Nov. 16, 1965 E. E. CHILVERS 3,217,490

INSTALLATION OF JET ENGINES IN ENGINE BAYS

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Fig. 1.

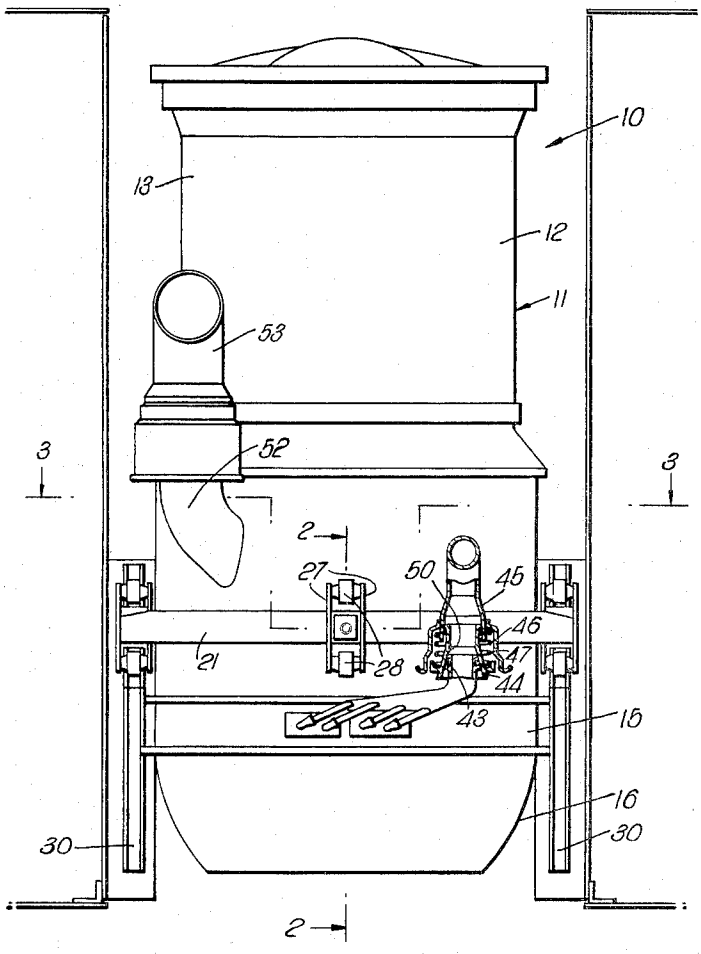

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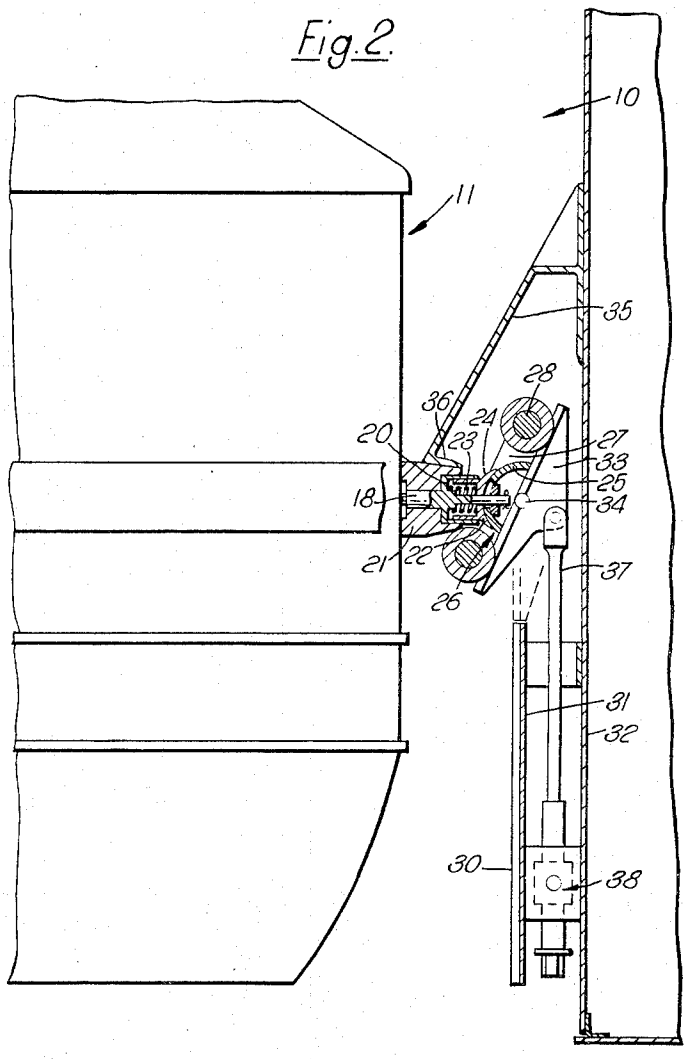
Fig. 2.



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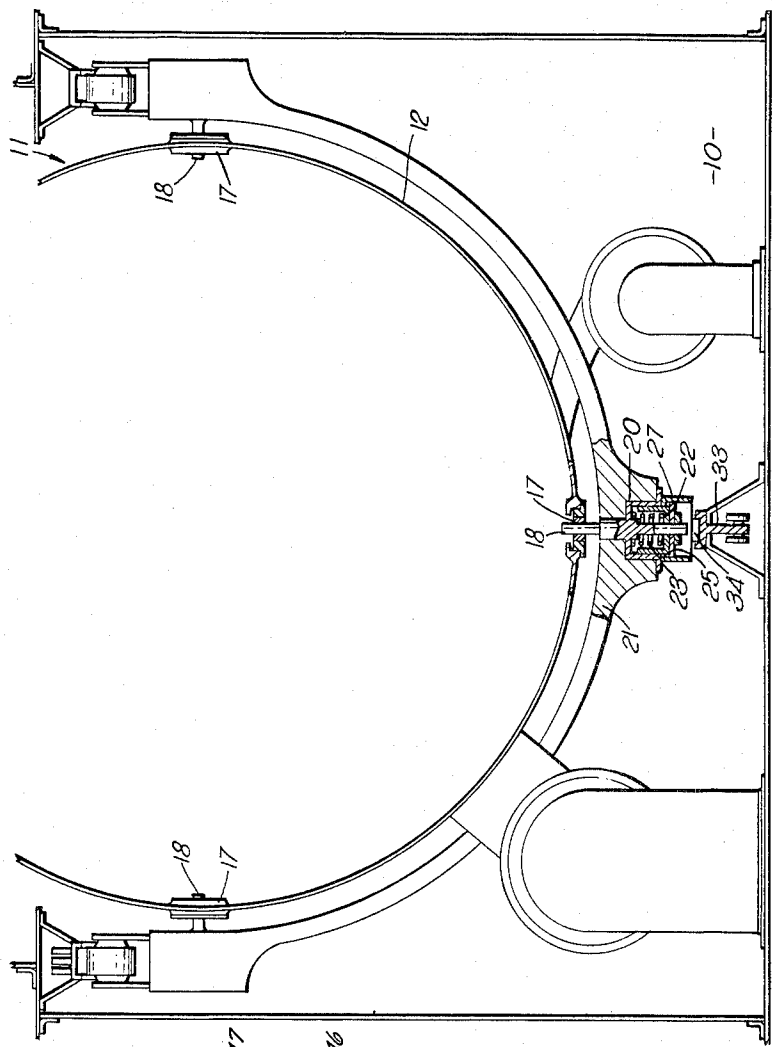

Fig. 3

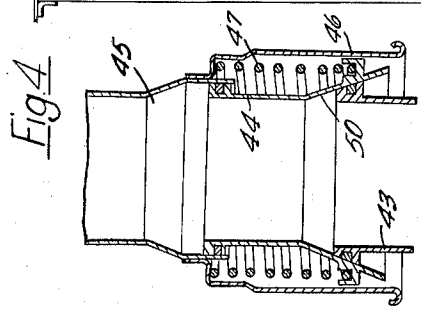

Fig. 4

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3,217,490

INSTALLATION OF JET ENGINES IN ENGINE BAYS

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Claims priority, application Great Britain, May 16, 1962, 18,948/62
9 Claims. (Cl. 60—39.31)

This invention concerns the installation of jet engines in engine bays.

According to the present invention there is provided an installation comprising a jet engine installed in an engine bay, the engine and the engine bay being respectively provided with relatively movable members which are in engagement with each other, the relatively movable members being relatively movable between an inoperative position in which the engine may be installed in or may be removed from the engine bay and an operative position in which the engine is supported by the said relatively movable members in the engine bay, and means for effecting relative movement of the relatively movable members between, and for retaining them as required in, the operative and the inoperative positions.

In its preferred form, the installation comprises a jet engine installed in an engine bay, there being pivotally mounted in the engine bay a plurality of engine support members each of which is pivotable between an inoperative position in which the engine may be installed in or removed from the engine bay and an operative position in which it engages the engine, or means carrying the engine, so as to support the latter, and means for pivotally moving the engine support members between, and for retaining them as required in, the operative and the inoperative positions.

Preferably the engine is provided with a plurality of pivoted guide members each of which is movable along a track formed or provided in the engine bay, each of the guide members engaging an engine support member which is provided with a portion of the respective track.

Each guide member is preferably provided with at least one roller which engages said track. Means are, moreover, preferably provided for resiliently urging each guide member into contact with the respective engine support member.

Preferably the guide members are pivotally mounted on a yoke member in which the engine is carried. In this case, the engine bay is preferably provided with an abutment member against which the yoke member is brought when the engine is installed.

The engine and the engine bay may be respectively provided with mutually cooperating parts which are such, and are so arranged that, they are automatically brought into operative engagement with each other when the engine is correctly installed in the engine bay.

The said mutually engageable parts may be parts of one or more fluid conduits. Thus the said parts of the or each fluid conduit may be provided with mutually engageable conical surfaces which are resiliently urged towards one another.

The engine is preferably a vertical lift engine i.e. an engine adapted to produce vertical lift forces on an aircraft independently of those generated aerodynamically by forward flight of the aircraft.

The invention is illustrated, merely by way of example, in the accompanying drawings, in which:

FIG. 1 is an elevation of an installation according to the present invention, the installation comprising a vertical lift engine for an aircraft installed in an engine bay;

FIGS. 2 and 3 are sections taken respectively on the lines 2—2 and 3—3 of FIG. 1, and

FIG. 4 is a sectional view of part of the structure shown in FIG. 1 on an enlarged scale.

Referring to the drawings, an aircraft (not shown) is provided with a plurality of engine bays one of which is indicated in the drawings by the reference numeral **10**.

Mounted in the engine bay **10** is a vertical lift gas turbine engine **11**. The engine **11** has an engine casing **12** within which are mounted in flow series a compressor **13**, combustion equipment **14**, and a turbine **15**, the turbine exhaust gases being downwardly directed through a short exhaust duct **16**.

The engine casing **12** is provided with three bearing members **17** (FIG. 3) two of which are diametrically oppositely disposed and the third of which is disposed midway between the other two. In each of the bearing members **17** is mounted a trunnion pin **18**.

Each of the trunnion pins **18** is formed integrally with a cup member **20**, the three cup members **20** being mounted in a common yoke member **21**.

Mounted within each cup member **20** is a cup member **22** which is urged outwardly of the cup member **20** by a spring **23**.

Each cup member **22** has a part-cylindrical concave surface **24** (FIG. 2) within which is mounted a part-cylindrical plate **25** which forms part of a guide member **26**. Each plate **25** is pivotally connected to its respective trunnion pin **18**.

Each of the guide members **26** comprise a pair of spaced plates **27** between which are rotatably mounted two spaced apart rollers **28**, the plates **27** being spaced apart by the respective plate **25**.

Each pair of rollers **28** is engagable with a vertically extending track **30**. Part of each track **30** is provided on a member **31** which is secured to a wall **32** of the engine bay **10**, the remaining part of each track **30** being provided on an engine support member **33** which is mounted on a pivot **34**.

The wall **32** also has secured thereto a bracket **35** which is provided with an abutment member **36**, the abutment member **36** being engaged by the yoke member **21**.

Each engine support member **33** is pivotally connected to a rod **37** which is provided with a screw jack **38** by means of which the rod **37** may be raised and lowered.

The engine support members **33** are movable by the rods **37** between, and are retainable in an inoperative position (shown in dotted lines in FIG. 2), in which the rollers **28** may roll over the engine support members **33** so as to permit the engine **11** to be installed into the engine bay **10** and to be removed therefrom, and an operative position (shown in full lines in FIG. 2) in which the engine support members **33** support the rollers **28** and the lower rollers **28** engage the yoke member **21** and so support the engine **11**.

The installation includes (FIGURE 4) an air conduit having portions **43**, **44**, **45**, air passing through the said air conduit being employed to effect starting of the turbine **15**.

The portion **43** is mounted on the engine **11**, the portion **44** is an intermediate portion carried by the portion **45**, and the portion **45** is fixed to the engine bay **10**, the portion **45** being adapted to extend to a source of compressed air (not shown).

The portion **45** has a skirt **46** within which is mounted a spring **47**. The spring **47** engages the portion **44** so as to urge a conical surface **50** thereof into sealing contact with a conical surface on the portion **43**. The positions **43–45** are so arranged that they will be automatically coupled to each other when the engine **11** is correctly installed, no bolting of these portions together being necessary.

The installation also includes an air bleed conduit having portions **52, 53** which are respectively mounted on the engine **11** and in the engine bay **10** and which are connected together by parts (not shown) corresponding to the parts **44, 47, 50**. The portion **52** of the said air bleed conduit is adapted to receive compressed air from the compressor **13**.

The engine **11** and the engine bay **10** may, as disclosed in our co-pending United States patent application Serial Number 276,639, filed April 29, 1963, now abandoned, be provided with a member of other mutually engageable parts (not shown) which are automatically operatively engaged together when the engine **11** is correctly installed.

In operation, when it is required to install an engine **11** in position in the engine bay **10**, the engine support members **33** are disposed in the dotted line position shown in FIG. 2 and a lifting tackle is secured to the intake end of the engine. The three pair of rollers **28** are engaged in their tracks **30** (the springs **23** taking account of any tolerances in the positions of the latter), and the engine **11** is lifted until the yoke member **21** abuts the abutment member **36**.

The screw jacks **38** are then operated to cause the rods **37** to move downwardly, whereby the engine support members **33** will be pivoted into the full line position shown in FIG. 2 so as to support the engine **11**. The lifting tackle is then removed from the yoke member **21**.

Once the engine **11** is correctly installed, all, or substantially all, of the parts (such as the air conduit **43–45** and the air bleed conduit **52–53**) which extend from the engine bay **10** to the engine **11** are automatically coupled together.

I claim:

1. An installation comprising an engine bay, a jet engine installed therein, a track disposed in the engine bay, a plurality of pivoted guide members which are secured to the engine and each of which is movable along the track, a plurality of engine support members each of which is engaged by a said guide member and each of which is provided with a portion of the respective track, each engine support member being pivotable between an inoperative position in which the engine may be installed in and removed from the engine bay and an operative position in which it supports the engine, and means for pivotally moving the engine support members between, and for retaining them as required in, the operative and the inoperative positions.

2. An installation as claimed in claim **1** in which each guide member is provided with at least one roller which engages said track.

3. An installation comprising an engine bay, a jet engine installed therein, a track disposed in the engine bay, a plurality of pivoted guide members which are secured to the engine and each of which is movable along the track, a plurality of engine support members each of which is engaged by a said guide member and each of which is provided with a portion of the respective track, each engine support member being pivotable between an inoperative position in which the engine may be installed in and removed from the engine bay and an operative position in which it supports the engine, and means for pivotally moving the engine support members between, and for

retaining them as required in, the operative and the inoperative positions, and means for resiliently urging each guide member into contact with the respective engine support member.

4. An installation comprising an engine bay, a jet engine installed therein, a yoke member in which the engine is carried, a track disposed in the engine bay, a plurality of guide members which are pivotally mounted on the yoke and which are secured to the engine and each of which is movable along the track, a plurality of engine support members each of which is engaged by a said guide member and each of which is provided with a portion of the respective track, each engine support member being pivotable between an inoperative position in which the engine may be installed in and removed from the engine bay and an operative position in which it supports the engine, and means for pivotally moving the engine support members between, and for retaining them as required in, the operative and the inoperative positions.

5. An installation comprising an engine bay, a jet engine installed therein, a yoke member in which the engine is carried, a track disposed in the engine bay, a plurality of guide members which are pivotally mounted on the yoke and which are secured to the engine and each of which is movable along the track, a plurality of engine support members each of which is engaged by a said guide member and each of which is provided with a portion of the respective track, each engine support member being pivotable between an inoperative position in which the engine may be installed in and removed from the engine bay and an operative position in which it supports the engine, and means for pivotally moving the engine support members between, and for retaining them as required in, the operative and the inoperative positions, and an abutment member in the engine bay against which the yoke member is brought when the engine is installed.

6. An installation as claimed in claim **5** in which the means for pivotally moving the engine support members comprise a plurality of jacks, one for each engine support member.

7. An installation as claimed in claim **6** in which the engine and the engine bay are respectively provided with mutually cooperating parts which are automatically brought into operative engagement with each other when the engine is correctly installed in the engine bay.

8. An installation as claimed in claim **7** in which the said mutually engagable parts are parts of a fluid conduit.

9. An installation as claimed in claim **8** in which the said parts of the fluid conduit are provided with mutually engagable conical surfaces which are resiliently urged towards one another.

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