the inlet cross section through the conduit 15, so that the dynamic pressure can escape through the chamber 28 and aperture 37 in case the aperture 38 is uncovered.

The example of construction of Figure 8 shows a fairing of the power plant similar to that of Figure 2. A streamlined body 9 is displaced in the direction of the upstream region with the help of the dynamic pressure being produced through the conduit 28 in the chamber 18. In the displacement body 9 one or more conduits 51 are provided which permit the corresponding dynamic pressure in dependence upon the actual flying attitude to reach the chamber 19 behind the partition wall 17, for being able to exert a correcting influence on the position of the displacement body 9 according to the flying attitude. In the conduits 26 and 51 in common or in one of them preferably in the conduits 51 a particular throttle member 52, preferably designed after the manner of a rotary valve, can be provided, which uncovers the corresponding conduit according to the flying attitude. The regulation of the throttle member 52 can be effected automatically, e. g. by submitting it to the force of gravity by attaching a weight 53 or the like. In such a case the throttle member 52 uncovers according to the flying attitude, in case said throttle member is controlling more of them, the desired conduit. The regulation of the throttle member can be effected of course, as shown in the examples of construction, particularly those of Figures 3 to 7, also by the pressure drop of a plurality of measuring points by means of a special sleeve valve or the like. The provision of special conduits 51 has the advantage that the displacement body 9 will occupy in any flying attitude according to the airflow the actual most favourable position. By accordingly choicing the overlapping of the apertures of the throttle member 52 an exact tuning of the different regulating motions is possible. For diving, e. g. special abutments can be provided for the counter weight 53, fixing the throttle member 52 in a position, in which the conduit 26 is uncovered. The arrangement of a counter weight controlled throttle member 52 preferably conditions a displacement body 9, which is mounted with its fairing 4, as shown in the example of construction of Figure 1, freely rotatable on the propeller casing or on the propeller hub.

Figures 9 and 10 show examples of construction of a fairing permitting two or more positions of the fairing parts. For this purpose in the fairing 4 and in the air guidance 54, provided within the fairing, one or more annular fairing parts 55 are provided, which, as shown in the example of construction of Fig. 9, when diving, are abutting on the cooling air guidance 54. Only when the aircraft has passed again to its normal flight speed the annular fairing part 55 is displaced forward e. g. in accordance with the dynamic pressure or another regulating value so far into the position shown in dotted lines, that this fairing part forms e. g. with the fairing 4 a continuous way for the air flow. The inlet port area is still more advanced by this measure corresponding the higher flight speed, so that as already discussed above, the throughflow velocity can be attuned to that of the encompassing air flow. For diving or with the power plant cutoff, especially in the case of multi-engined aircrafts, the inlet port area can be completely closed by the movable cap 56.

Figure 10 shows as modification of Figure 9 a further subdivision in two movable fairing parts 55 and 55′, in which it is also possible to fix the fairing parts 55, 55′ in any intermediate position. The fairing 4 is outlined in this example of construction for accommodating a heat exchange device 57 and of course also can find application in an air-cooled internal combustion engine, e. g. a radial engine. The fairing parts are preferably so designed that in all their regulating positions within the fairing and the cooling air guidance 54 a passage is formed diverging in the direction of the heat exchange device 57.

The fairing of this kind has the advantage that among other things during climbing the cooling air will enter always at the stagnation point, i. e. the fairing is not sensitive to variations of the angle of attack. Only when the normal cruising speed respectively the maximum speed is attained the conditions of flow are correspondingly taken into account and the inlet port area is so far advanced, as already mentioned, that the region of slowed down flow in front of the fairing is declined as far as possible. The example of construction of Figure 10 has still the advantage that, since the fairing parts 55, 55′ are only withdrawn to their full-line position, they can act as twindiffusor in order to reduce in this manner the corresponding conversion-losses, in which case, owing to the subdivision of a fairing of the type described considerable variations of the inlet cross sectional areas are produced notwithstanding the relatively short regulating paths.

The examples of construction of Figure 11 and 12 finally show another automatic displacement of an annular fairing part 55, e. g. in accordance with the dynamic pressure entering through the conduit 56 the aperture 13 into the aerodynamic body 9. The dynamic pressure reaches through the conduit 56 into the chamber formed by the two walls 57 and 58. The walls 57 and 58 are movable so as to telescope one within the other under the influence of a returning force **20**. The wall **58** is in this case connected with the aerodynamic body **9** and can be mounted with the fairing **4** freely rotatable on the extension **5** of the propeller hub. The wall **57** is in connection with the fairing part **55** through recesses in the aerodynamic body **9** and being capable of sliding motion. The dynamic pressure in the chamber between the two walls **57** and **58** has the effect that the cowling part **55** is displaced more or less far into the upstream region according to the flight speed. When arranging the fairing so as to produce anterior to the aerodynamic body **9** still a region of slowed-down airflow, then it is possible by the aid of the movable fairing part **55** in its intermediate positions to influence the boundary line of flow by the fact that a partial stream between the fairing part **55** and the hub fairing **4** is branched-off for circumferentially surrounding the interior flow. In this manner the boundary line of flow is artificially flattened corresponding to the dimensions of the partial stream. Attention must be paid only to the necessity that the inlet cross section for the partial stream is larger than the outlet cross section. In this way the course of the airflow encompassing the cowling **1** shows no discontinuities of pressure. The lower part of Figure 11 shows the position of the fairing part **55** e. g. during climbing.

Figure 12 is a further modification of Figure 11, in which case for the displacement of the fairing part **55** not the full dynamic pressure, but the difference in pressure between the pressure acting outside the fairing **4**, e. g. the low pressure and the total pressure prevailing within the fairing part, is used. Within the fairing part **55** a measuring point **58** is provided, discharging e. g. into a chamber formed of two walls **57** and **58** movable telescopically into one another. This chamber is simultaneously in connection with the low pressure zone outside the fairing **4** through the conduit **59**. The cross section of the conduit **59** can be varied e. g. manually through a controlling linkage **60** or the like. The ratio of the cross sections of the inlet conduit and the static tube must preferably be so dimensioned that the compensating pressure being produced within the chamber with the static tube completely opened and the inlet conduit partly opened effects a sufficient opening, i. e. displacement of the fairing part **55**. A tension spring **20** cares for an automatic return of the regulating parts at a standstill. In order to be able to provide in the case of unforseen circumstances the full opening of the inlet cross sectional area, the total cross section of the inlet conduit **59** is uncovered. This has as a consequence a decrease of pressure within the fairing, so that the fairing part **55** is withdrawn still further into the fairing **4** respectively cowling **1**. If there is the danger of the aircraft power plant being excessively cooled, the fairing part **55** is then displaced more in the direction of the upstream region by throttling the conduit **59** eventually as far as the inlet cross section is completely closed. The fairing part **55** can be connected through a special linkage **61** with the body **9** and the fairing **4** as is further to be seen in the example of construction of Figure 12. This connection has the advantage that e. g. with a movable body **9**, according to the choiced transmission ratio, owing to the position of the articulation points on the linkage **61** a favourable influence on the conditions of flow is possible with relatively small movements.

In the examples of construction of Figures 13 to 16, in which the inlet cross section and the fairing are designed deliberately in such a way that the velociay of the throughflowing air is equal to the velocity of the airflow encompassing the fairing and eventually equal to the flight speed. In order to be able in particular flying attitudes, specially in climbing to attune the throughflow velocity again to the flight speed, among other things the inlet cross section of the fairing can be varied. This is effected, according to the invention, by pivotally arranging the fairing **4** or essential parts of it about the axis **25**, in a similar way as shown in the examples of construction of Figure 3 and 4. For this purpose the fairing **4** is circumferentially subdivided and eventually provided with a resilient cover. The fairing and regulating means for its cross section can be mounted in this case freely rotatable on an extension or the like of the propeller, as in the other examples of construction. The control members are preferably guided through their axle in case an automatic regulation is not desired.

A further development shows the example of construction of Figure 14. In this form of embodiment particular openings **62** are provided in the fairing **4**, which can be opened or closed by means of a plurality of sleeves or a common sleeve **63**, preferably of annular form. Within the fairing **4** a further cone-shaped fairing part **64** can be provided. Between this fairing part **64** and the fairing **4** is preferably mounted the sleeve **63**, which may co-operate with the cone-shaped fairing **64** in such a way that the openings provided in the latter are more or less uncovered. According to the position of the sleeve **63** the inlet cross-sectional area of the fairing **4** and hence the throughflow velocity is varied.

The example of construction of Figure 15 is likewise a further development of Figure 13, the pivotable fairing part **4** is however co-operating with the preferably non-movable, cone-shaped fairing part **64** mounted within the fairing in such a manner that in the closed position only the inlet cross-sectional area between the fairing part **64** and the aerodynamic body **9** is uncovered. This position may correspond to the normal cruising speed. For other flying attitudes, e. g. for climbing, the exterior fairing part **4** is pivoted in the direction of arrow, as shown in the upper part of Figure 15, and the inlet cross-sectional area correspondingly increased. The passage formed between the fairing **4** and the fairing **64** further can be so choiced that its inlet cross-sectional area is larger than that of its outlet in case it is desired to use in the intermediate positions the partial stream branched-off by this passage for flattening the boundary line of flow. It is possible to design the pivotable fairing part **4**, as shown in Figure 16 in a front view, consisting of two interengaging parts, in which case the pivoting device, in case the fairing system is mounted in the wing of an aircraft, is arranged in the direction of this wing. This has the advantage that no unfavourable influence on the conditions of flow of the wing section is to be expected.

HEINRICH NEUMANN.
GÜNTHER BUKOWSKI.
REINHARD RAMSHORN.
ERWIN SPIEGEL.
HANS TONN.