March 29, 1960 P. A. METCALF 2,930,492

WORK STAND AND LOADING APPARATUS

Filed July 23, 1957 2 Sheets-Sheet 1

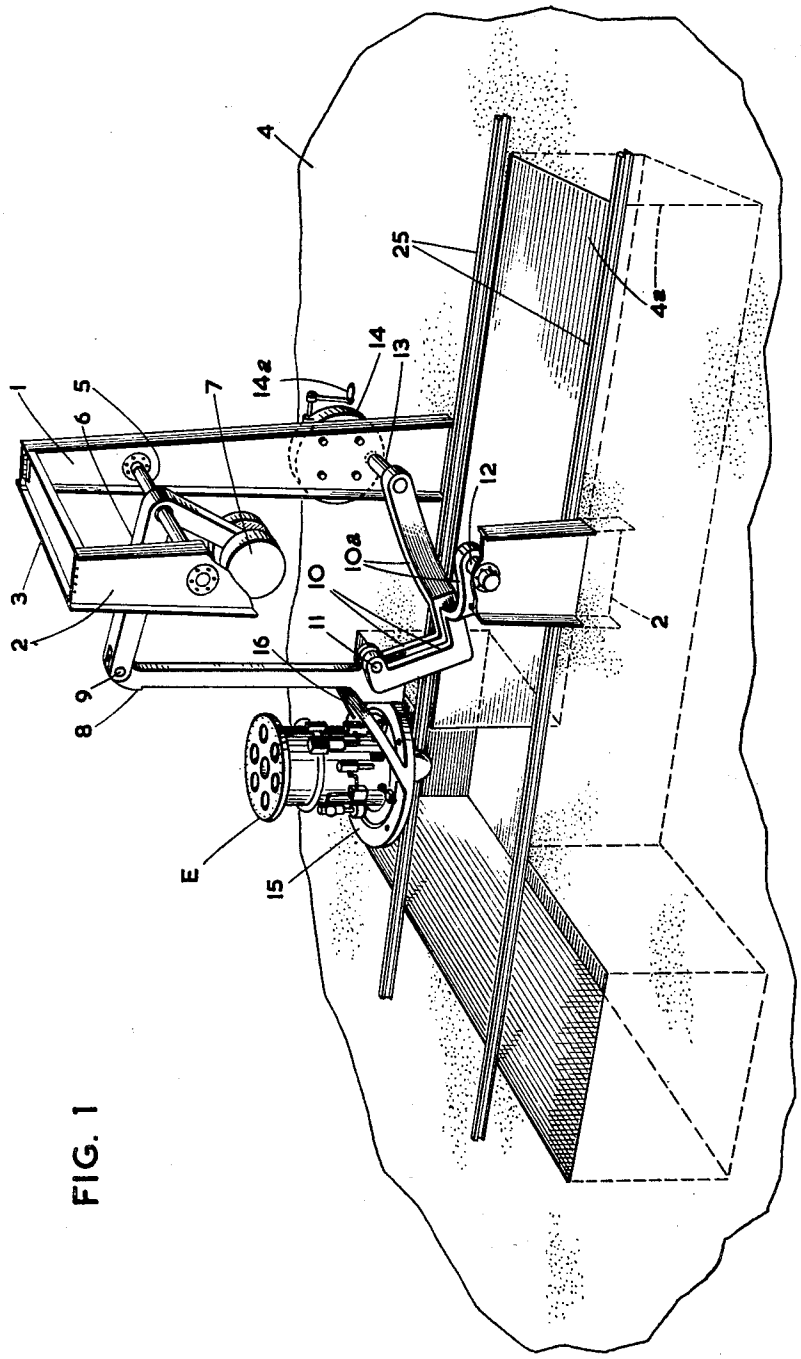


FIG. 1

INVENTOR
P. A. METCALF

BY Maybee & Legris
ATTORNEYS

March 29, 1960 P. A. METCALF 2,930,492

WORK STAND AND LOADING APPARATUS

Filed July 23, 1957 2 Sheets-Sheet 2

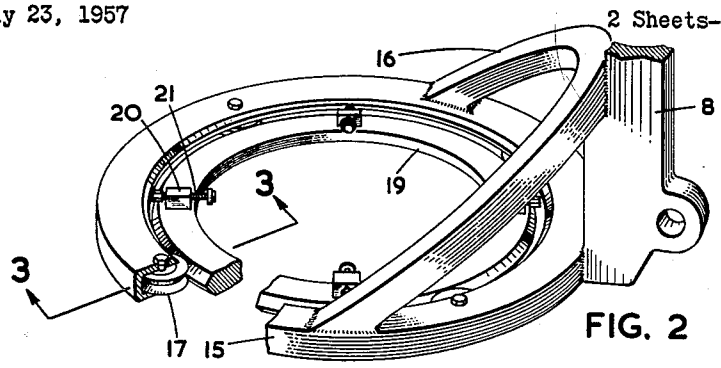


FIG. 2

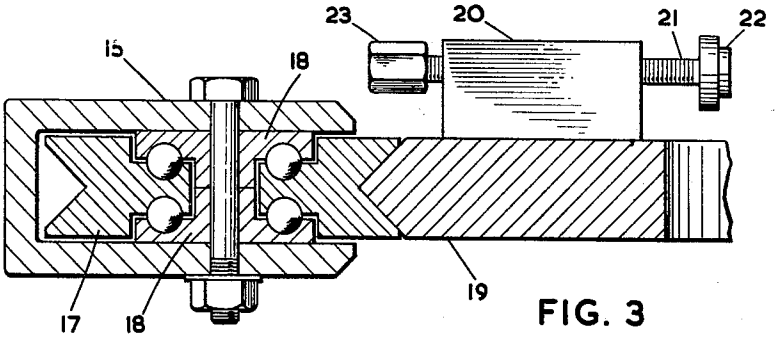


FIG. 3

FIG. 5

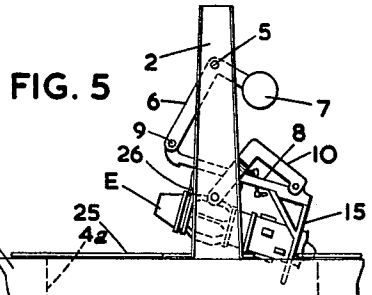


FIG. 4

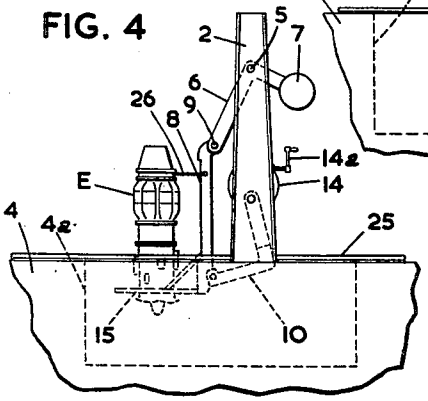
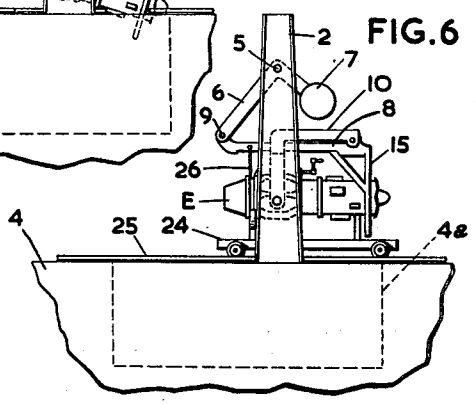


FIG. 6



INVENTOR
P. A. METCALF
BY Maybee & Legris
ATTORNEYS

United States Patent Office 2,930,492
Patented Mar. 29, 1960

2,930,492

WORK STAND AND LOADING APPARATUS

Philip Armitage Metcalf, Malton, Ontario, Canada, assignor to Orenda Engines Limited, Malton, Ontario, Canada, a corporation

Application July 23, 1957, Serial No. 673,737

2 Claims. (Cl. 214—1)

This invention relates to a build and loading stand.

During the assembly of gas turbine engines it is desirable to be able to raise and lower the engine relative to the workman's station without changing the angular position of the engine. It is also desirable that the engine be mounted for axial rotation to give access to the various parts of the engine for working upon it and inspecting it.

With more modern longer engines, difficulty is encountered in lowering the engine after it has been assembled from a vertical position on a work stand to a horizontal position for loading on a transport carriage.

An object of this invention, therefore, is to provide a build stand and loading apparatus which can raise or lower the workpiece while maintaining it in a constant angular position. A further object is to provide such a stand which can swing the workpiece into position for loading on a transport carriage.

The object of the invention is attained by connecting a workpiece holder to a supporting frame by means of a parallel arm linkage arranged to permit up and down movement of the workpiece holder while maintaining it in a substantially constant angular position relative to the supporting frame and by constructing and arranging the linkage to permit a subsequent tilting movement of the workpiece holder through approximately 90° to a position at substantially right angles to its original position relative to the supporting frame.

By the above described means, an engine may be assembled on the workpiece holder in a substantially vertical position relative to the work platform and raised and lowered without substantially changing its vertical position. Subsequent movement of the device will swing the engine into a substantially horizontal position for loading onto a transport carriage.

The invention is hereinafter more particularly described and is illustrated in the accompanying drawings in which:

Figure 1 is a perspective view of the improved work stand, partly broken away and partly in phantom showing the workpiece holder in its uppermost position, with a partly assembled engine therein;

Figure 2 is a perspective view of the workpiece holder on a somewhat enlarged scale, partly broken away;

Figure 3 is a horizontal cross-section through the ring of the workpiece holder on the line 3—3 in Figure 2;

Figure 4 is a diagrammatic view on a smaller scale showing the build stand with the workpiece holder in its lowermost position with a fully assembled engine therein;

Figure 5 is a diagrammatic view showing the build stand with the workpiece holder swung to hold the engine in an inclined position, and

Figure 6 is a diagrammatic view showing the engine stand with the workpiece holder swung to an angular position substantially at right angles to the position in Figures 1 and 4.

In the drawings corresponding numerals refer to corresponding parts.

The stand is provided with a supporting frame consisting of two uprights **1** and **2** connected by a cross-piece **3** at the upper end thereof and anchored to a horizontal concrete work platform **4** by setting the lower ends of the uprights **1** and **2** into the floor as shown in Figure 1 or by other suitable means whereby a firm support for the uprights can be obtained.

A pit **4***a* is provided in the platform **4** extending between the uprights **1** and **2** and providing space to permit the engine to swing from its upright position as shown in Figure 1 to its horizontal position as shown in Figure 6.

Extending transversely of the supporting frame between the uprights **1** and **2** and below the cross-piece **3** is a rotatable shaft **5** mounted in bearings on the two uprights.

A right-angled arm **6** is secured at its angle to the mid-point of the shaft **5** to rotate therewith. A counter balancing weight **7** is attached to one end of said arm **6** and one end of a beam **8** is pivotally connected to the other end of said arm **6** by means of a pin **9**. The other end of said beam **8** is pivotally connected to one end of another right-angled arm **10** by means of a pin **11**.

The right-angled arm **10** is formed of two spaced parts which embrace the beam at the pivot point at one end and which extend outwardly to form a fork **10***a*. One arm of the fork is secured to a stub shaft **12** pivoted to the upright **2** adjacent the lower end thereof and the other arm is secured to the stub shaft **13** journalled in the upright **1** and extending therethrough into a gear box **14** bolted to the upright **1** and provided with a crank **14***a* which can be turned to rotate the stub shaft **13** and thereby operate the whole above described linkage arrangement including the arm **10**, the beam **8** and the arm **6**.

The right-angle in the arm **10** is located between the point of pivoting with the beam **8** and the point of commencement of the fork **10***a*. Its purpose is to raise the arm **10** to clear the engine when the engine is in the horizontal position shown in Figure 6. However, it will be observed that a line from the longitudinal axis of stub shafts **12** and **13** to pivot pin **11** is substantially parallel to arm **6** and that the distance between stub shafts **12** and **13** and pin **11**, is equal to the distance between shaft **5** and pin **9**, so that, arm **10**, beam **8** and arm **6** form a parallel arm linkage.

Secured to the beam **8** and extending outwardly therefrom at substantially right angles is a workpiece holder **15** in the form of a ring. A substantially semi-cylindrical brace member **16** extends from the ring to the beam **8**.

The workpiece (illustrated in Figures 1, 4, 5 and 6 as a gas turbine engine E) is mounted for rotary movement to assist in assembly and inspection and for this purpose a rotatable mounting is provided on the workpiece holder **15**. As shown particularly in Figures 2 and 3, the periphery is U-shaped in section and four peripherally grooved rollers **17** are mounted on ball bearings **18** with a portion of their peripheries extending beyond the inner circumference of the workpiece holder to receive an annular workpiece mounting member **19**. Secured to the upper surface of the annular workpiece mounting member **19** at substantially equally spaced intervals are blocks **20** bored and threaded to receive threaded spindles **21** having spigots **22** attached to their inner ends and having their outer ends provided with heads **23** machined to accommodate a wrench for turning the spindles. The spigots fit in spigot recesses in the workpiece when tightened.

The periphery of the annular workpiece mounting member **19** is bevelled to fit the grooves in the rollers **17**. Rotation of the annular member **19** causes the rollers **18** to rotate, and thereby the workpiece can be rotated as desired for work or inspection.

In Figure 4 there is shown diagrammatically the position of the engine E after it has been lowered to a position below the work platform to permit workmen to assemble the upper part of the engine and showing the engine in completed condition. It will be observed that the angular position of the workpiece holder **15** relative to the supporting frame and the work platform (and therefore the longitudinal axis of the engine) is unchanged from the raised position of Figure 1 to the lowered position of Figure 4. In both positions the longitudinal axis of the engine is substantially perpendicular. It will also be observed that the workpiece holder moves substantially vertically when it is being raised or lowered.

In Figure 5, however, the linkage has been manipulated so that the workpiece holder has swung to an angle at which the longitudinal axis of the engine is inclined and this position is useful for some work operations and inspections.

It will be observed at a position intermediate the position shown in Figs. 4 and 5, arms **6** and **10** will both be in a vertical position and parallel to beam **8**. From that point, on further operation of the mechanism, the arm **6** must reverse its movement. The counterbalancing weight **7** exercises a constant pressure on arm **6** urging it to pivot anti-clockwise and thus, to reverse its movement after reaching the vertical position. The counterbalancing weight, also, of course, is designed to take at least part of the load off the gear box especially under conditions where a completely assembled engine is being manipulated, assuming that the mechanics of the device have been designed to efficiently handle the mean weight of the engine at all stages of the assembly.

In Figure 6 the linkage has been operated to swing the workpiece holder to a position substantially at right angles to the position of Figures 1 and 4 with its central axis substantially parallel to the platform **4** and the longitudinal axis of the engine above and parallel to the platform **4**. At this point a transport carriage **24** can be pushed on rails **25** beneath the engine as shown in Figure 6. Cradle members are provided on the carriage **24** and by jacking up one of these members the engine may be supported while being disconnected from the workpiece holder **15**. The carriage may then be pushed off to take the engine to any desired location. By suitable modification of the linkage the stand can be swung more than 90°, up to 180°.

It will be observed that by reason of the spacing of the parts of the arm **10** the beam **8** may pass between the parts. The right angle raises the arm to clear the engine in the position shown in Figure 6.

In use, a section of the article to be built is mounted on the workpiece holder **15** and subsequent sections are progressively fitted above and below the original section with the manual operations being done at a convenient height for the workman who remains standing on the floor, without requiring pits or scaffolds. On completion of the assembly the engine may be braced at its upper end as shown in Figure 4 by brace **26** secured at one end to the beam **8** and at the other end to a flange or other convenient part of the engine.

The operation above described can be reversed when it is desired to take the engine apart for inspection or repair. The engine can be brought into position on a carriage, secured to the strand, the carriage then removed, and the engine swung to a vertical position for disassembly.

Although described in connection with building an engine, the stand may be used for assembling other devices or apparatus, and may also be used for lifting any horizontal object and swinging it to a vertical position or the reverse. The stand could be made mobile and thus moved from place to place and used for different purposes, such as the erection and assembly of poles, by swinging them from a horizontal to a vertical position and dropping them into a hole. The poles may be worked on while mounted on the stand, by painting, or by adding steps, cross bars, insulators, etc., thereto.

It will be understood that the above describes a specific embodiment of the invention and that the construction may be changed without departing from the invention claimed in the appended claims.

What I claim as my invention is:

1. A work stand and loading apparatus, comprising a supporting frame having spaced apart vertical members, aligned journal bearings in said vertical members adjacent their upper ends, a first arm journalled in said bearings for swinging movement in a vertical plane, a link, a pivotal connection between said link and an end of said first arm remote from said upper journal bearings, aligned journal bearings in said vertical members adjacent their lower ends, a second arm journalled in said lower bearings for swinging movement in said vertical plane, a pivotal connection between said link and an end of the second arm remote from said lower bearings, the pivotal connections of said link to the first and second arms being spaced from the axis of the journal bearings of the respective arms by an identical distance for the arms and link to operate as a parallel linkage system with the link in a substantially vertical attitude when both arms are extending laterally to the same side of a plane which includes the axes of the respective journal bearings, said link extending transversely of said axis-containing plane when the arms extend laterally to opposite sides of that plane, said identical distances being respectively greater than one-half the distance between the axes of the upper and lower journal bearings to permit the link to be oriented in a horizontal attitude when the arms are extending laterally to opposite sides of said axis-containing plane, means biasing the first arm for it to extend exclusively to one side of said axis-containing plane, a drive mechanism for swinging said second arm about the axis of its journal bearings and for maintaining that arm in a position to which it is swung, and a workpiece holder carried by said link.

2. A work stand and loading apparatus according to claim 1, in which said second arm comprises two spaced parts extending respectively from adjacent one of the vertical members and converging toward said pivotal connection with the link, the spacing of said parts being greater than the greatest width of the workpiece in order that the workpiece may be accommodated between said parts.

References Cited in the file of this patent

UNITED STATES PATENTS

1,617,743	Barnes	Feb. 15, 1927
2,517,853	Eickmeyer et al.	Aug. 8, 1950
2,548,476	Horstmann	Apr. 10, 1951
2,557,228	King et al.	June 19, 1951
2,613,822	Stanley	Oct. 14, 1952
2,730,252	Oswalt	Jan. 10, 1956
2,786,434	Klungtvedt	Mar. 26, 1957