June 13, 1967 J. D. DEAL, JR 3,324,894

CONDUIT SECTION

Original Filed Dec. 24, 1963

Fig. 1

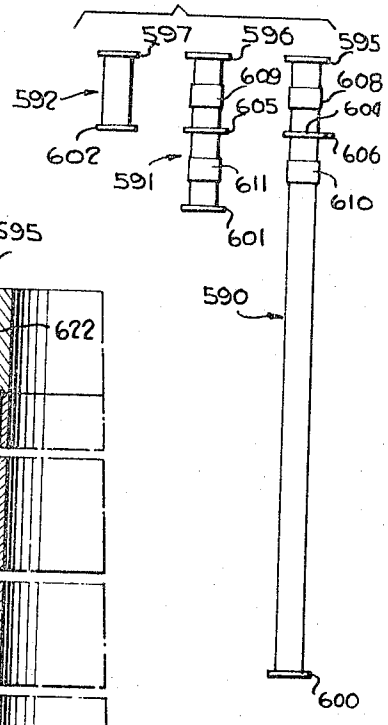


Fig. 2

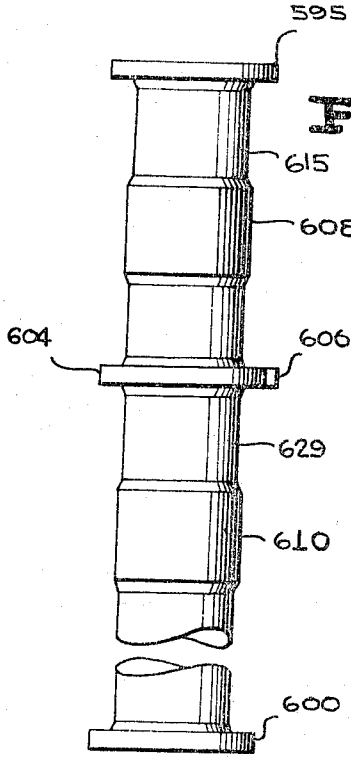


Fig. 3

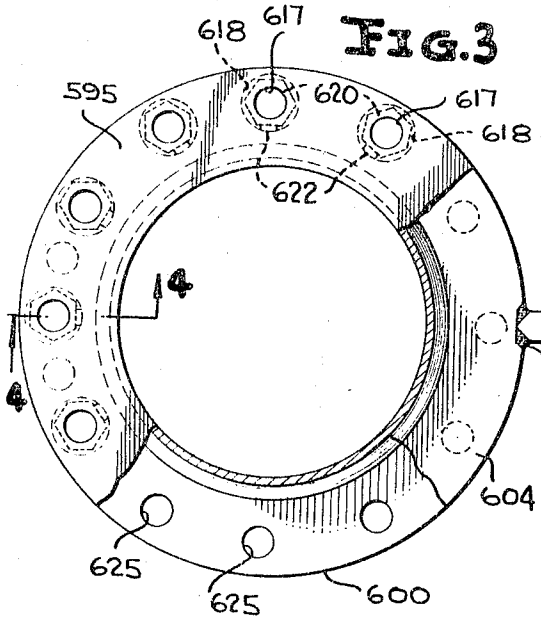
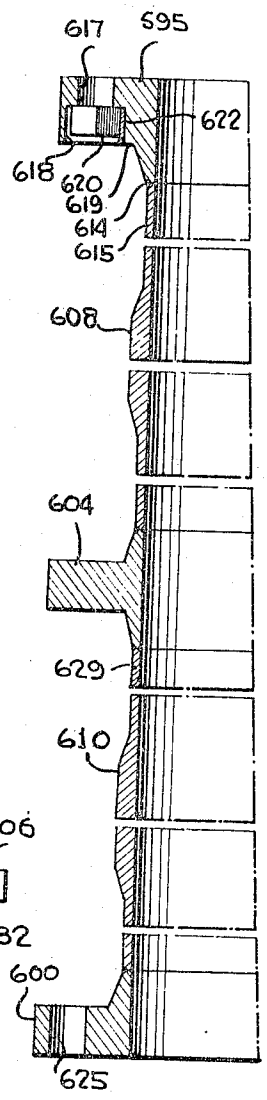


Fig. 4



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CONDUIT SECTION

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2 Claims. (Cl. 138—109)

The present invention relates to a new and novel conduit section construction, and more particularly to a conduit section which is adapted for use in underwater mining at great depth beneath the surface of the sea.

The present application is a division of copending U.S. patent application Ser. No. 332,999, filed Dec. 24, 1963.

The conduit section construction of the present invention is especially adapted for use with apparatus employed for the recovery of solid substances disposed at the bottom of the sea such as manganese nodules which are resting on the sea bottom and which are found in quantities sufficient for commercial mining at depths ranging generally from 400 feet to 12,000 feet or more beneath the surface of the sea.

Apparatus employed for mining of such substances includes a ship adapted to move through the water over a particular mining area of the sea bottom along with a collecting means adapted to move along the sea bottom itself to collect the solid substances, and a conduit means is provided for transporting the collected solid bodies from the collecting means up to the ship.

The conduit means employed in this underwater mining operation is composed of a plurality of conduit sections of the present invention. These conduit sections must be of relatively large size since in order to be economically feasible, the apparatus must be capable of raising a substantial amount of solid bodies from the sea bottom, and for example, it is anticipated that a successful commercial operation must raise as much as 4,000 tons or more of nodules per day. These nodules are generally spherical solid bodies normally ranging in size from small ones about the size of a toy marble to large ones the size of basketballs or even larger. As a practical matter, it is considered that mining of nodules from about three-quarters of an inch in diameter to about 6 inches in diameter may be the most economical and efficient arrangement, and accordingly the conduit sections according to the present invention are designed to handle this size and quantity of material. It will of course be realized that the examples as to size, depth and so forth are merely illustrative in order to provide in idea as to the size and scope of the operation being carried out. These quantities are in no way limiting and may be varied in accordance with the particular conditions existing in any certain situation.

The conduit means employed for connecting the collecting means with the mining ship includes a plurality of separate sections of such a construction that they may be readily and quickly assembled and disassembled and which provide an effective joint between the individual sections when assembled. These conduit sections furthermore are constructed so as to permit ready handling by the ship handling apparatus for lifting and lowering the conduit sections as required, the conduit sections also being of reinforced construction so as to afford adequate strength and rigidity adjacent to the handling portions thereof. Means is also provided on the conduit sections for assisting in properly aligning the conduit sections when assembling them for lowering into operative mining position.

The mining ship may be provided with a suitable well portion through which a conduit means is lowered, and

suitable handling means is provided on the ship for engaging certain portions of the conduit sections for maneuvering them as required in lifting and lowering them into operative mining position and into stowed position in suitable stowage means provided on the ship.

An object of the present invention is to provide a new and novel conduit section construction adapted to be employed in the depending conduit means utilized with a mining ship and a collecting means for raising solid bodies of material from the sea bottom.

A further object of the present invention is to provide a conduit section construction which permits the conduit means to be readily and quickly assembled and disassembled and which provides an effective joint between the sections when assembled.

Another object is to provide a conduit section construction which permits ready handling by the ship handling apparatus for lifting and lowering the conduit sections as required and wherein the conduit sections are of reinforced construction so as to afford adequate strength and rigidity adjacent the handling portions provided on the conduit section.

A further object of the invention is to provide a conduit section construction including means for enabling proper alignment of the conduit sections with respect to one another.

Other objects and many attendant advantages of the invention will become more apparent when considered in connection with the specification and accompanying drawings wherein:

FIG. 1 illustrates three different types of conduit sections employing the novel construction of the present invention;

FIG. 2 is an enlarged view partially broken away of one of the constructions illustrated in FIG. 1;

FIG. 3 is a top view of the construction shown in FIG. 2 broken away in certain portions to illustrate certain details of construction; and

FIG. 4 is a sectional view taken substantially along line 4—4 of FIG. 3 looking in the direction of the arrows.

Referring now to the drawings wherein like reference characters designate corresponding parts throughout the several views, there is shown in FIG. 1 three different conduit section constructions indicated respectively by reference numerals **590**, **591** and **592**. Each of these different constructions is utilized in certain procedures involved in the mining operation, and the construction indicated by reference numeral **590** is a typical conduit section from which the major portion of the conduit means is assembled.

Each of the individual conduit sections **590**, **591** and **592** is provided with an upper flange indicated by reference numerals **595**, **596** and **597** respectively. Each of these individual sections is also provided with a lower flange indicated by reference numerals **600**, **601** and **602** respectively. The construction of the upper flanges of each of the individual sections may be substantially identical with one another, and the construction of the lower flanges of each of these individual sections may also be substantially identical with one another as hereinafter described.

In each instance, the conduit sections **590**, **591** and **592** include main tubular portions having the upper and lower flanges disposed at the upper and lower ends thereof respectively. The two conduit sections **590** and **591** additionally include intermediate collar portions indicated by reference numerals **604** and **605** respectively. The collar portions are of substantially identical construction as hereinafter described, the only difference being that the collar portion **604** is provided with an additional boss **606** as hereinafter described.

The conduit sections **590** and **591** also include first thickened portions **608** and **609** respectively disposed between the upper flanges and the intermediate collar portion. Additional thickened portions **610** and **611** are provided between the intermediate collar portion and the lower flanges of the two conduit sections. The construction of these thickened portions may be substantially identical as hereinafter described.

Referring now particularly to FIGS. 2, 3 and 4, the constructional details of the conduit section **590** are illustrated, as an example, it being understood that conduit sections **591** and **592** are of similar construction. The upper flange **595** of conduit section **590** may comprise a separate forging which is welded as indicated at **614** to the tubular portion **615**. Flange **595** is provided with a plurality of spaced holes **617** formed therethrough and shown as being 12 in number. Each of holes **617** is in communication with the central portion of a counterbored portion **618** formed in the undersurface **619** of the flange. A nut **620** is press fitted within each of the counterbored portions formed in the undersurface of the flange, and a plug member **622** is spot welded in the counterbore and is also welded to the nut so as to positively prevent rotation of the nut with respect to the counterbored portion. The nut provides a screw threaded means for receiving the threads on a suitable attaching means such as a cap screw or the like for rigidly attaching flange **595** to the flange of an associated conduit section.

The lower flange **600** of conduit section **590** is also provided with a plurality of spaced holes **625** formed therethrough, these holes being shown as 12 in number. It is apparent that the bottom flange of each individual conduit section is adapted to be fixed to the top flange of an adjacent conduit section by passing suitable attaching means such as cap screws through the holes in the bottom flange of one of the sections, with such screws being threaded into the nuts provided at the bottom portion of the holes provided in the top flange of the next adjacent section. This arrangement permits the conduit sections to be readily and quickly assembled and disassembled with respect to one another and at the same time provides an effective joint therebetween when in assembled position.

As seen particularly in FIGS. 2 and 4, the tubular portion **615** of the conduit section is provided with a circumferentially extending thickened portion **608**, and a tubular portion **629** of the conduit section also includes a similar circumferentially extending thickened portion **610**. The flange **600** of conduit section **590** may comprise a separate forging as is the upper flange **595** previously mentioned. The collar portion **604** may also comprise a separate forging welded to the tubular portions **615** and **629** of the conduit section and being disposed intermediate the two thickened portions **608** and **610**.

During handling of the conduit sections as entailed in lifting and lowering the conduit sections into operative mining position and into stowed position as the case may be, certain components of the handling mechanism on the ship are adapted to engage the undersurfaces of upper flange **595** and collar portion **604**. The thickened portions of the conduit sections disposed immediately below the upper flange and the collar portion respectively serve to reinforce the conduit section and to provide adequate strength and rigidity adjacent to these handling portions on the conduit section.

As seen particularly in FIG. 3, a radially outwardly extending boss **606** is suitably secured as by welding as indicated at **632** to the outer surface of the collar portion **604**. This radially outwardly extending boss may be utilized for properly aligning adjacent sections of the conduit means in order to ensure that the conduit sections are properly oriented when bolting them together.

While the flange and collar portions have been illustrated as being formed of separate forging, it is also apparent that the flange portions and collar portions may comprise integral portions of the same casting if desired. In addition, the thickened portions provided in the tubular parts of the conduit section may either comprise integral portions as shown, or may also take the form of separate sleeve portions which are welded in place about the outer surface of the tubular portions. In any event, the over-all construction will be such as to facilitate handling of the conduit sections by the handling mechanism on the ship and to also provide sufficient strength and rigidity to the conduit section when subjected to stress and loadings involved in the handling procedures.

In a typical example, conduit sections **590**, **591** and **592** may have a length of approximately 36 feet, 11 feet and 4½ feet respectively. The distance from the top of the upper flange of each of sections **590** and **591** to the bottom of the collar portions thereof may also be approximately 4½ feet. The conduit sections may have an internal diameter of approximately 19 inches.

It is apparent from the foregoing that there is provided according to the present invention a conduit section construction which permits the individual sections to be readily attached to one another so as to provide a conduit means of great length, an effective joint being provided between the individual sections when assembled, and the assembled conduit means also being capable of ready disassembly. The conduit section construction permits ready handling by the ship handling apparatus for lifting and lowering the conduit sections as required and the conduit sections are of reinforced construction so as to afford adequate strength and rigidity adjacent the handling portions thereof. The conduit sections also include means for enabling proper alignment of the conduit sections with respect to one another when they are being assembled into operative relationship.

As this invention may be embodied in several forms without departing from the spirit or essential characteristics thereof, the present embodiment is therefore illusrtative and not restrictive, and since the scope of the invention is defined by the appended claims, all changes that fall within the metes and bounds of the claims or that form their functional as well as conjointly cooperative equivalents are therefore intended to be embraced by those claims.

I claim:

1. Apparatus adapted to be carried by a vessel for underwater mining at great depths beneath the surface of the sea comprising a rigid integral conduit section having a generally uniform cross sectional thickness and a substantially uniform cylindrical bore formed longitudinally therethrough, said section including an upper handling portion formed on the upper end thereof and a lower handling portion formed on the lower end thereof, each of said handling portions extending radially outwardly thereof and peripherally around said section, said section including an integral collar portion disposed adjacent to said upper handling portion, said collar portion extending radially outwardly of and peripherally around said section, said section including a first circumferentially extending portion of greater wall thickness than said uniform cross sectional thickness intermediate said upper handling portion and said collar portion, said section including a second circumferentially extending portion of greater wall thickness than said uniform cross sectional thickness adjacent to but spaced on the opposite side of said collar portion from said first circumferentially extending portion of greater wall thickness, said portions of greater wall thickness being of substantially the same axial extent, said circumferentially extending portions of greater wall thickness serving to reinforce the conduit section to provide adequate strength and rigidity when subjected to bending moments to said last-mentioned handling portion and said collar which also comprises a handling portion of the conduit section.

2. Apparatus as defined in claim **1** including a boss on said collar portion, said boss extending radially outwardly of said collar portion a greater distance than the radial

outward extent of said handling portion so as to be readily visible when aligning adjacent conduit sections.

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