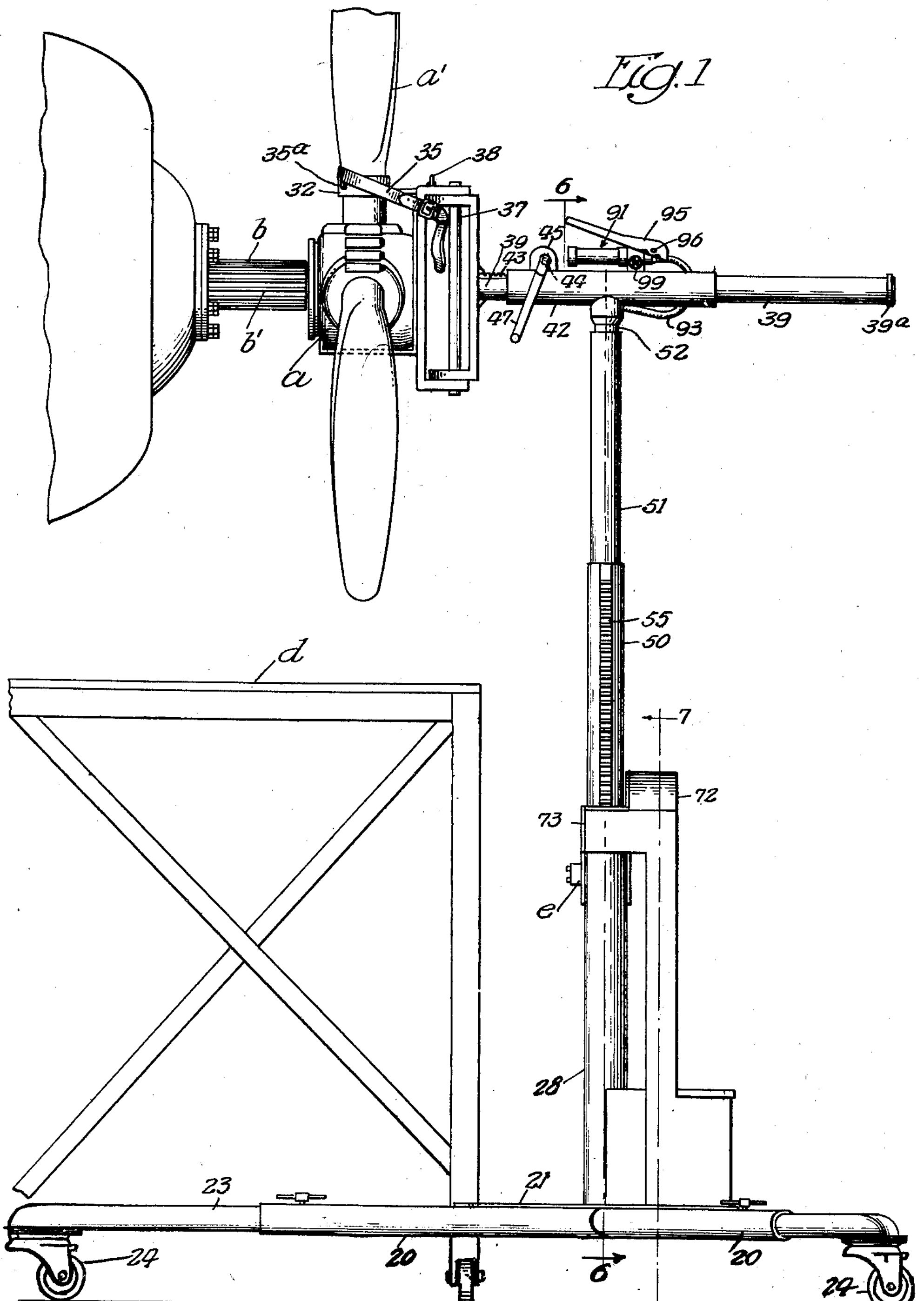
Feb. 26, 1946. H. S. KITTEL 2,395,411

PROPELLER HANDLING MECHANISM

Filed Nov. 10, 1943 4 Sheets-Sheet 1

Fig. 1



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PROPELLER HANDLING MECHANISM

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Fig. 2

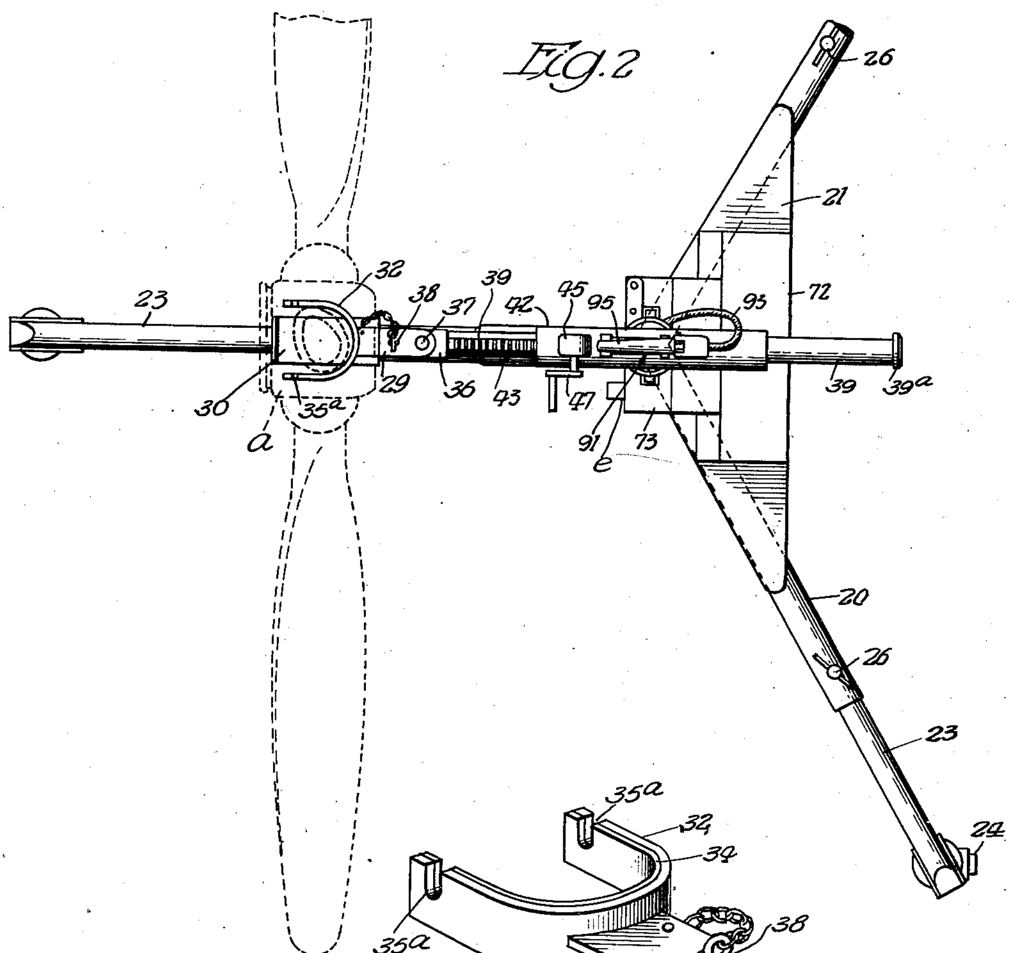


Fig. 3

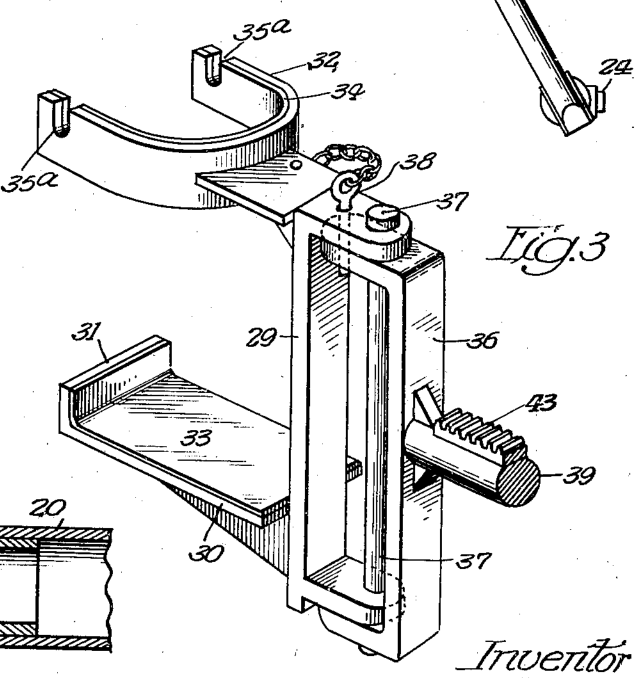
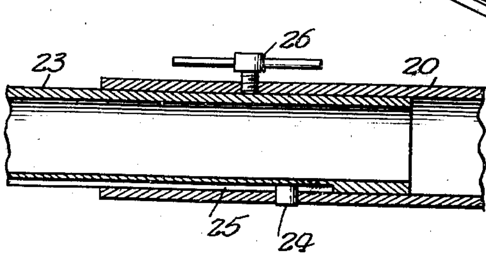


Fig. 4



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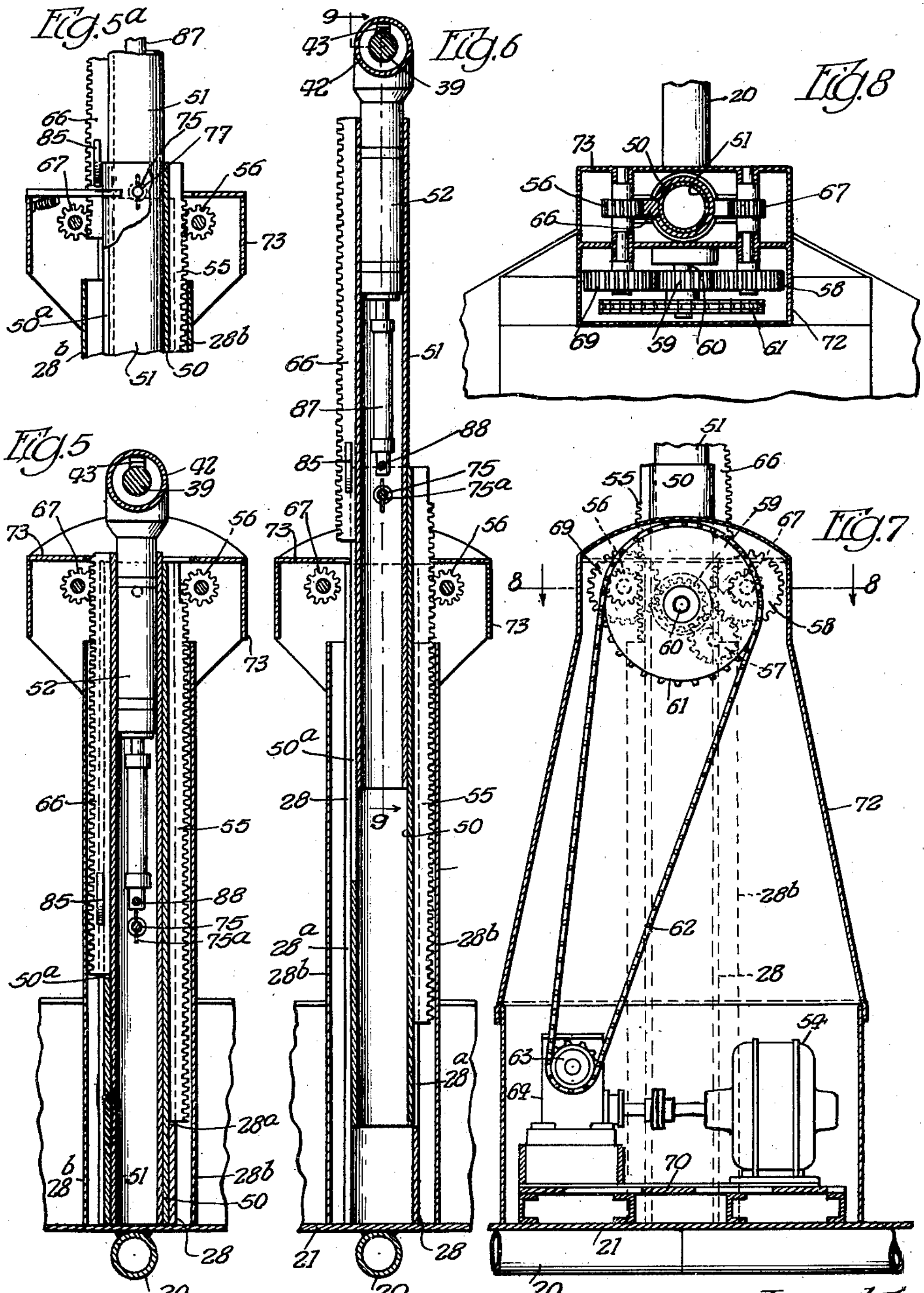
PROPELLER HANDLING MECHANISM

Filed Nov. 10, 1943 4 Sheets-Sheet 3



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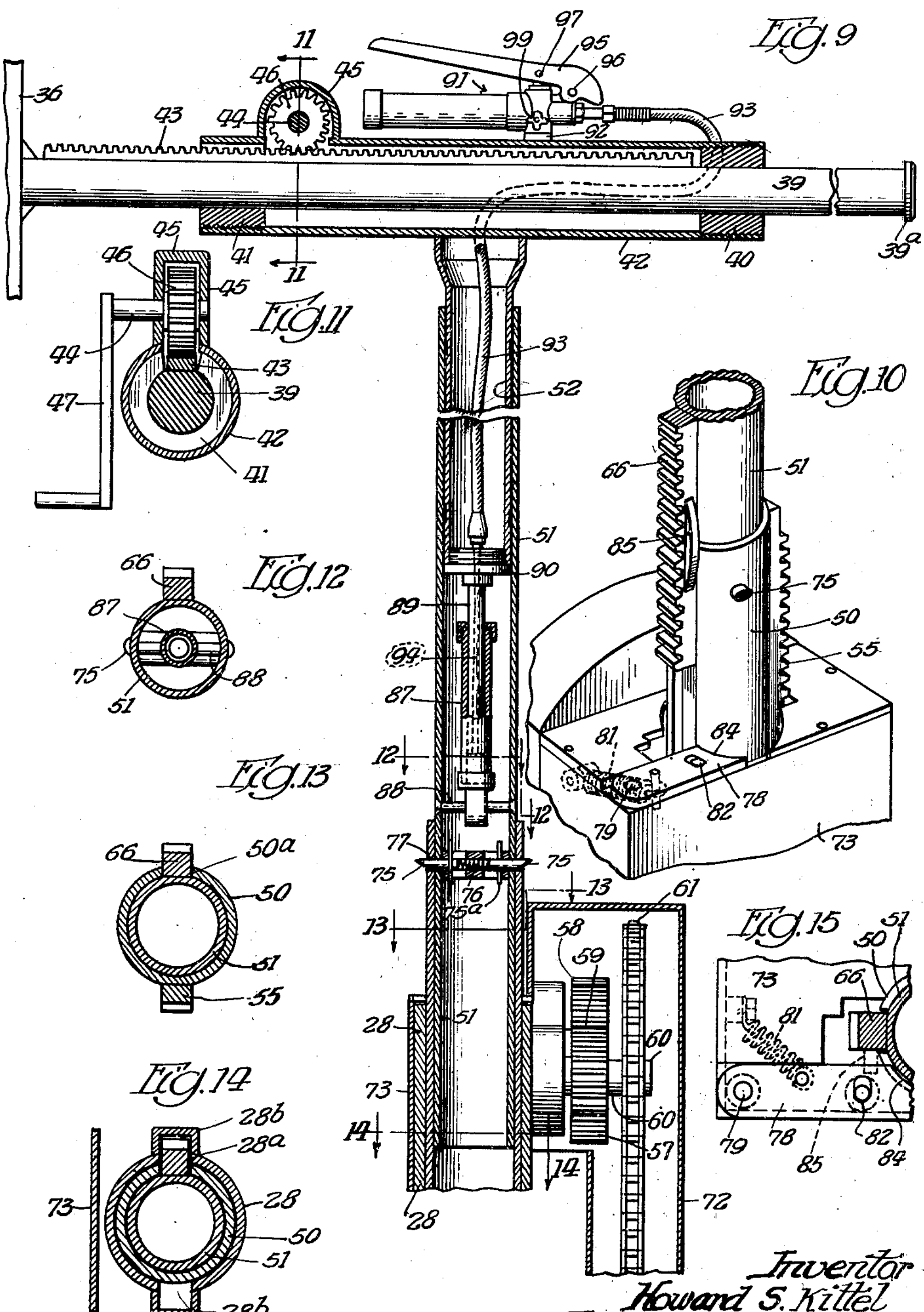
PROPELLER HANDLING MECHANISM

Filed Nov. 10, 1943 4 Sheets-Sheet 4



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UNITED STATES PATENT OFFICE

2,395,411

PROPELLER HANDLING MECHANISM

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Application November 10, 1943, Serial No. 509,715

12 Claims. (Cl. 214—1)

The invention relates to apparatus for positioning aircraft propellers for coupling them to propeller shafts.

The propeller shaft in an airplane in a shop or hangar where overhaul or repairs are made or where airplanes are assembled is usually positioned at a considerable elevation above the floor. Heretofore it has been the usual practice to hoist propellers from the floor to the level of the propeller shaft in the airplane by an overhead crane with the propeller suspended from a hook. The work involved in positioning the propeller into axial alignment with the shaft was difficult and slow and required several or a group of workmen in manipulating the suspended propeller into correct position for sliding the propeller hub onto the propeller shaft because of the difficulties in controlling movements of the propeller while it is suspended from the crane.

One object of the invention is to provide apparatus by which the work involved in positioning an aircraft propeller into position to be slipped onto its drive shaft in the airplane will be expedited and lessened through means for positively controlling the vertical and lateral movements of the propeller.

Another object of the invention is to provide apparatus which makes it possible for a single workman to position the propeller and includes power-operated hoisting and shifting mechanism which facilitates the mounting and demounting of the propeller.

Another object of the invention is to provide compact lifting apparatus for the propeller, which has a sufficient range of movement above the floor for elevating the propeller into position for coupling it to its drive shaft in the airplane and which comprises slidably and telescopically connected standards which are successively shiftable by power driven gear mechanism for cumulating the movements of the standards.

Another object of the invention is to provide a propeller positioning device which includes means, such as a hydraulic ram, for positioning the propeller with precision into coaxial relation with the drive shaft.

Another object of the invention is to provide lifting apparatus which includes a cradle for retaining the propeller and mechanism for horizontally shifting the propeller to bring its hub into interfitting relation with the propeller shaft.

A still further object of the invention is to provide an improved portable supporting frame for the lifting apparatus for the propeller.

Another object of the invention is to provide apparatus which is efficient in operation, simple in construction, and greatly expedites the time required in mounting and demounting the propellers.

Other objects of the invention will appear from the detail description.

The invention consists in the several novel features which are hereinafter set forth and more particularly defined by claims at the conclusion hereof.

In the drawings:

Fig. 1 is a side elevation of apparatus embodying the invention, the propeller being elevated and in axial alignment with the drive shaft in readiness for sliding the propeller on the shaft.

Fig. 2 is a plan, parts being broken away.

Fig. 3 is a perspective of the retaining device for the propeller and its immediate support.

Fig. 4 is a detail section of one of the tubular members of the supporting frame on which the lifting mechanism is mounted.

Fig. 5 is a vertical section through the column on the supporting frame with the slidable telescopic standards of the shifting mechanism in their lowered positions.

Fig. 5a is a vertical section showing the position of the lifting racks while they are engaged with their respective pinions during a lifting operation.

Fig. 6 is a view similar to Fig. 5, the slidable telescopic standards being shown in partly elevated positions.

Fig. 7 is a vertical section taken on line 7—7 of Fig. 1.

Fig. 8 is a section taken on line 8—8 of Fig. 7.

Fig. 9 is a section taken on line 9—9 of Fig. 6.

Fig. 10 is a perspective illustrating the latch for holding the lower slidable standard of the lifting mechanism in its lowered position while the other slidable standard is being independently shifted.

Fig. 11 is a vertical section taken on line 11—11 of Fig. 9.

Fig. 12 is a horizontal section taken on line 12—12 of Fig. 9.

Fig. 13 is a horizontal section taken on line 13—13 of Fig. 9.

Fig. 14 is a horizontal section taken on line 14—14 of Fig. 9.

Fig. 15 is a plan view, parts being broken away, illustrating the latch for locking the lower slidable standard in its lowered position, and the retracting spring for the latch.

The apparatus is supported by a portable frame so that it can be quickly wheeled from any load-receiving point over the floor to a position below and in front of the propeller shaft in the airplane. This frame is built up of three radially arranged tubular members 20, the inner ends of which are butt welded together. Members 20 are also rigidly secured together by a triangular plate 21 which is welded to the top of said members. Tubular sections 23 are slidably and telescopically mounted in the members 20, respectively, and a swiveled caster 24 is connected to the outer end of each section 23 for supporting the frame for transportation on the floor of the shop or hangar. Each outer section 23 is provided with a longitudinal groove 25 into which extends a pin 24 which is fixed in one end of the members 20 to prevent relative rotation between members 20 and sections 23. A screw 26 is adapted to lock together each tubular member 20 and its extensible section 23. This exemplifies a portable supporting frame or carriage composed of members which are adapted to be extended to spread the casters 24 sufficiently to adequately support the lifting mechanism against being tilted by the off-center weight of the propeller and to permit the extension members to be moved together when desired for storage purposes, for clearing parts of apparatus on the shop floor, or for adjusting the spread of the casters for propellers of different weights. A tubular mast 28 has its lower end rigidly secured, for example by welding, to the plate 21.

A cradle is provided for retaining a propeller and is adapted to be raised and lowered by the lifting mechanism hereinafter described to bring the axis of the propeller to or from the axis of the propeller shaft. The cradle comprises a shelf 30 upon which the hub *a* of the propeller is adapted to rest, a yoke 32 adapted to straddle one of the blades a^1 of the propeller, and a bracket 29 to which said shelf and yoke are rigidly secured by welding. A flange or abutment 31 is provided at the outer end of shelf 30 to hold the hub on the shelf. The shelf 30 and abutment 31 are covered with a lining 33 of cushioning material, such as rubber or neoprene, and the inner face of yoke 32 is provided with a lining 34 of similar material to reduce the possibility of injury to the propeller. A strap 35 which is adapted to extend through notches 35^a in the yoke 32 and around one of the blades of the propeller and around the inner side of bracket 29 is adapted to firmly secure and position the propeller in the cradle. The form of the cradle may be modified for propellers of different constructions. The bracket 29 of the cradle is supported by a forked bracket 36 and is pivotally connected thereto so the cradle can swing horizontally relatively to bracket 36 by a pin or rod 37 which extends through overlapping lugs on the upper and lower ends of said brackets. A pin 38 which is slidable through the upper lug of bracket 29 is adapted to enter a hole in the upper lug of bracket 36 to lock the cradle against horizontal swinging movement relatively to the bracket 36.

The cradle is supported for vertical movement by the lifting mechanism hereinafter described to bring the propeller retained therein to the elevation of the propeller shaft on the airplane and is horizontally and rectilinearly movable to permit the hub of the propeller to be coupled to and removed from the propeller shaft. The propeller shaft and the hub of the propeller are usually provided with interfitting splines for driving the propeller from the shaft. A horizontally extending tubular member 42 is vertically shiftable by the lifting mechanism. A shaft 39 has one of its ends rigidly secured, as by welding, to the bracket 36 which supports the cradle and extends longitudinally through bushings 40, 41 in the end portions of tubular member 42 for supporting the cradle for horizontal movement in coupling the propeller hub to the propeller shaft. A stop 39^a is formed on the inner end of shaft 39 to limit the movement of the cradle away from, and the movement of shaft 39 in, the tubular member 42.

A device for manually sliding the shaft 39 in the tubular member 42 and horizontally shifting the cradle comprises a gear rack 43 which is welded to shaft 39, a gear 46 housed in an extension 45 of tubular member 42 and meshing with rack 43, a cross-shaft 44 journaled in the sides of said extension, and a crank 47 on the outer end of shaft 44 and at one side of the tubular member 42. By manually rotating the crank 47 and gear 46, rack 43 and shaft 39 will be shifted horizontally and rectilinearly for sliding the hub to or onto or off the propeller shaft. The rack 43 extends through a slot in bushing 41 which has sufficient clearance for the rack 43 to permit the slight rotation of the propeller hub necessary to bring the splines on the hub and propeller shaft into position to slide into interfitting relation. In practice a staging or platform *d*, which may be portable, is usually provided at a suitable elevation for a workman while coupling or uncoupling the propeller and the shaft.

The lifting mechanism for raising and lowering the cradle and the propeller retained therein comprises a tubular standard 50 which is telescopically slidable in the tubular column 28 which is fixed to the portable supporting frame, a tubular standard 51 which is telescopically slidable in the tubular standard 50, and a tubular member 52 which is telescopically slidable in the upper end of tubular standard 51 and has its upper end welded to the horizontal tubular member 42. The tubular standard 50 is slidable in column 28 and the standard 51 is slidable in standard 50 for cumulating their vertical movements to increase the range of lift of the propeller sufficiently for raising the propeller from near floor level to the propeller shaft in the airplane.

A gear rack 55 is fixedly secured, as by welding, to one side of the tubular standard 50. The tubular column 28 is provided with a vertical slot 28^a in which rack 55 is vertically slidable and the slot is bridged and closed by a channel bar 28^b. A rack 66 is welded to the tubular standard 51. Standard 50 is provided with a slot 50^a for the vertical movement of rack 66 and column 28 is provided with a second slot 28^a for the vertical movement of rack 66 in said column. Racks 55 and 66 are disposed on diametrically opposite sides of the standards 50, 51 so that they may be independently shifted by pinions 56 and 67.

Pinions 56 and 67 are simultaneously driven from a common source of power, such as a reversible electric motor 54. When the standards 50, 51 are lowered as illustrated in Fig. 5, pinion 67 will mesh with rack 66, while pinion 56 is clear from rack 55, for raising the standard 51 while the standard 50 remains in its lowered position. When the standard 51 and rack 66 are elevated to a predetermined point, standard 50 will be locked to the standard 51 by a device hereinafter described, so that rack 55 will be raised and pass into mesh with pinion 56 before the rack 66 is disengaged from pinion 67. Pinion 56 will then raise rack 55 and standard 50 for raising the standard 51 while said standards are locked together so that cumulative lifting movement will be imparted to standard 51 by the successive lifting of the racks 66 and 55. After the pinion 56 commences to lift rack 55, rack 66 will pass out of engagement with pinion 67 so that continued movement of standard 50 will also lift standard 51. This exemplifies lifting mechanism comprising a pair of telescopically connected standards which are slidable relatively to each other and in the column 28 and which are operable to cumulate the movements of the standards for lifting the propeller the necessary distance from near floor level to the propeller shaft in the airplane.

The mechanism for driving both of the pinions 56 and 67 from reversible electric motor 54 comprises speed reducing gearing 64 coupled to said motor, an output sprocket 63, a sprocket chain 62 driven by sprocket 63, a sprocket wheel 61 mounted on a shaft 60, and a gear 59 fixed to rotate with sprocket 61. The pinion 56 for shifting rack 55 on the lower standard 50 is driven from gear 59 by a gear 69 which meshes with gear 59 and is connected to drive pinion 56. The pinion 67 for shifting rack 66 and the upper standard 51 is driven by an idler gear 57 which meshes with gear 59 and a gear 58 which meshes with idler 57 and is connected to drive pinion 67. Pinions 56 and 67 are driven in opposite directions. Motor 54 and gearing 64 are mounted upon a plate 70 which is secured on beams which are secured to the plate 21 of the portable supporting frame. A suitable housing 72 encloses the gearing for driving the pinions 56 and 66 and the latter are enclosed by an extension 73 of housing 72. Pinions 56 and 67 are supported by shafts which are carried by the walls of housing 72 and its extension 73. Shaft 60 and the shaft for idler gear 57 are supported by the inner wall of housing 72.

A suitable switching device *e* is mounted on the column 28 for controlling the operation of the reversible motor 54 for raising the lifting mechanism to raise the propeller and for lowering the lifting mechanism to lower the propeller. This switching device may include suitable limit switches for automatically stopping the operation of the motor at the end of predetermined lifting and lowering strokes, as well understood in the art.

The locking device for securing the standard 51 to the standard 50 for conjoint vertical movement comprises a pair of pins 75 (Fig. 9) which are slidably mounted in a cross-sleeve fixed in standard 51, and are pressed outwardly by a spring 76, and are adapted to pass into holes 77 in the tubular standard 50. The ends of the pins 75 are inclined so they will be cammed inwardly by the upper end of the column 28 during the conjoint lowering movement of standards 50 and 51. Stops 75ª on pins 75 limit the outward movement of pins 75. After the pins 75 have been retracted during the lowering movement of the standards, their outer ends will slide on the inner periphery of the tubular standard 50 until the standard 51 is fully lowered in standard 50. As the standard 51 approaches the upper end of the lifting stroke imparted thereto by pinion 67, and slightly before rack 66 passes out of engagement with pinion 67, pins 75 will snap into the holes 77 and lock standards 50 and 51 together so that rack 55 will be lifted into engagement with its pinion 56 before rack 66 becomes disengaged from pinion 67. This exemplifies an automatically controlled device for locking together the standards which are slidable in the column and relatively to each other, for imparting cumulative movement to the standard 51.

A latching or holding device is provided for holding the lower slidable tubular standard 50 in its lowered position during the upward shift of standard 51 by pinion 67, until the standard 50 is lifted by the locking device between the standards. This latching device comprises an arm 78 which is pivoted at 79 to the top of the housing-extension 73 and is normally held into the path of the upper end of the tubular standard 50 by spring 81 in the extension 73 of the housing 72. A pin and slot 82 between the arm 78 and the top of extension 73 limit the inward movement of the latch by the spring 81 so that the curved end 84 of arm 78 will lap the upper edge of standard 50 when the latter is in its lowermost position. A cam 85 on one side of and adjacent the lower end of the rack 66 on standard 51 is adapted to shift arm 78 to release the standard 50 for upward movement before the locking-pins 75 enter the holes 77 in the standard 50. In practice, lubricant is provided in the standards and this latching device, which is automatically controlled by the movement of standard 51, prevents untimely upward movement of the standard 50.

In coaxially positioning the propeller blade with the propeller shaft in the airplane for coupling them together, great accuracy is required which cannot be readily achieved by power driven gearing for the lifting mechanism. The invention provides a hydraulic device for accurately and vertically positioning the propeller retained in the cradle on the tubular member 42. This device comprises a vertical cylinder 87 which is fixed, and has its lower end secured by a pin 88, in the tubular standard 51, a piston or plunger 89 which is slidable and rotatable in the cylinder 87 and is fixedly secured for vertical movement and rotation to a head 90 which is screw threaded into the lower end of tubular standard 52. A hydraulic pump 91 is secured at 92 on the top of tubular member 42 and its casing is connected by a flexible pipe 93 to the head 90 for the flow of fluid under pressure between the pump casing and the cylinder 87. The pump is provided with a handle or lever 95 which is pivoted at 96 to the pump casing, connected to the stem 97 of a piston in said casing, and adapted to force fluid through the pipe 93, head 90 and the duct 94 in piston 89 into the lower end of cylinder 87 for micrometrically and vertically lifting piston 89, the hollow standard 52 to which the member 42 is secured, and the propeller retained in the cradle which is supported by said member 42. This pump usually comprises a suitable valve through which fluid may be by-passed from cylinder 87 through pipe 93 to the casing of pump 91, said valve being controlled by handle 99. This pump may be of standard construction used for hydraulic power. By imparting strokes to the lever 95, fluid in small and accurately controlled volume may be forced into the cylinder 87 for micrometrically lifting the propeller to bring it into horizontal alignment with the axis of the propeller shaft. By opening the by-pass valve, fluid in the cylinder 87 may be returned to the pump casing 91 for lowering the member 42. This exemplifies a hydraulic device for accurately or micrometically shifting the propeller vertically and supplementally to the power operable gearing of the lifting mechanism.

In practice, the positioning of the propellers can sometimes be facilitated by horizontal rotation of the cradle on the portable supporting frame. The tubular standard 52 to which the horizontal supporting member 42 is fixed, is rotatable in the standard 51 through a complete circle. The piston 89, standard 52, tubular member 42, and pump 91 are conjointly rotatable horizontally for this purpose. In some instances it also facilitates the handling of the propeller to swing the cradle horizontally relatively to the horizontal slidable shaft 39. This can be done when the pin 38 is withdrawn from bracket 36.

The operation of the apparatus in raising the propeller for positioning it adjacent the propeller shaft will be as follows: The hub of the propeller *a* will be placed on the shelf 33 and one of its blades a^1 will be secured by strap 35 in the yoke 32 while the slidable standards 50 and 51 are lowered, as illustrated in Fig. 5. The portable frame may be easily wheeled to any convenient loading point to receive the propeller and then wheeled into position adjacent the airplane where the propeller, when elevated, will be at the front of the propeller shaft in the airplane. The motor 54 will then be operated under control of the switching device *e* to drive pinions 56 and 67 in the proper direction for raising the lifting mechanism. The pinion 67 then meshes with gear rack 66 and the pinion 56 is disengaged from rack 55. The latching arm 78 will overlie the upper end of standard 50 and prevent upward movement of said standard with the standard 51. The rack 66 will slide the standard 51 upwardly in the standard 50. Shortly before the standard 51 and rack 66 reach the limit of the upward stroke imparted thereto by the pinion 67, cam 85 on rack 66 will shift latch arm 78 to release the standard 50 for upward movement and the spring-pressed pins 75 will snap into holes 77 in standard 50 and lock standards 50 and 51 together for conjoint vertical movement. This locking occurs before the lower end of rack 66 clears the pinion 67. The initial lift of standard 50, after it is locked to standard 51 by pins 75, will engage the rack 55 with the rotating pinion 56. The pinion 56 will then continue the lifting movement of standard 50 and the standard 51 which is locked thereto, and rack 66 on standard 51 will be disengaged from pinion 67. The continued movement of standard 50 by pinion 56 and rack 55 will conjointly lift the standards 50 and 51 for cumulative lift of the upper standard 51. Standard 51 will then be raised sufficiently to elevate the propeller approximately to the level of the propeller shaft and the motor 54 will be stopped. The shaft 39 will usually be retracted in the tubular horizontal member 42 while the propeller is being elevated. The operator will next rotate the crank 47 and gear 46 to slide rack 43 and shaft 39 in the tubular member 42 and toward the front end of the propeller shaft to bring the rear end of the propeller hub in close proximity to the front end of the propeller shaft. If necessary, the supporting frame may be wheeled to bring the propeller hub and propeller shaft into vertical coaxial alignment. In order to bring the axes of the propeller hub and propeller shaft into accurate horizontal coaxial alignment, the operator will impart the necessary number of strokes to pump lever 95 to force sufficient fluid into the lower end of cylinder 87 to raise piston 89, standard 52, and the horizontal tubular member 42. The propeller and cradle may then be rocked slightly as permitted by the slight clearance of shaft 39 in the groove in bushing 41 which is fixed in tubular member 42 to bring the splines on the hub and the propeller shaft into position to be slipped into interfitting relation. Next, the operator will rotate crank 47 and gear 46 to horizontally slide rack 43 and shaft 39 in the tubular member 42 to slide the propeller onto the propeller shaft. After the propeller hub has been coupled to the propeller shaft, the strap 35 can be removed and the cradle lowered slightly by returning some of the fluid from cylinder 87 into the casing of pump 91 so that abutment 31 will clear the propeller hub. The cradle can then be withdrawn from the propeller, leaving the latter coupled to the propeller shaft.

The apparatus may also be used to demount the propeller from the shaft. For that purpose the lifting mechanism will be operated to its raised position and the cradle will be secured to the propeller hub on the shaft. The crank 47 can then be operated to shift the cradle horizontally to uncouple or remove the propeller away from the propeller shaft. The motor 54 will then be operated in reverse direction to lower the cradle and bring the propeller approximately to floor level. In lowering the propeller, the pinion 56 will first lower rack 55 and standard 50. When standard 50 is lowered, latch arm 54 will snap over the upper end of said standard and hold it lowered. Before the rack 55 becomes disengaged from pinion 56, rack 66 will engage pinion 67. Pinion 67 will then lower rack 66 in standard 51. During this lowering movement and slightly before the standard 50 is fully lowered, the inclined ends of pins 75 will engage the upper end of column 28 and be forced inwardly so that standard 51 will be released for downward sliding movement in the standard 50, the pins being then held retracted by engagement with the inner periphery of standard 50.

The invention exemplifies apparatus for handling aircraft propellers: which makes it possible for a single operator to position a propeller for coupling it to a propeller shaft; which comprises telescopically and slidably connected standards which are successively and slidably shifted for cumulative movement of the upper standard to provide the desired range of lift for bringing the propeller from a position near the floor to the propeller shaft on the airplane; means for accurately or micrometrically shifting the propeller for bringing the propeller and the propeller shaft in exact coaxial relation horizontally to facilitate coupling them together; means on the lifting mechanism for slidably and horizontally shifting the propeller to or from the propeller shaft; a propeller retaining cradle which is supported on the lifting mechanism to swing laterally to facilitate handling of the propeller; means for locking the standards together while one is being raised or lowered from the other; means for locking one of the standards against sliding movement for the independent shift of the other; which greatly facilitates the positioning of the propeller relatively to the propeller shaft and its removal therefrom; and which is simple in construction and efficient in operation.

The invention is not understood as restricted to the details set forth since these may be modified within the scope of the appended claims without departing from the spirit and scope of the invention.

Having thus described the invention what I claim as new and desire to secure by Letters Patent is:

1. Apparatus for handling an aircraft propeller in coupling it to a propeller shaft comprising, a portable supporting frame, a tubular column on the frame, a tubular standard telescopically slidable in the column, a standard telescopically slidable in the standard which is slidable in the column, gear racks on opposite sides of the standards, respectively, gearing, comprising pinions, for separately and successively engaging the racks and lifting the standards relatively to the column, means for lifting one of the standards for cumulative movement from the other, and a propeller support carried and shiftable by the standard having the cumulative movement.

2. Apparatus for handling and positioning an aircraft propeller for coupling it to a propeller shaft comprising, a supporting frame, a tubular column on the frame, a tubular standard telescopically slidable in the column, a standard telescopically slidable in the standard which is slidable in the column, gearing for separately and successively lifting the standards relatively to the column, means for lifting one of the standards for cumulative movement from the other, means for locking the standard which is slidable in the column against vertical movement while the other standard is being shifted, and a propeller support carried and shiftable by the standard having the cumulated movement.

3. Apparatus for positioning an aircraft propeller for coupling it to a propeller shaft comprising, a supporting frame, a tubular column on the frame, a tubular standard telescopically slidable in the column, a standard telescopically slidable in the standard which is slidable in the column, gearing for separately and successively lifting the standards relatively to the column, means for lifting one of the standards for cumulative movement from the other, automatically controlled means for locking the standard which is slidable in the column against vertical movement while the other standard is being shifted, and a propeller support carried and shiftable by the standard having the cumulated movement.

4. Apparatus for handling and positioning an aircraft propeller for coupling it to a propeller shaft comprising, a supporting frame, a tubular column on the frame, a tubular standard telescopically slidable in the column, a standard telescopically slidable in the standard which is slidable in the column, gearing for separately and successively lifting the standards relatively to the column, means automatically controlled by relative movement between the standards for lifting one of the standards for cumulative movement from the other, means for locking the standard which is slidable in the standard against vertical movement while the other standard is being shifted, means for releasing said locking means by relative movement between the standards, and a propeller support carried and shiftable by the standard having the cumulated movement.

5. Apparatus for positioning an aircraft propeller for coupling it to a propeller shaft comprising, a portable supporting frame, a tubular column on the frame, a standard slidably supported for vertical movement by the column, power driven gearing for lifting the standard, a propeller support shiftable vertically with the standard, and hydraulic means between the standard and the propeller support for micrometrically lifting the support for accurately positioning the propeller relatively to a propeller shaft.

6. Apparatus for positioning an aircraft propeller for coupling it to a propeller shaft comprising, a portable supporting frame, a tubular column on the frame, a standard slidably supported for vertical movement by the column, power driven gearing for lifting the standard, a horizontally slidable propeller support, means in which the propeller support is slidably mounted and shiftable vertically with the standard, and hydraulic means between the standard and the propeller support for micrometrically lifting the support for accurately positioning it relatively to a propeller shaft.

7. Apparatus for positioning an aircraft propeller for coupling it to a propeller shaft comprising, a portable supporting frame, a tubular column on the frame, a standard slidably supported for vertical movement by the column, power driven gearing for lifting the standard, a stem slidable in the upper end of the standard, a horizontally extending tubular support on the stem, a propeller support comprising a shaft slidable in said tubular support, a cylinder and piston in the standard and a pump carried by the horizontally extending tubular support for forcing fluid into the cylinder and micrometrically lifting the tubular support for accurately positioning it relatively to a propeller shaft.

8. Apparatus for positioning an aircraft propeller for coupling it to a propeller shaft comprising, a portable supporting frame, a cradle, including an under support and a yoke for straddling a portion of the propeller for retaining the propeller, means for slidably supporting the cradle for horizontal movement, means for slidably shifting the support, and raising and lowering means for the slidable support mounted on the frame.

9. Apparatus for positioning an aicraft propeller for coupling it to a propeller shaft comprising, a portable supporting frame, a cradle, including an under support and a yoke for straddling a portion of the propeller for retaining the propeller, a slidable shaft supporting the cradle for horizontal movement, means for slidably shifting the shaft, a pivotal connection between the shaft and the cradle for permitting lateral pivotal movement of the cradle relatively to the shaft, and raising and lowering means for the shaft mounted on the frame.

10. Apparatus for positioning an aircraft propeller for coupling it to a propeller shaft comprising, a portable supporting frame, a cradle, including an under support and a yoke for straddling a portion of the propeller for retaining the propeller, a shaft for slidably supporting the cradle for horizontal movement, means for slidably shifting the shaft, a pivotal connection between the shaft and the cradle for permitting lateral pivotal movement of the cradle relatively to the shaft, means for locking the cradle and shaft against pivotal movement, and raising and lowering means for the shaft mounted on the frame.

11. Apparatus for positioning an aircraft propeller for coupling it to a propeller shaft comprising, a portable supporting frame, lifting mechanism mounted on the frame, a standard mounted for horizontal rotation on the lifting mechanism, and a cradle including an under support and a yoke adapted to extend around a portion of a

propeller blade for retaining a propeller supported by and rotatable with the standard.

12. Apparatus for positioning an aircraft propeller for coupling it to a propeller shaft comprising, a portable supporting frame, lifting mechanism mounted on the frame, a standard mounted for horizontal rotation on the lifting mechanism, a horizontal tubular member fixed on the upper end of and rotatable with the standard, a shaft slidably supported in said member, and a cradle including an under support and a yoke for straddling a portion of the propeller for retaining a propeller supported by the shaft.

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