

Sept. 10, 1968

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3,400,593

PARTS LIFTING EQUIPMENT FOR DIE PRESS

Filed March 28, 1966

2 Sheets-Sheet 1

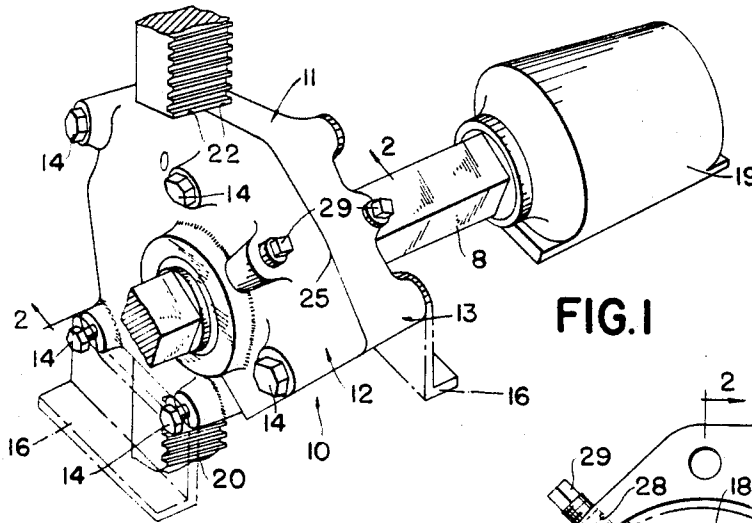


FIG. 1

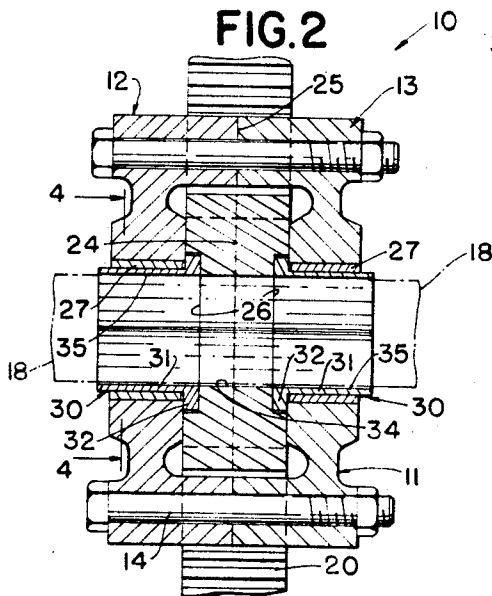


FIG. 2

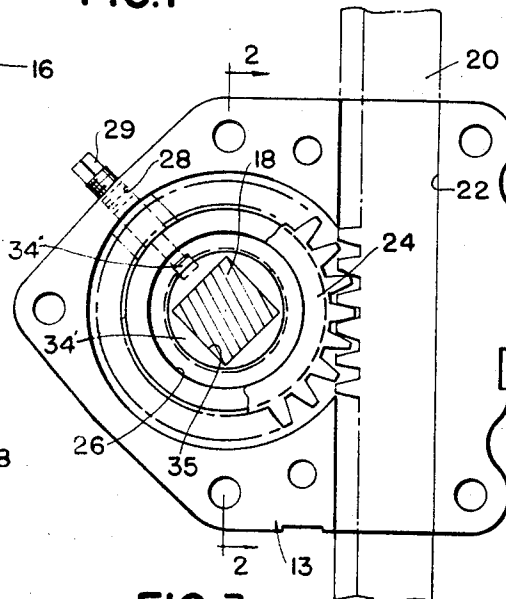


FIG. 3

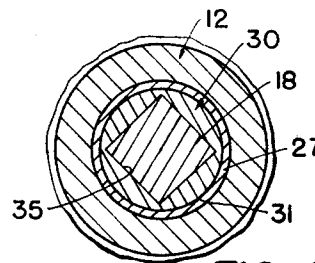


FIG. 4

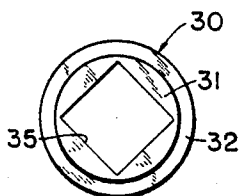


FIG. 5

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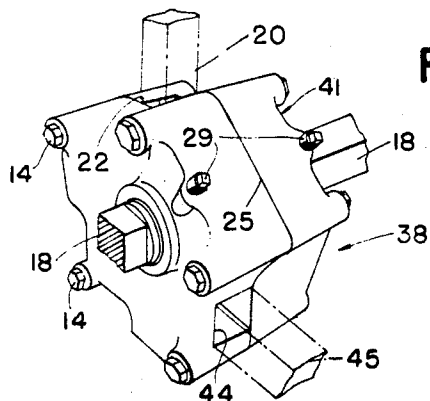


FIG. 6

FIG. 7

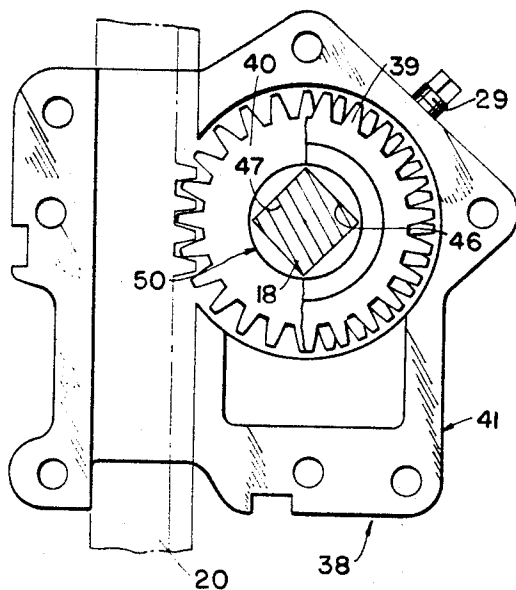
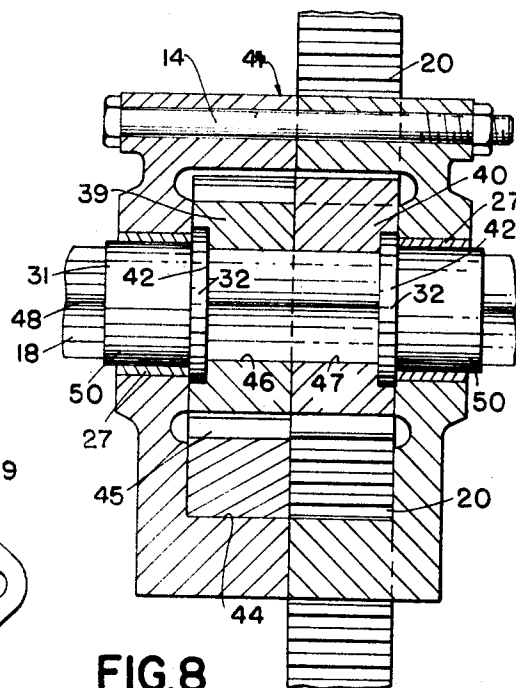
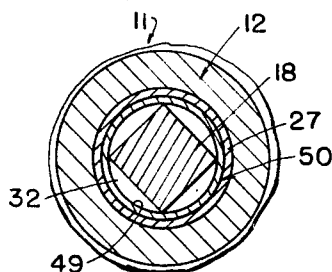


FIG. 8

FIG. 9



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PARTS LIFTING EQUIPMENT FOR DIE PRESS

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ABSTRACT OF THE DISCLOSURE

A material handling unit comprising a housing having a shaft-receiving bore opening. A pair of bushing members coaxial with the housing bore are rotatably mounted in the housing. Each bushing member has a flange which engages counterbores on a pinion to rotatably mount the pinion within the housing. The pinion meshes with the rack. A shaft extends through the pinion in driving engagement therewith.

The present invention relates to improved equipment for lifting stamped metal parts from the die cavity of the normally lower female die of a stamping press. More particularly, the invention relates to a lifting unit of this sort which is to be employed in multiple beneath the lower die half of such a press, in the manner generally illustrated and described in the patent to Robb 3,213,657 of Oct. 26, 1965.

In assembling units of the character of the present improvement, the axially bored housings of a pair of the units are located and fixedly mounted with the respective bores in true alignment on a suitable base support fixedly associated with the lower die. Each unit comprises a pinion mounted for rotation in its housing on the axis of the bore or bores of the latter, and an upright rack in meshing engagement with the pinion and projecting out of the housing for its lifting function. The two units are then drivingly coupled, for operation in common by a suitable reversing power source, by thrusting an elongated drive shaft through the housing and bores of the pinions therein, in driving engagement with such pinions. There may be more than one aligned pair of lifting units of this general description, but the individual driving connections to the pinion pairs thereof are accomplished in the manner referred to, and as also described in some detail in the Robb patent.

It is an object of the invention to provide a lifting unit or lifting equipment for this purpose, in which the problem of maintaining the individual pinions in the individual housings in properly oriented or aligned relation to the housing bores, so that the final operation of inserting the drive shaft may be performed with ease and speed, is solved in a novel, simplified and improved manner.

More particularly, each pinion is rotatably journaled or piloted on opposite axial sides thereof by a pair of special adapter bushings, which bushings are in turn journaled themselves in efficient sleeve bearings or bushings of the lifter housing. This housing is formed of two like halves, to the end of facilitating the initial assembly of the lifter structure prior to shipment to its point of use, at which the final assembly of the lifters to the press and the drive shafting to the lifters is accomplished.

In further accordance with the invention, the special adapter bushings piloting the pinion are provided with enlarged annular shoulders or flanges at their inner axial ends, which fit (preferably with running tolerance) in counterbored recesses in the sides of the pinion, concentrically of an axial bore of the pinion; and the remainder of each adapter bushing is constituted by an axially elongated bearing sleeve portion journaled in the bushing seats of the housing halves.

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Still further in accordance with the invention, the drive of the pinions of the lifter housings is through the agency of an elongated drive shaft of non-circular, preferably rectangular cross section, the pinions having bores of corresponding, mating outline to receive and be driven by this special shafting.

In accordance with one embodiment of the present invention, the adapter bushings also have non-circular bores or openings therethrough corresponding in size and shape to that of the pinion bore, and, like the latter, matingly engaged internally by the shafting. In this form, while the adapter bushing shoulder or flange has running tolerance within the pinion side counterbore, and the adapter bearing sleeve also runs in the housing bushing bearing structure, the pinion and adapter sleeves are nevertheless coupled by the shafting for rotation as a unit.

In another adaptation of the invention, the pinion has a square bore which has mating driving engagement by a square shaft, but internal bores of the adapter bushings are cylindrical throughout the axial length thereof. Thus, the shafting drives the pinion but may rotate within the bushing bores without occasioning positive rotation of the latter.

A lifter unit of the foregoing description has the advantage that the upright rack in mesh with the pinion may be pre-set exactly for elevation, and proper contact of part-engaging elements at its top with a die-stamped work-piece in the lower die cavity, prior to insertion of the driving and unit-coupling shaft, followed by such insertion with the square bushing bores in register with the pinion bore. It is evident that, in the second embodiment mentioned above having cylindrical adapter bushing bores, the assembly just described is even further facilitated.

A further advantage is that the improved lifter unit, in addition to its extreme simplicity of structure and ease of assembly in manufacture and on location, enables the pinion to be reversed as to its axis to equalize tooth wear.

The preceding descriptive comment applies to a lifter unit having but a single upright rack for a die press installation. The invention also extends to a further improvement, involving adapter bushing and pinion features of improvement of a similar nature, in which there are a pair of racks associated with each unit housing at 90° to one another, these racks meshing with a pair of pinions disposed in direct side-by-side relation to one another. The pinions are angularly offset a distance of one tooth, thus preventing the possibility of its associated rack from sliding onto or interfering with the teeth of the other pinion. Typically, in such a dual-rack unit, one rack will be employed as a lifter component, and the other rack employed as a driving component powering the lifter component through the agency of the square shafting drivingly coupled to the square pinion bores.

However, it is to be understood that in any embodiment or adaptation of the principle of the present invention, the improved unit or equipment is also well adapted for other applications than in stamping press equipment, such as various types of transfer machinery, parts feed and removal equipment, and the like. Likewise, although the improved unit is one which employs a pinion as its operating member and a rack as its operated member, it is to be understood that other types of mechanical force-transmitting gearing, such as a rotatable worm operating member and a worm gear type operated member, a screw arrangement, and the like, are also contemplated, so long as the operating member is piloted in the housing of the unit in the improved fashion contemplated by the invention.

Likewise, although in the several embodiments of the invention illustrated therein, the tubular operating member or pinion is shown as being held with its bore in align-

ment with the boring of the housing by piloting opposite axial sides or ends of the pinion on special adapter bushing members, it is contemplated that the same result of temporarily holding the operating member or pinion in proper axial position, pending the insertion of a drive shaft through the pinion in direct driving engagement with the latter, may be accomplished in other ways, involving the provision of internal structure provisions within the housing for the purpose, for example, a modification of the housing interior adjacent the pinion.

The foregoing as well as other objects will become more apparent as this description proceeds, especially when considered in connection with the accompanying drawings illustrating the invention, wherein:

FIG. 1 is a fragmentary view illustrating one of the improved units in accordance with the invention, as driven by a suitable prime mover, illustrated in a form of a reversing electric motor, it being understood that, in a parts lifting installation, the shafting will extend further through another similar unit (not shown);

FIG. 2 is a fragmentary view in vertical section through the axis of the square drive shaft for the unit, i.e., in the vertical plane 2—2 of FIGS. 1 and 3, this view showing internal features of the unit before installation of a driving and coupling shaft, indicated in dot-dash line;

FIG. 3 is a fragmentary view of the unit with one of its housing halves removed, i.e., the right-hand housing half appearing in FIGS. 1 and 2, further illustrating structural features of the pinion, rack and shafting of the unit;

FIG. 4 is a fragmentary view in transverse section on line 4—4 of FIG. 2, in a plane at 90° to the axis of the unit, this view showing the square drive shaft for the unit;

FIG. 5 is an end elevation of one of the special adapter type, pinion-piloting bushings of the unit, as viewed in the direction of FIG. 3;

FIG. 6 is a fragmentary view showing a double rack embodiment of the improved unit, with vertical and horizontal racks shown in dot-dash line;

FIG. 7 is an end elevational view, similar to FIG. 3, showing internal features of the dual rack type;

FIG. 8 is a view in vertical section through the axis of this unit, generally similar to FIG. 2; and

FIG. 9 is a fragmentary sectional view similar to FIG. 4, but showing a modified embodiment in which the adapter bushings are cylindrically bored throughout the axial length thereof, rather than square bored, as in the embodiments of FIGS. 1 through 5.

Referring first to FIGS. 1 through 5, the improved unit which is illustrated therein comprises a hollow housing 11 constituted by two substantially identical, but reversely oriented, cast housing halves 12 and 13. These are tightly clamped together by five through bolts or studs 14, of which the lower two thereof are in a horizontal plane. They serve to clamp to the housing 11 a pair of mounting angles 16, shown in dot-dash line in FIG. 1, by which the unit 10 is rigidly affixed to a horizontal base support (not shown) fixedly associated with the lower die half (also not shown) of a standard die stamping press. As indicated above, there are usually a pair of the units in axially spaced and aligned relation to one another along the axis of a drive shaft 18. This shaft is shown as rotatively driven by a reversing motor 10, although other types of drive may be employed.

An upright toothed rack 20 is slidably guided in the housing 10, provision being made for it to clear downwardly through the base support, as well as to operate upwardly for its lifting function, through the agency of appropriate elements (not shown) at its top. As herein shown and described, the rack 20 operates vertically; however, it is to be understood that in other installations the housing structure may be differently oriented, with the rack operating in any desired direction.

FIG. 1 shows the housing halves 12 and 13 as being provided with rectangular recesses 22 in register with one

another on their inner meeting surfaces, thus defining an approximately square opening through which the approximately square-shaped rack 20 extends upwardly. Similar recessing is provided at the bottom of housing 12 to accommodate the rack movement.

The driving pinion of unit 10 is designated 24, being located between housing halves 12 and 13 in reasonably close running side tolerance relative thereto, as determined by the face meeting engagement of those halves at the central upright meeting zone or plane 25 (FIGS. 1 and 2). As illustrated in FIGS. 2 and 3, the pinion 24 is provided with a cylindrical counterbore 26 at each axial side thereof which is of relatively shallow extent, as compared with the full axial dimension of the pinion, yet of adequate depth to stably receive certain bushing or adapter provisions, to be described. Each housing half has a cylindrical bearing surface defined by an annular bushing 27; and the adapter or pilot means referred to has running engagement in such a bore. FIGS. 1 and 3 show the housing halves 12 and 13 as each being equipped with a lubricating passage 28 to the interior of the bushing or sleeve 27, normally closed by an external plug 29.

The adapter bushings of the unit 10 are generally designated by the reference numeral 30. They are identical, but face oppositely in the unit, each comprising an external cylindrical, axially elongated bearing sleeve portion 31, enlarged at its inner end to provide an externally cylindrical piloting flange or shoulder 32. Sleeve portion 31 has an anti-friction bearing in the housing bushing 27; and the piloting shoulder or flange 32 of each adapter bushing 30 preferably has running tolerance within a pinion counterbore 26. It suffices if the pinion is held adequately centered on the shoulder or flanges 32 to permit the ready final insertion of the drive shaft 18, which is of non-circular preferably square, cross-section.

In further accordance with the invention, the operating member or pinion 24 has a non-circular broached center bore 34, shown as square, in axial alignment with the housing bushings 27; and each of the special adapter or piloting bushings 30 is also broached to provide a square center bore designated 35.

The square bore 34 of pinion 24 may be broached directly in and through the latter or, for considerations of practical manufacturing procedure, its own bore may be drilled and reamed cylindrical, with an adapter insert 34' (FIG. 3) having a square bore rigidly secured thereto, as by press fit or a key 34''. The cross-sectional dimensions of the bores 34 and 35 are identical, and are but slightly greater (as indicated in dot-dash line in FIG. 2) than the dimensions of the shaft 18, so that the latter may be readily entered into and passed axially through the square bores in question, but in rotative driving engagement therein.

In view of the fact that the special adapter bushings 30 and the pinion 24 are freely rotatable relative to one another on a substantially common axis prior to insertion of the shaft, it will be seen that it is a simple matter to properly orient all three bores in register with one another, in a hand operation from outside the housing 11, then shove the shaft 18 in place. This keys the adapter bushings and pinion for rotation as a unit under the drive of the square shaft. The free rotatability of pinion 24 in the housing 10, in mesh with the operated member or rack 20, enables the latter to be accurately positioned, vertical-wise, for proper lifting action on a die stamping, after which the bushings 30 will be aligned, as to register of their bores 35 with the pinion bore 34, and the shaft 18 inserted to key the rotating parts together.

FIGS. 6, 7 and 8 of the drawings illustrate an alternative embodiment of the invention in a double-rack type of unit, generally designated by the reference numeral 38. Its structural features are similar to those of the embodiment of FIGS. 1 through 5, but there are two identical pinions 39, 40 mounted in direct side-by-side engagement (FIG. 8) within the two-part housing 41. Each pinion has a single cylindrical and rather shallow counterbore 42 on

its outer axial side for the reception of the enlarged pilot shoulder 32 of an adapter bushing 30 of the type previously described. Other bushing mounting provisions are the same.

In addition to its rack receiving openings 22 for the upright lifter rack 20, one of the housing halves of the unit 38 is provided with additional, horizontally aligned side openings 44 for the reception of a horizontally operated rack 45. Assuming that the pinion 40 drives the rack 20 as an operated member in the fashion described in connection with FIGS. 1-4, the rack 45 is driven in direct side-by-side relation to rack 20 by the other operating member or pinion 39 of the unit.

As in the earlier embodiment, the pinions 39 and 40 may have square center bores 46 and 47, respectively, as do the adapter bushings 30, for driving engagement by power input shaft 18. Thus, as driven by that shaft, the pinion 40 operates the upright lifter rack and the pinion 39 operates the horizontal rack 45, which may be used as a driver for another, transversely spaced unit 38. In the alternative, the shaft 18 may be dispensed with and the rack 45, driven by a suitable hydraulic or pneumatic reciprocating prime mover, may be utilized to operate lifter rack 20. As a further alternative, a pair of transversely spaced units 38 may be operated tandem-wise and in common by an intermediate source of reciprocatory power for rack 45.

As shown in FIG. 7, the teeth of the respective pinions 39, 40 are circumferentially or angularly offset one-half of the circumferential spacing between teeth. This is for the purpose of positively preventing any tendency of one rack to shift laterally into interfering engagement with the teeth of the other rack.

In either a single rack or a double rack adaptation, the invention also contemplates an alternative feature which is illustrated in FIG. 9 of the drawings. That is, instead of providing the adapter bushing 30 with a square through-bore, as in the embodiment of FIGS. 1-5, they are bored cylindrically at 49, leaving internal space at S between the square shaft 18 and their cylindrical inner wall.

Thus, the adapters, in this case designated 50, are drivingly disconnected completely from the shaft 18, disregarding a minimal friction which may exist therebetween tending to cause the bushings 50 to drag and rotate with the shaft and/or pinion. This they will not normally do if there is some degree of radial clearance between their enlarged pilot shoulder or flange in the pinion counterbore. However, since there may be some objection to even a running engagement of the shoulder of the adapter bushing, which is of steel, with the pinion 24, also of steel, it may be desirable to press-fit the adapter bushing shoulder into the pinion counterbore. In other respects, the embodiment of FIG. 9 contains all features illustrated and described above in connection with FIGS. 1 through 5.

It is seen that the invention affords a unit for use in a parts lifting press installation, or in a material or part handling operation of a different sort, or, indeed, in other mechanical applications of an even more general nature, which is extremely simple, compact and inexpensively produced, initially assembled, and ultimately assembled to other equipment. Its use of square shafting in association with the squared boring of pinion and/or adapter bushing means has great importance in its contribution to ease of assembly, both in the initial manufacture of the unit and the ultimate assembly to the press on location.

As indicated above, the tubular operating member or pinion may be held in temporary alignment with the housing bore axis in various ways, other than by piloting it on special adapter bushing members, for example, by an appropriate modification of the internal surface structure of the housing. For instance, this might well devolve simply to a reduction of the radial space between the pinion and mated housing halves to a clearance less than is depicted in FIGS. 3 and 7, so as to temporarily sustain

the pinion about a part of its periphery sufficiently to permit the axial insertion of the shaft in the square pinion bore.

What I claim as my invention is:

1. A material handling unit comprising a housing having a shaft-receiving bore opening to the interior thereof, a tubular operating member in said housing rotatable on the axis of said housing bore, a drive shaft insertable in said bore into direct driving engagement with said tubular operating member at the internal bore of the latter, and an operated member operatively engaged with said operating member and driven by the latter upon its driving rotation by said shaft, said housing having means therein to maintain said operating member with its bore substantially coaxial with the housing bore prior to the insertion of said shaft, said means comprising a pair of axially spaced bushing members coaxial with said housing bore, said bushing members having axial piloting engagement with said operating member at opposite axial ends of the latter to so maintain its bore.

2. The unit of claim 1, in which said operating member is a pinion, said operated member being a rack in meshing engagement with said pinion, said rack projecting externally of said housing for the handling of material.

3. The unit of claim 1, in which said operating member is a pinion, said operated member being a rack in meshing engagement with said pinion, said rack projecting externally of said housing for the handling of material, the bore of said pinion being non-circular and said shaft being non-circular and in mating engagement with the bore of the pinion to drive the latter.

4. The unit of claim 1, in which said operating member is a pinion, said operated member being a rack in meshing engagement with said pinion, said rack projecting externally of said housing for the handling of material, the bore of said pinion being non-circular and said shaft being non-circular and in mating engagement with the bore of the pinion to drive the latter, said bushing member also having a non-circular bore drivingly engaged by said shaft.

5. The unit of claim 1, in which said operating member is a pinion, said operated member being a rack in meshing engagement with said pinion, said rack projecting externally of said housing for the handling of material, the bore of said pinion being non-circular and said shaft being non-circular and in mating engagement with the bore of the pinion to drive the latter, said bushing having a cylindrical bore non-drivingly receiving said shaft.

6. The unit of claim 1, in which said operating member is a pinion counterbored at its opposite axial ends to receive and be piloted by the respective bushing members.

7. The unit of claim 1, in which said operating member is a two-part pinion, the respective parts of which are each counterbored at an outer axial end thereof to receive and be piloted by the respective bushing members.

8. The unit of claim 1, in which said operating member is a two-part pinion, the respective parts of which are each counterbored at an outer axial end thereof to receive and be piloted by the respective bushing members, there being two operating members in the form of racks in meshing engagement with the respective pinion parts and projecting externally of said housing.

9. The unit of claim 1, in which said operating member is a pinion, having means to drivingly engage directly with said shaft after said insertion of the latter, said operated member being a rack in meshing engagement with said pinion, said rack projecting externally of said housing, said pinion having cylindrical counterbores at its opposite axial sides, said bushing members each having a cylindrical inner flange received in one of said pinion counterbores, and an axially elongated sleeve portion, said housing having axially aligned bearing means receiving the respective sleeve portions.

10. A material handling unit comprising a housing having a shaft-receiving bore opening to the interior there-

of, a tubular operating member in said housing rotatable on the axis of said housing bore, a drive shaft insertable in said bore into direct driving engagement with said tubular operating member at the internal bore of the latter, and an operated member operatively engaged with said operating member and driven by the latter upon its driving rotation by said shaft, said housing having means therein to maintain said operating member with its bore substantially coaxial with the housing bore prior to the insertion of said shaft, said means comprising a bushing member coaxial with said housing bore, said operating member having a counterbore in an axial side thereof, said bushing member having a flange in axial piloting engagement with said counterbore of said operating member.

11. The unit of claim 10, in which said operating member is a pinion, said operated member being a rack in meshing engagement with said pinion, said rack projecting externally of said housing for the handling of material.

12. The unit of claim 10, in which said operating member is a pinion, said operated member being a rack in meshing engagement with said pinion, said rack projecting externally of said housing for the handling of material, the bore of said pinion being non-circular and said shaft being non-circular and in mating engagement with the bore of the pinion to drive the latter.

13. The unit of claim 10, in which said operating member is a pinion, said operated member being a rack in meshing engagement with said pinion, said rack projecting externally of said housing for the handling of material, the bore of said pinion being non-circular and said shaft being non-circular and in mating engagement with the bore of the pinion to drive the latter, said bushing mem-

ber also having a non-circular bore drivingly engaged by said shaft.

14. The unit of claim 10, in which said operating member is a pinion, said operated member being a rack in meshing engagement with said pinion, said rack projecting externally of said housing for the handling of material, the bore of said pinion being non-circular and said shaft being non-circular and in mating engagement with the bore of the pinion to drive the latter, said bushing having a cylindrical bore non-drivingly receiving said shaft.

15. The unit of claim 10, in which said operating member is a pinion, having means to drivingly engage directly with said shaft after said insertion of the latter, said operated member being a rack in meshing engagement with said pinion, said rack projecting externally of said housing, said counterbore of said pinion being cylindrical, said flange of said bushing member being cylindrical, and said bushing having an axially elongated sleeve portion, said housing having axially aligned bearing means receiving the respective sleeve portions.

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