May 16, 1961 R. E. NEARMAN 2,984,513

LIFTING TOOL FOR MISSILES

Filed July 24, 1959

2 Sheets-Sheet 1

FIG. 1

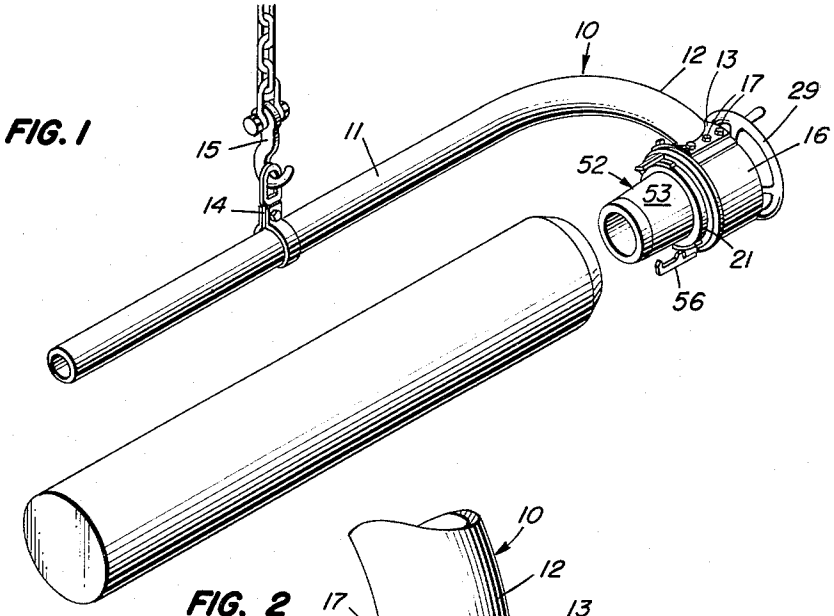


FIG. 2

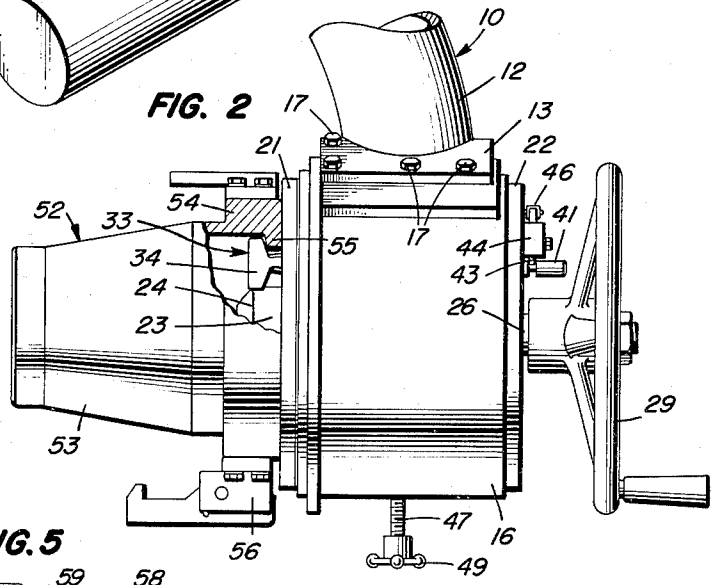
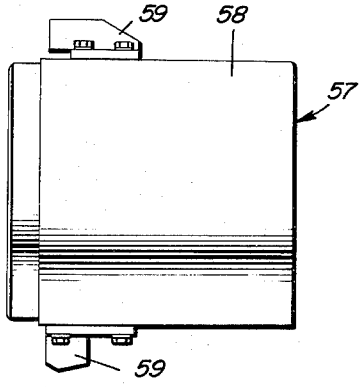


FIG. 5



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2 Sheets-Sheet 2

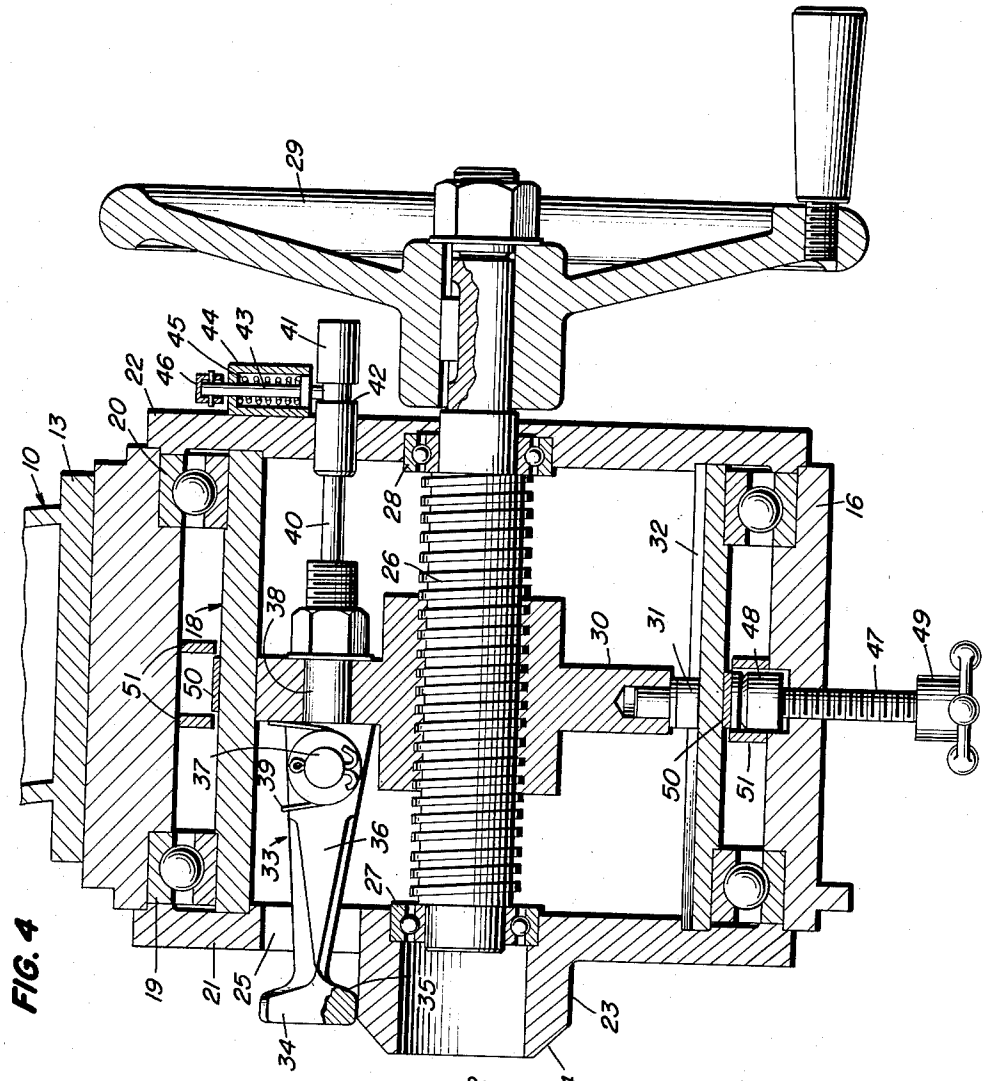

FIG. 4

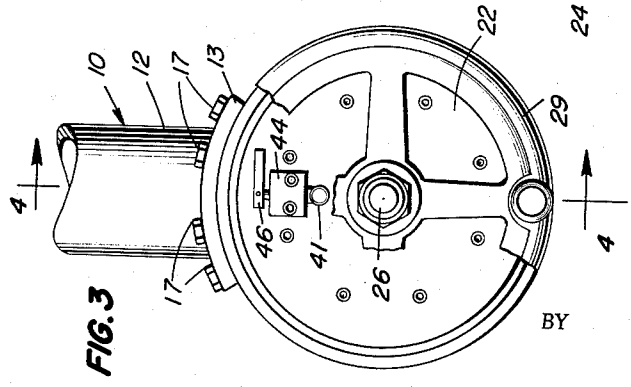

FIG. 3

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LIFTING TOOL FOR MISSILES

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6 Claims. (Cl. 294—67)

The present invention relates generally to weapon component handling devices and more particularly to an improved lifting tool.

One of the more important objects of the invention is to provide a lifting tool which, when used in conjunction with a suitable hoist, will function for lifting various sections or components of an aerial missile, or the booster therefor, to convenient positions for testing, assembly, or other operations.

Another object of the invention resides in the provision of a lifting tool which will permit full 360-degree rotation of a missile component or booster suspended thereon, to facilitate work on such component or booster.

As further objects, the invention provides a lifting tool which will be self-centering on the component and attach thereto with a minimum of alignment, and that will, when attached to the component, leave all surfaces thereof free and unobstructed, except at the point of attachment.

And still further objects of the invention are to provide a tool for the purpose set forth that will be simple and rugged in construction, and one that will be light in weight and readily maneuverable.

Other objects and many of the attendant advantages of the present invention will be readily appreciated as the same becomes better understood by reference to the following detailed description when considered in connection with the accompanying drawings, wherein:

Fig. 1 is a perspective view of the invention in position for engagement with a missile component;

Fig. 2 is an enlarged side elevation showing the head of the tool with a missile component engaging adapter thereon, a portion of the adapter being broken away and shown in section to illustrate one of the latch fingers employed;

Fig. 3 is an end view of the head of the tool;

Fig. 4 is an enlarged axial section on the line 4—4 of Fig. 3; and

Fig. 5 is a side elevation showing a modified adapter construction.

Referring more specifically to the drawings, wherein like reference numerals designate similar parts throughout the views, the numeral **10** indicates generally a supporting beam. The beam **10** includes a straight section **11** and a curved section **12**, the section **12** being curved, or bent, through substantially 90 degrees. A suitable attaching plate **13** is secured to the free end of the curved section **12**, and a clip **14**, for engagement by a hoist chain hook **15**, is adjustably mounted on the straight section **11**.

As best seen in Figs. 1 and 2, a cylindrical head **16** is secured to the attaching plate **13** by bolts **17**. Referring to Fig. 4, a cylindrical housing **18** is rotatably mounted in the head by bearings **19** and **20**, and is provided with fore and aft end walls **21** and **22**. The wall **21** is formed with an axially positioned outwardly projecting cylindrical cam sleeve **23** having a frusto-conical outer end wall **24** thereon. Said wall **21** is also formed with openings adjacent the sleeve, said openings being preferably three

in number and arranged in a circumferentially spaced series. One of the openings is shown at **25**.

Extending axially of the housing **18** is a threaded follower shaft **26**. The shaft **26** is rotatably mounted in the housing by bearings **27** and **28**, and one end of said shaft projects outwardly from the aft wall **22** to receive thereon a handwheel **29**. Mounted in the housing for axial movement on the follower shaft **26** is a follower plate **30**, rotation of the follower plate being prevented by a key **31** that is movable in a slot **32** in the cylindrical wall of the housing. Rotation of the handwheel **29** will advance the plate **30** toward the fore wall **21** or retract said plate toward the aft wall **22**.

Mounted on the follower plate **30** and extending through the openings **25** are latch fingers, one of which is shown at **33**. More specifically, each of the latch fingers **33** is of generally T-shape, being formed with a head **34** having curved rear walls **35** and a tapered shank **36**, the shank being pivotally connected to the follower plate by a pin **37** which is carried by a bolt **38**. A spring **39** normally urges the shank **36** and head **34** toward the cam sleeve **23**. The bolt **38** carries a safety latch rod **40** that extends rearwardly in the housing **18** and carries a latch member **41** having an annular groove **42**, the latch member extending through the aft wall **22**. A plunger **43**, for engagement in the groove **42**, is mounted in a latch housing **44** secured to the outer face of the wall **22**. The plunger is normally urged into the groove **42** by a spring **45**, but may be lifted out of said groove by manually engaging a handle **46** on the outer end of said plunger.

As stated hereinabove, the housing **18** is rotatable in the head, such rotation permitting a missile component attached to the tool to be rotated about its axis to any desired position. For retaining the housing in such desired position, a brake is employed. The brake includes a screw **47** which is carried by the head **16** and has a shoe **48** on its inner end and a knob **49** on its outer end. The shoe **48** is engageable with a brake band **50** which extends about the housing **18** medially of its length. Spaced guides **51** retain the shoe and band in alignment.

The lifting tool comprising the subject matter of the present invention may be used for handling a "Quadpac" or a "Tripac" (assembled missile components), or a missile booster. However, adapters of slightly different configurations are required for the different jobs. In Fig. 2 the lifting tool is shown with a missile component adapter **52** thereon. The adapter shown in Fig. 2 has a tapered cylindrical body **53** and a base **54**, the base being provided with an inwardly directed mounting flange **55**. Suitable component attaching devices are shown at **56**. The adapter **57**, shown in Fig. 5, is used for supporting a missile booster. It is identical to the adapter **52** except for the provision of a straight outer wall **58** and slightly modified attaching devices **59**.

In operation, the cantilevered tubular beam **10** is moved by a suitable hoist (not shown) to a position for engagement with a missile component assembly or missile booster. The clip **14** is moved along the beam to a position above the center of gravity of the component assembly or booster. Then the proper adapter is secured to the head **16**, depending upon whether a missile component assembly or booster is to be lifted. Attachment of the adapter is accomplished in the manner now to be described.

First the handwheel **29** is rotated in one direction, for advancing the latch fingers **33** so that the heads **34** will move along the cam sleeve **23** away from wall **21** and onto the frusto-conical outer end wall **24** thereof. It will thus be seen that the heads **34** will be moved toward each other and toward the axis of the housing **18**, by the action of the springs **39** as the heads **34** ride along

conical wall **24**. The desired adapter, **52** or **57**, may then be placed about the fingers with the mounting flange **55** in engagement with the inner walls **35** of the heads. Counter-rotation of the handwheel will retract the fingers and, by the action of the sleeve **23**, expand them for centering the adapter on the fore wall **21**. Further retraction of the fingers will tightly secure the adapter against the fore wall **21** of the housing, as shown in Fig 2. The aforesaid retraction of the fingers will also move the latch member **41** through the aft wall **22**, whereupon the plunger **43** will be moved into the groove **42** for preventing further movement of the plate **30** as best shown on Fig. 4. Accidental release of the fingers, with consequent separation of the adapter from the head **16**, will thus be prevented. When the desired adapter is in position the tool may be quickly attached to a missile component or booster.

Substitution of adapters may be easily effected by lifting the plunger **43** from the groove **42** and rotating the handwheel **29**, when the follower plate **30** will be advanced for releasing the grip of the fingers on the adapter flange **55** and freeing the adapter for quick removal.

Obviously many modifications are possible in the light of the above teachings. It is therefore to be understood that within the scope of the appended claims the invention may be practiced otherwise than as specifically described.

What is claimed is:

1. A lifting tool including a beam having a straight portion, and an end portion curved through ninety degrees, a cylindrical head secured to the free end of the curved end portion and having its axis parallel to the axis of the straight portion, an adapter having a mounting flange, and means carried by the head for detachably securing the adapter to the head, said adapter being engageable with a missile conmponent, said means including a plurality of annularly spaced fingers, a follower plate mounting the fingers, a cam sleeve engageable by the fingers, a follower shaft mounting the follower plate, and a hand wheel for rotating the shaft for shifting the follower plate and engaging the fingers with the mounting flange of the adapter, said shaft being counter-rotatable for moving the fingers along the cam sleeve and clamping the adapter mounting flange against the head.

2. A lifting tool including a beam having a straight portion and a curved end portion, a head secured to the curved end portion, an adapter having a mounting flange, latch means in the head and movable into engagement with the mounting flange for securing the adapter to the head and movable out of engagement with the mounting flange to release the adapter from the head, said adapter being engageable with a missile component, and means including a hand wheel operatively connected to said latch means for controlling the movement of the latch means into and out of engagement with the mounting flange.

3. A lifting tool including a supporting beam having a straight portion and a curved end portion, a head secured to the curved end portion at its free end, said head being cylindrical and having a housing rotatable therein, an adapter having a mounting flange, means including a plurality of latch fingers for detachably securing the adapter to the housing, a follower plate slidably mounted in the housing and carrying said latch fingers, means including a threaded shaft mounted on said housing for slidably shifting the follower plate and engaging the fingers with the adapter, said adapter being engageable with a missile component for attaching said component to the tool, means including a latch rod connected with the plate and latch fingers for preventing accidental detachment of the adapter from the housing, and brake means carried by the head and engageable with the housing for locking the housing, adapter, and component in a desired attitude with respect to the supporting beam.

4. A lifting tool including a supporting beam having straight and curved sections, a cylindrical head on the curved section with its axis parallel to the axis of the straight section, a housing having fore and aft end walls, bearings rotatably mounting the housing in the head axially thereof, an adapter having a mounting flange, a follower shaft in the housing between the end walls and extending beyond the aft wall, a follower plate on the shaft in the housing, means preventing rotation of the follower plate on the shaft, latch fingers on the follower plate, a cam sleeve on the fore end wall and engageable by the fingers, said fingers being engageable with the adapter mounting flange, and a handwheel connected with the follower shaft for rotating the same, rotation of the follower shaft moving the follower plate and fingers whereby said fingers will move on said cam sleeve for clamping the adapter mounting flange against the fore end wall, said adapter being engageable with a missile component assembly or booster for connecting such assembly or booster to the tool.

5. A lifting tool as recited in claim 4, including additionally a safety latch comprising a rod carried by the follower plate, a latch member on the rod and extending through the aft wall, said latch member having a groove, and a spring-pressed plunger on the aft wall and engageable in the groove, said safety latch securing the follower plate with the latch fingers engaging the adapter mounting flange.

6. A lifting tool as recited in claim 5, including additionally a brake for securing the housing in a desired attitude with respect to the head.

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