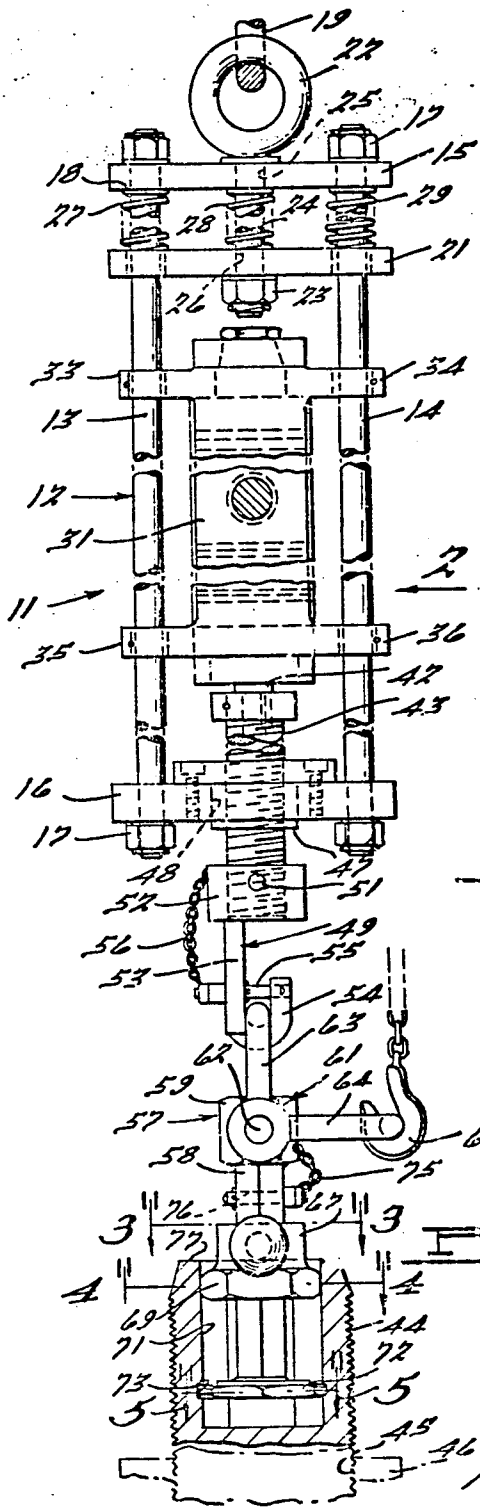
Nov. 24, 1964 LE ROY S. DE MART 3,158,051
STUD HANDLING TOOL
Filed Jan. 9, 1961 2 Sheets-Sheet 1



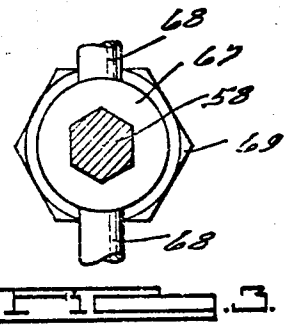


FIG. 3.

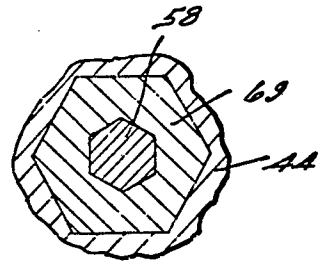


FIG. 4.

FIG. 1.

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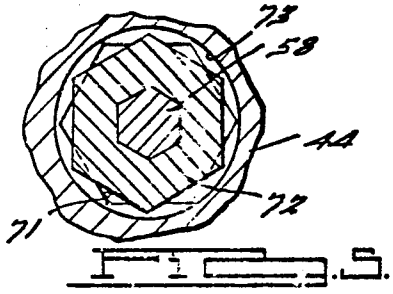

FIG. 1

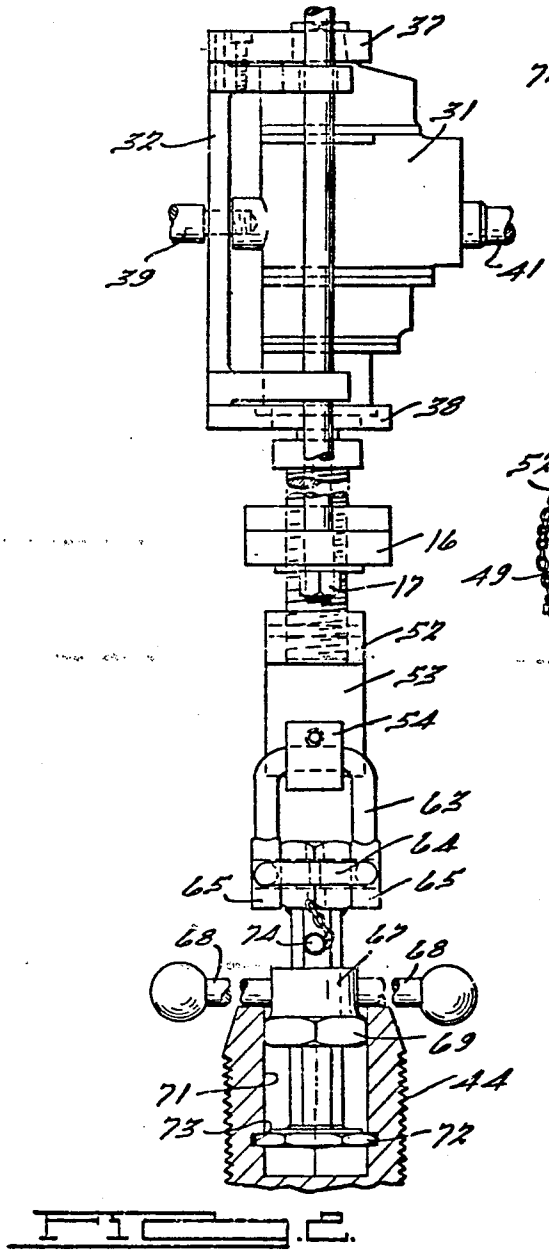

FIG. 2

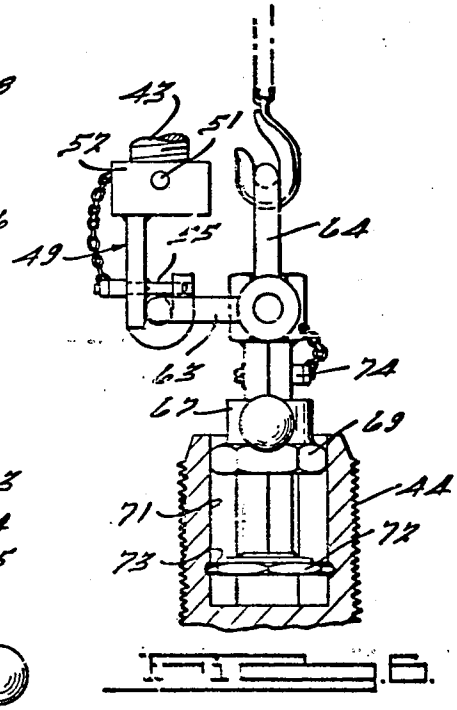

FIG. 3

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STUD HANDLING TOOL

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This invention relates to stud handling tools, and more particularly to mechanisms for installing and removing relatively heavy studs or the like from large pressure vessels or similar installations.

The installation and removal of studs from the flanges of reactor vessels or similar apparatus of large size has presented problems, not only because of the cumbersomeness of the studs, but their relatively delicate threads which must not be damaged during installation or removal.

It is an object of the present invention to provide a novel and improved tool for handling heavy studs or the like which are to be installed or removed from an installation such as a reactor vessel, and which permits a large number of such studs to be handled in quick succession with a minimum of manual exertion and without danger of damage to the stud threads.

It is another object to provide an improved stud handling tool of the above nature which may be readily attached to the stud and locked thereto, a portion of the locking means also serving as a driving connection between the stud and a power driven motor.

It is also an object to provide an improved stud handling tool having the above characteristics in which studs may be transported from a storage area to the power driven motor using the same adaptor means which serves as a driving connection between the motor and stud, and in which this last-mentioned means may be automatically and simply converted from its transporting condition to its driving condition.

Other objects, features, and advantages of the present invention will become apparent from the subsequent description, taken in conjunction with the accompanying drawings.

In the drawings:

FIGURE 1 is a side elevational view, with parts broken away and sectioned, showing the novel stud handling tool of this invention attached to a stud and in its driving position;

FIGURE 2 is an end elevational view taken in the direction of the arrow 2 of FIGURE 1 and showing further details of the connection between the driving motor and adaptor;

FIGURE 3 is a plan cross-sectional view taken along the line 3—3 of FIGURE 1 and showing the cross-sectional configuration of the central adaptor shaft;

FIGURE 4 is a plan cross-sectional view taken along the line 4—4 of FIGURE 1 and showing the manner in which the adaptor key member fits into the hexagonal stud recesses;

FIGURE 5 is a plan cross-sectional view taken along the line 5—5 of FIGURE 1 showing the manner in which the adaptor locking member is received by the slot in the lower end of the stud recess; and

FIGURE 6 is a fragmentary side elevational view similar to the lower portion of FIGURE 1 but showing the adaptor in its transporting position and about to be placed in its driving position.

In general terms, the illustrated embodiment of the invention comprises a driving motor assembly having a pair of vertical guide rods adapted to be suspended by a hand-operated hoist or other lifting apparatus, and a reversible air motor vertically slidable on said rods. A screw extends downwardly from the air motor and is

drivable thereby, the screw having the same thread pitch as that of the studs which are to be handled and being threaded in a nut carried by the lower ends of the rods. The lower end of the screw carries a hook-shaped member on which may be mounted an adaptor capable of use for transporting the studs to the motor and also serving as a driving connection between the motor and attached stud.

Several adaptors may be provided for a single motor so that one stud may be transported while another one is being driven into its threaded aperture. Each adaptor comprises a central shaft carrying a locking member at its lower end and a key member slidably but non-rotatably mounted on the central shaft. Each stud has a non-circular recess with an outwardly extending groove or undercut in its lower end. Each adaptor locking member corresponds in shape to the stud recess and is receivable thereby, so that when it reaches the level of the groove a slight rotation will cause the outer portions of the locking member to be received by the groove. This slight rotation will also permit the key member to slide into the upper portion of the stud recess, a detachable retaining member being mounted on the central shaft to prevent separating movement of the key member from the locking member.

Referring more particularly to the drawings, the stud handling tool includes a driving motor assembly generally indicated at 11 which has a frame generally indicated at 12, this frame being of generally vertically elongated shape. The frame includes a pair of vertical guide rods 13 and 14 rigidly connected by an upper cross member 15 and a lower cross member 16, the rods having nuts 17 threaded on their ends and shoulders 18 for securing members 15 and 16 in place. For suspending frame 12 from a crane having a hook indicated partially at 19, or other lifting means, a bar 21 is slidably mounted on the upper portions of rods 13 and 14, and has an eye 22 secured thereto by means of a nut 23 threaded on the downward extension 24 of the eye, this extension passing through central apertured portions 25 and 26 of member 15 and bar 21 respectively. Springs 27, 28 and 29 are mounted on the upper portions of rods 13 and 14 and on extension 24, these springs being disposed between members 15 and bar 21, so that frame 12 is resiliently suspended.

An air motor 31 carried by a C-shaped frame 32 (FIGURE 2) is provided for driving the stud handling tool. Frame 32 has upper extensions 33 and 34 and lower extensions 35 and 36, extensions 33 and 35 being slidably mounted on rod 13, while extensions 34 and 36 are slidably mounted on rod 14. The frame also carries an upper member 37 and a lower member 38 between which motor 31 is secured. The motor is provided with a pair of horizontally extending handles 39 and 41, and one of these handles may include a conventional control valve for driving the motor in either direction.

The output shaft 42 of motor 31 is connected to a screw 43 coaxial therewith, this screw having a thread with the same pitch as the thread on a stud 44 mountable in the threaded recess 45 of a reactor vessel flange 46, or similar installation. Screw 43 is threaded in a bushing 47 secured to member 16 and extending through an aperture 48 thereof coaxially with motor shaft 42.

A hook generally indicated at 49 is secured by a pin 51 to the lower end of screw 43. This hook comprises a collar 52 secured to the screw and a flat plate 53 extending downwardly therefrom, a U-shaped member 54 formed from a flat plate being secured to the lower end of plate 53. Both members 53 and 54 have flat portions in spaced parallel relation, as seen in FIGURES 1 and 2. An adaptor retaining pin 55 is carried by a chain 56 secured to collar 52 and is insertable in a pair of aligned

apertures in members 53 and 54 as seen in FIGURE 1, the pin carrying detent means for holding it in its inserted position.

An adaptor generally indicated at 57 is shown in the drawings. In practice, two or more adaptors will normally be provided for a single driving motor assembly 12 so that they may be sequentially used. Each adaptor comprises a central shaft 58 having a non-circular cross-sectional shape, a hexagonal shape being illustrated, as shown in FIGURE 3. An enlarged pivot portion 59 is secured to the upper end of shaft 58 and carries a bail assembly generally indicated at 61 by means of a pivot pin 62. Bail assembly 61 comprises two U-shaped bails 63 and 64 positioned in fixed relation at right angles to each other and having a common pair of spaced journals 65 adapted to be mounted on pin 62 on opposite sides of adaptor element 59, so that the bails may be swung between the positions shown in FIGURES 1 and 6. Each bail 63 and 64 has a straight central portion, bail 63 being adapted to be received by hook 49 while bail 64 is adapted to be engaged by hook 66 carried by a portable crane (not shown).

A key member 67 is slidably but non-rotatably mounted on shaft 58 below element 59, the interior of member 67 having a hexagonal aperture corresponding to the cross-sectional shape of shaft 58. The upper portion of member 67 is circular and carries a pair of oppositely disposed aligned handlebars. The lower portion 69 of member 67 is of hexagonal shape complementary to the cross-sectional shape of a recess 71 in the upper portion of each stud 44.

A locking member 72 is fixedly secured to the lower end of shaft 58. This locking member is also of hexagonal shape to correspond with the shape of stud recess 71, but is substantially thinner than the hexagonal portion 69 of key member 67. Moreover, locking member 72 is angularly displaced with respect to key member portion 69 a distance of 30°, as is evident from a study of FIGURES 1 and 2. The recess 71 of each stud is provided with a groove 73 at its lower portion, this groove extending outwardly a distance sufficient to permit the outer portions of locking member 72 to enter the groove when the locking member is rotated 30° after having passed downwardly through hexagonal recess 71 to the level of the groove. A key member retaining pin 74 is secured to upper adaptor portion 59 by a chain 75 and is adapted to be received by aperture 76 passing through shaft 58 above the operative position of key member 67 as seen in FIGURES 1 and 2. Pin 74 is provided with detent means for holding in its inserted position, and its distance from the operative position of key member 67 is such as to prevent withdrawal of the key member from recess 71.

In operation, assuming that a plurality of studs 44 are stored at a location remote from flange 46 and that it is desired to install these studs in threaded recesses 45 of the flange, a first adaptor 57 will be attached to a first stud 44. This may be done by withdrawing pin 74, entering locking member 72 in recess 71, and sliding the locking member down toward groove 73. Before locking member 72 reaches the level of groove 73, the outer portions of key member section 69 will engage the upper surface 77 of stud 44, it being recalled that portion 69 and locking member 72 are angularly misaligned. Since pin 74 is removed, however, further downward movement of shaft 58 and locking member 72 will not be impeded, key member 67 merely sliding upwardly on shaft 58. With slight rotative pressure exerted on handles 68, the outer portions of locking member 72 will enter groove 73 when the locking member reaches the groove level. The adaptor may thus be rotated 30°, at which point key member portion 69 will drop into recess 71 until handles 68 engage upper stud surface 77. Pin 74 may then be inserted into aperture 76 and adaptor 57 will be secured to the stud for transportation purposes.

Bail 64 of the adaptor may then be engaged by a portable crane hook 66 and the stud and adaptor carried to the location of driving motor assembly 12, the latter being supported by hook 19 with motor 31 in its upper position. Since bail 64 is supporting the weight of the stud, bail 63 will be projecting to the left as seen in FIGURE 6. With pin 55 removed, crane hook 66 may be lowered until bail 63 enters hook 49 and pin 55 replaced, upon which further lowering of hook 66 will cause bail 63 to become vertical as seen in FIGURE 1. With crane hook 66 removed, hook 19 may be slowly lowered until the lower end of the stud thread engages the upper turn of thread 45, the spring support for frame 12 aiding in this engagement. Motor 31 may then be started, rotating screw 43 and with it hook 49, adaptor 57 and stud 44, the latter being driven through shaft 58 and key member 57. As screw 43 is rotated, it will thread itself downwardly through bushing 47 at the same rate as stud 44 is fed into threaded aperture 45. The engagement of the straight central portion of bail 63 with flat plates 53 and 54 will prevent any undesirable angular shifting between screw 43 and stud 44.

While the first stud 44 is being threaded into its recess, a second stud may be carried to the driving motor assembly by a second adaptor 57 and crane hook 66. When the first stud has been fully threaded into its recess, hook 49 may be detached from bail 63 of the first adaptor and engaged with bail 63 of the second adaptor. Meanwhile, the first adaptor may be detached from its stud by removing pin 74, lifting key member 67 until its portion 69 clears the top of the stud, and rotating the adaptor 30° so that locking member 72 may be removed from recess 71. The first adaptor may then be returned to the stud storage area for further use. After being detached from each adaptor, motor 31 will be returned to its upper position in readiness for handling the next stud.

When it is desired to remove studs from flange 46, the above-described procedure may be reversed. In this case, motor 31 will be placed in readiness by rotating screw 43 until the motor and its attached parts are at the lower portions of rods 13 and 14. Hook 49 may then be connected to an adaptor 57 previously mounted in the stud to be removed, and removal effected by rotation of screw 43 to cause stud unthreading. Hook 66 may then engage the adaptor so as to detach it from the driving motor and transport it to its storage area, hook 49 meanwhile being returned to its lower position and connected to the next adaptor 57.

While it will be apparent that the preferred embodiment of the invention disclosed is well calculated to fulfill the objects above stated, it will be appreciated that the invention is susceptible to modification, variation and change without departing from the proper scope or fair meaning of the subjoined claims.

What is claimed is:

1. In a tool for handling studs or the like, a frame, means for suspending said frame from a hoist, said last-mentioned means including resilient means for permitting limited vertical shifting movement between said hoist and frame, a vertically disposed screw threadably carried by said frame and having the same pitch as the stud threads, means for rotating said screw, and means at the lower end of said screw for detachably securing the upper portion of a stud thereto.

2. In a tool for handling studs or the like, a vertically extending frame, a vertically disposed screw, means at the lower end of said frame for threadably supporting said screw, the screw threads having the same pitch as the threads of of said stud, a reversible power actuated motor having a housing and rotary shaft, the housing being slidably but nonrotatably mounted on said frame above said screw and said shaft being secured at one end to said screw for rotating the screw in either direction, and means carried by the lower portion of said screw for detachably securing a stud thereto.

3. In a device for handling heavy studs or the like, a frame comprising a plurality of vertically extending guides, resilient supporting means at the upper ends of said guides, a reversible power actuated motor slidably but nonrotatably mounted on said guides, a screw connected to and extending downwardly from said motor, means at the lower ends of said guides for threadably supporting said screw, the screw threads having the same pitch as the threads of said stud, and means at the lower portion of said screw for detachably securing the upper portion of a stud thereto.

4. The combination as defined in claim 2, said last-mentioned means comprising a hook secured to the lower end of said screw, an adaptor of elongated shape having one end adapted to be secured to one end of a stud, first and second bails fixed to each other in transverse relation and having a common pivotal connection with said other end of the adaptor, said first bail being engageable with said hook when the first bail extends horizontally whereby the adaptor may then be suspended from the motor output shaft and in driven relation therewith with the first bail extending vertically, said adaptor being suspendible by said second bail when the second bail is in a vertical position to cause the first bail to assume a horizontal position for engagement with said hook.

5. The combination according to claim 3, said motor comprising an air driven motor having horizontally extending handles, a C-shaped bracket secured to the upper and lower ends of said motor, and extensions on said bracket slidably mounted on said guides.

6. In a device for handling heavy studs or the like of the type having a non-circular central recess in the upper portion thereof, and an undercut groove in the lower portion of said recess extending outwardly therefrom, a frame, stud engaging means extending downwardly from said frame, means on said frame for rotating said stud engaging means in either direction and simultaneously advancing the stud engaging means at the rate of said stud thread pitch, a locking member secured to the lower end of said stud engaging means, said locking member having the same non-circular shape as the stud recess, a key member slidably and non-rotatably mounted on said stud engaging means above said locking member, the lower portion of said key member having the same non-circular shape as said thread recess but being angularly shifted with respect to said locking member, and means on said key member above said lower key member portion engageable with the upper end of said stud when said key member portion is rotated to fit into the stud recess, whereby the outer portion of said locking member will enter said groove.

7. The combination according to claim 6, further provided with a stop member movably mounted on said stud engaging means above said key member and engageable thereby to limit movement of said key member away from said locking member.

8. A handling tool for a stud having a central recess of polygonal cross-sectional shape in the upper end thereof and a groove extending radially outwardly from the lower portion of said recess, comprising a vertically elongated member, means for raising and lowering said member, a locking element secured to the lower end of said member and having a polygonal shape adapted to fit in said recess, the outer portion of said element being receivable in said groove, a key member slidably and non-rotatably mounted on said elongated member, a polygonal lower portion of said key member adapted to be received by said recess but angularly shifted with respect to the polygonal shape of said locking element, and means for limiting separating movement of said locking element and key member.

9. The combination according to claim 8, said last-mentioned means comprising a cross pin detachably mounted on said elongated member and engageable by said key member, and handle means for rotating said key member.

10. The combination according to claim 8, said elongated member comprising a bar having a non-circular cross-sectional shape, and a corresponding non-circular apertured portion in said key member receiving said bar.

11. A handling tool for a stud having an upper central recess of polygonal cross-sectional shape and a groove extending outwardly from the lower portion of said recess, comprising vertically extending guide means, means for resiliently suspending said guide means, a screw having the same pitch as the stud threads threadably supported at the lower portion of said guide means, a reversible motor slidably supported by said guide means and connected to said screw, a central shaft of non-circular cross-sectional shape extending downwardly from said screw, a locking member of polygonal shape secured to the lower end of said shaft adapted to be slidably received by said stud recess and having outer portions receivable by said groove when said locking member is rotated out of alignment with said stud recess at the level of said groove, a key member having a central non-circular aperture corresponding to the non-circular shape of said shaft and slidably but non-rotatably mounted on said shaft, the lower portion of said key member having a polygonal shape adapted to be received by said stud recess but angularly misaligned with respect to the polygonal shape of said locking member, a shoulder above said lower key portion adapted to engage the upper end of said stud when said lower key portion is received by said stud recess, handle means extending outwardly from said key member, and retaining means mounted on said shaft and engageable by said key member to limit separating movement of the key member and locking member.

12. In an apparatus for handling studs having a predetermined thread pitch and non-circular recesses in their upper ends with outwardly extending grooves in the lower recess portions, a driving motor assembly comprising a vertically elongated frame adapted to be supported by a hoist, a vertically slidable rotary motor on said frame, a screw secured to the motor output shaft and extending downwardly therefrom, said screw having the same pitch as said studs, a bushing carried by the lower end of said frame and threadably receiving said screw, a hook secured to the lower end of said screw, an adaptor having a central shaft, first and second angularly disposed bails secured to each other and having a common pivotal connection to the upper end of said central adaptor shaft, one of said bails when turned to a horizontally outwardly extending position being adapted to be engaged with said hook, said adaptor being suspendible by said other bail when the other bail is in a vertical position whereby said one bail will extend horizontally outwardly so that it may be engaged with said hook, a locking member secured to the lower end of said shaft and having a non-circular shape corresponding to the shape of said recess, a key member slidably and non-rotatably mounted on said shaft above said locking member and having a lower portion with a non-circular shape corresponding to said recess but angularly misaligned with respect to the locking member, an outwardly extending element secured to said key member above its lower portion and adapted to engage the stud top when the lower key member portion is received by the recess, and a removable retaining member mounted on said shaft above said key member to limit movement of the key member away from the locking member.

13. In a device for handling heavy studs or the like, a frame comprising a plurality of vertically extending guides, resilient supporting means at the upper ends of said guides, a reversible power actuated motor slidably mounted on said guides, said resilient supporting means comprising a horizontally extending member slidably mounted on said guides above said motor, means for connecting a central portion of said last-mentioned mem-

ber to a lifting apparatus, helical compression springs between said last-mentioned member and the upper ends of said guides, a screw connected to and extending downwardly from said motor, means at the lower ends of said guides for threadably supporting said screw, the screw threads having the same pitch as the threads of said stud, and means at the lower portion of said screw for detachably secured the upper portion of a stud thereto.

14. In a device for handling heavy studs or the like, a frame comprising a plurality of vertically extending guides, resilient supporting means at the upper ends of said guides, a reversible power actuated motor slidably mounted on said guides, a screw connected to and extending downwardly from said motor, means at the lower ends of said guides for threadably supporting said screw comprising a cross member connecting the lower ends of said guides, a threaded bushing carried by said cross member, a stop secured to said screw below said bushing and engageable with the underside of the bushing, the screw threads having the same pitch as the threads of said stud, and means at the lower portion of said screw for detachably securing the upper portion of a stud thereto.

15. In an apparatus for handling studs having a predetermined thread pitch, a driving motor assembly having a frame supportable by a hoist, a rotatable and vertically movable output member on said driving motor assembly

having the same pitch as said studs, an adaptor of elongated shape, means on said adaptor for detachably securing the adaptor to the lower end of said output member, means on the lower portion of the adaptor for detachably securing the adaptor to the upper end of a stud, the upper ends of said studs being provided with uniform non-circular recesses having annular grooves in the lower ends thereof, said last-mentioned means on the lower portion of the adaptor comprising a locking member secured to the lower end of the adaptor and a key member slidably mounted on the adaptor above the locking member, said locking member and key member each conforming to the cross-sectional shape of said recess but being angularly misaligned, and withdrawable retaining means on said adaptor for limiting the separating movement of said key member away from said locking member.

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