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(71) Applicant

Deutsche Gesellschaft für Wiederaufarbeitung von  
Kernbrennstoffen mbH

(Incorporated in the Federal Republic of Germany)

Hamburger Allee 4, D-3000 Hannover 1,  
Federal Republic of Germany

(72) Inventors

Karsten Gluck  
Klaus Blaseck

(74) Agent and/or Address for Service

Marks & Clerk  
57-60 Lincoln's Inn Fields, London, WC2A 3LS,  
United Kingdom

(54) Means for remote-controlled grasping and safe transporting of an article and for remote coupling of an electric plug connection

(57) Means for the remote grasping and safe transporting of an article and for remote coupling of an electrical plug connection comprises a first adapter device (2) which is suitable for connection to a crane block and includes at least one load latch (5), adapted to be locked by a locking device (12), as well as a centrally arranged first plug member (15). It further comprises a second adapter device (3) which is suitable for connection to an article to be transported and includes a pin member (16), adapted to be engaged with the load latch (5), as well as a second plug member (18) disposed centrally within the pin member (16). Descent of ring (12) by gravity locks latches (5) in position; a device is described which lifts ring (12) by remote control to release latches (5) for tool exchange purposes.

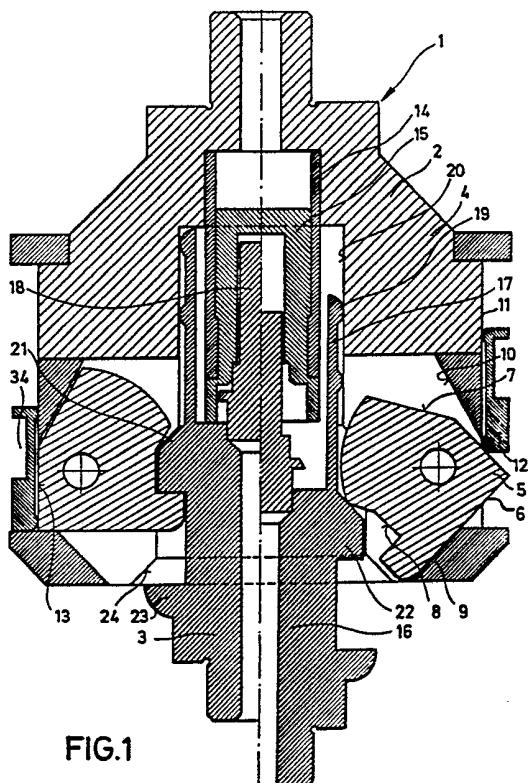
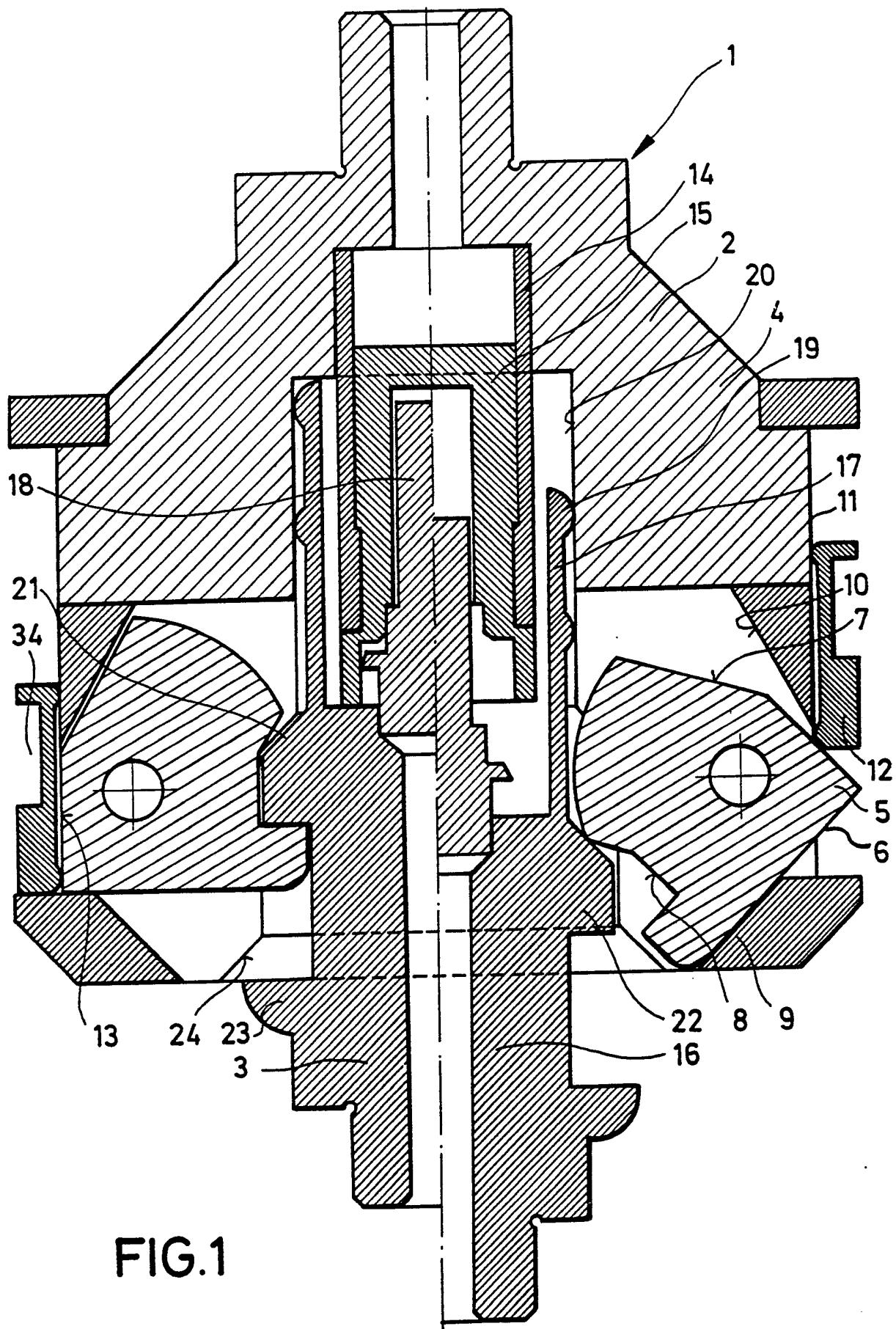
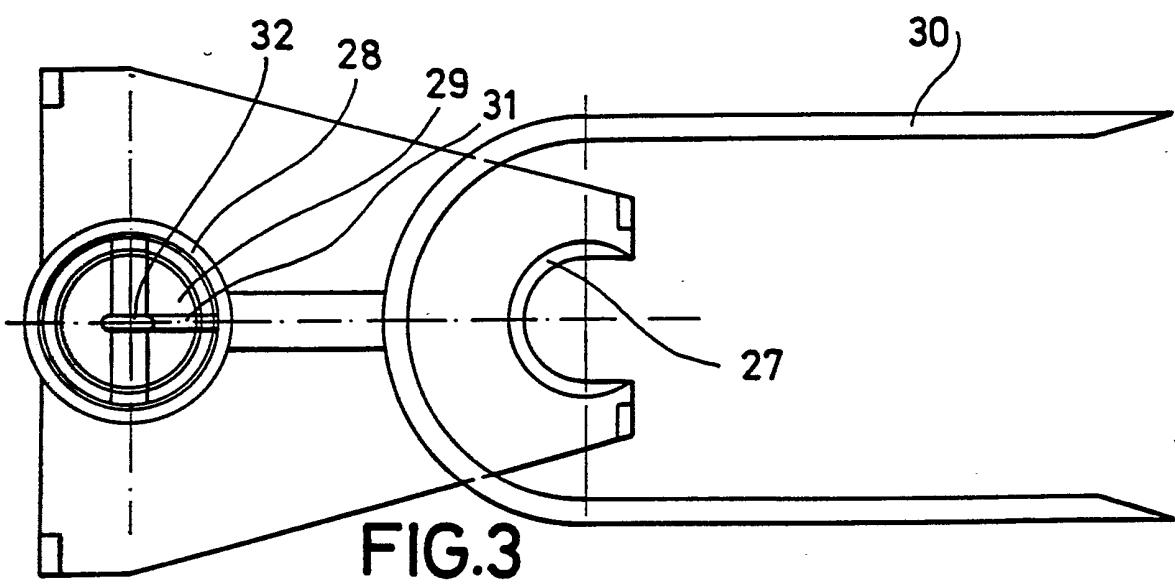
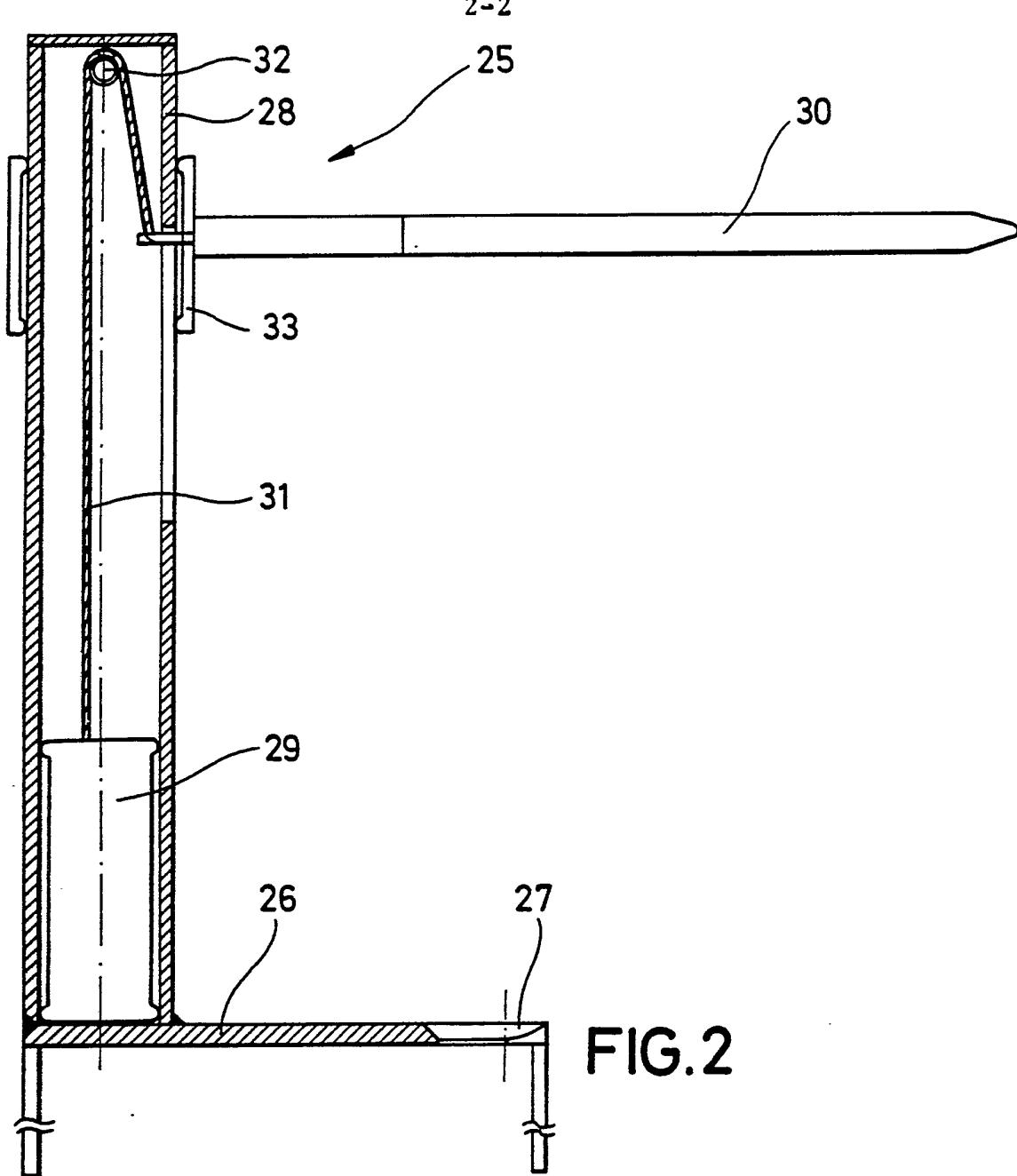


FIG.1

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**FIG.1**



Means for the remote-controlled grasping and  
safe transporting of an article  
and for remote coupling of an  
electric plug connection

The instant invention relates to means for the remote  
grasping and safe transporting of an article and for remote  
coupling of an electric plug connection.

The instant invention particularly relates to the remote-  
controlled grasping and safe transporting of a tool and  
the simultaneous remote-controlled coupling of an elec-  
trical plug connection for the tool exclusively by vertical  
movement of a block of a crane hook, the tool subsequently  
being used in such zones of nuclear plants as do not allow  
the entry of personnel because of influences of the en-  
vironment.

Means for the remote grasping and safe transporting of a  
tool and for the remote coupling of an electric plug con-  
nection for power supply to the tool has been disclosed in  
the applicant's earlier German patent application  
P 38 15 033.6 which is not a prior publication. That means  
substantially comprises a first plug member fastened to a  
crane hook block, a second plug member disposed at the tool  
opposite the first plug member, a crane hook mounted on  
the crane hook block, and a retainer device provided at  
the tool for engagement with the crane hook. The retainer  
device and the crane hook, on the one hand, and the two  
plug members, on the other hand, are spaced apart in a  
direction transversely of the hoisting movement of the  
crane hook block. The coupling procedure of the electrical  
plug connection may give rise to undesirable moments.

Moreover, the arrangement described of the means according to the applicant's earlier application requires certain space which is not always available.

Means for remote coupling of an electric plug connection for use in nuclear plants is known from German patent DE-PS 26 28 865. It operates by means of gripping devices which are adapted to be opened and closed by a drive motor acting through spindles and spindle nuts. The electrical connection is established by a multi-pole switch provided with a plurality of plug and socket contacts. The remote coupling of the electric plug connection requires additional handling means, such as electromechanical manipulators and active coupler systems and the like. The use of active coupler systems in turn requires additional servo drive means, such as feed spindles which again need to be supplied with power. That makes it necessary to provide a great number of individual leads in the cable duct and has an adverse effect on the cable storage dimensions. The reliability of the overall system suffers from the additional drive means.

It has become quite customary in nuclear plants to carry out remote controlled operations on working tools by means of a crane. A crane hook may be employed to grasp a great variety of working implements, to convey them to their job site, and to hold them in proper position during operation. A crane hook also may be used to take up and transport parts needing to be exchanged. Such a crane system for remote handling is extremely sturdy, easy to manipulate, and adaptable to the most diverse tasks. The only difficulty with this system is the making and breaking of electrical connections between power supply units, control lines, and the like as well as taking up, gripping, and safely conveying articles, such as electrical tools by the crane.

In contradistinction to the prior art discussed, the object of the instant invention resides in providing a means for

the remote grasping and safe transporting of an article and for remote coupling of an electric plug connection which means, in spite of being easy to handle, still meets the high demands as to reliability, for instance, in the 5 field of remote controlled operations in nuclear plants.

The object is met, in accordance with the invention, by a means for the remote grasping and safe transporting of an article and for remote coupling of an electric plug connection comprising the features recited in claim 1.

10 The design according to the invention of the means in question comprises a first adapter device which is connected to a crane block, has a load latch locking mechanism, and includes a central plug member, as well as a second adapter device which is connected to the article to be conveyed, preferably an electrical tool, and includes a pin member adapted for engagement with the load latch as well as a second plug member disposed centrally within the same. 15

The design of the means according to the invention provides a structure that is both sturdy and compact and prevents 20 the undesirable occurrence of moments when the electric plug connection is being coupled together. As the first plug member is located within the first adapter device, this adapter device acts as a mechanical protector of the first plug member. Furthermore, as the second plug member 25 is located within the pin member of the second adapter device, also the second plug member is protected against any mechanical damage. And as the overall structure can be made so as to be substantially of rotationally symmetrical configuration, the centering is easy and the coupling of the 30 plug connection as well as the mutual latching of the two adapter parts is effected without causing any moments.

It is an essential aspect of the means according to the invention that it is possible to obtain the catching of the first adapter device at the second adapter device by

the load latch and the arresting by the locking device as well as the simultaneous coupling of the first plug member to the second plug member to establish the electric plug connection by no more than aligning and subsequently vertically moving the crane hook block. The connection is made between the two adapter devices and the plug connection established between the two plug members by lowering the crane hook block, together with the first adapter device secured to the same, with respect to the second adapter device until the at least one load latch of the first adapter device enters into engagement with the pin member of the second adapter device and is arrested in that position by the locking device. The plug-in connection of the two plug members is made by the vertical relative movement of the two adapter devices with respect to each other. The subsequent lifting of the crane block will remove the second adapter device to which, preferably, an electrical tool is attached, from its mounting and bring it to its place of work. As will become apparent from the description below of the subject matter of subclaims and from the specification, the design according to the invention of the means of the invention likewise permits an easy separation of the two adapter devices from each other. The latter is obtained substantially by vertical movement of the crane hook block and the assistance of a storage device of suitable structure for the second adapter device.

In accordance with the further development of the means of the invention as defined in claim 2 the locking device is embodied by a displaceable element which is movable under gravity into a lower position, starting from an upper position, as the at least one load latch is pivoted into an elevated pivot position when the first adapter device is separated from the second adapter device, the displaceable element in its lower position locking the at least one load latch in elevated pivot position by form-lock engagement with said latch. Automatic shifting, caused by gravity, of the

displaceable element into its lower position for locking of the at least one load latch in the upper pivot position in which the two adapter devices are interlocked in form lock is accomplished by this design.

- 5 A particularly simple structure is obtained with a substantially rotationally symmetric design of the means according to the invention in accordance with the further development presented in claim 3 with which the first adapter device is realized in the form of a latch hood having a substantially cylindrical outer surface, and the displaceable element is designed as a displaceable ring adapted to be shifted in vertical direction on the cylindrical outer surface, and the load latch, when in its lower pivot position which it preferably adopts under gravity, projects in radial direction beyond the cylindrical outer surface while it does not project beyond the cylindrical outer surface when in its upper pivot position. Hereby it permits the displaceable ring to drop into the locking position.

In accordance with claim 4, preferably, the load latch is kept in its lower pivot position by a stop member. Hereby a fixed starting position of the load latch is defined as the pin member is first introduced. Proper configuration both of the pin member and the load latches thus permits automatic compensation of mutual axial offsets of the two adapter devices during the procedure of introducing the pin member.

According to another modification, as defined in claim 5, the pin member comprises a guiding sleeve which is radially spaced from the second plug member it surrounds. The guiding sleeve passes over into a frustoconical run-up surface provided at a holding collar which enters into engagement with the load latch in the upper pivot position thereof. This configuration of the pin member assures its automatic centering when it is being introduced into the area between the load latches, the second plug member being protected

mechanically by the guiding sleeve so as not to be damaged. As the pivoting of the load latches increases, the transition from the run-up surface into the holding collar causes an increasingly more accurate axial alignment of the two 5 adapter devices. In the upper arrested position of the load latches, the surfaces mentioned also form part of the form lock engagement between the load latch and the pin member.

According to the embodiment of the subject matter of the invention as defined in claim 6 the pin member is provided 10 with a storage collar by which the second adapter device, when uncoupled from the first adapter device, can be placed on a storage device.

A shockproof structure which does not permit live ring contact parts to be touched and which is protected against any 15 mechanical damage is obtained, according to claim 7, in that the first adapter device comprises a centering sleeve which encloses a ring contact socket and has a smaller outer diameter than the inner diameter of the guiding sleeve, the second plug member being a ring contact plug.

20 As already mentioned and defined in claim 8, the second adapter device preferably is connected to an electrical tool.

As recited in claim 9, preferably the locking device is of such design that it can be shifted, against gravity, 25 into its upper position when the second adapter device is deposited on the storage device. That cancels the locking by the load latch.

A preferred embodiment of the means according to the invention for the remote grasping and safe transporting of 30 an article and for remote coupling of an electric plug connection and a preferred embodiment of a storage device for the second adapter device of the means according to the invention will be described below with reference to the

accompanying drawings, in which:

Fig. 1 is a cross sectional elevation of a preferred embodiment of the means according to the invention, the left side in fig. 1 showing a locked condition of engagement of the parts and the right side an unlocked condition;

5 Fig. 2 is a sectional elevation of an embodiment of a storage device for a second adapter device of the means according to the invention; and

10 Fig. 3 is a top plan view of the storage device shown in fig. 2.

The embodiment of the means according to the invention for the remote grasping and safe transporting of an article and for remote coupling of an electric plug connection shown 15 in fig. 1 is designated, generally, by reference numeral 1. It comprises a first adapter device 2 and a second adapter device 3. The first adapter device 2 includes a latch hood 4 in which preferably three load latches 5 are arranged for pivotal movement. At its upper end in fig. 1 the first 20 adapter device 2 is linked to a crane block (not shown). Each of the load latches 5 has a lower abutment surface 6, an upper abutment surface 7 and a recess 8. When in its lower pivot position, the load latch 5 has its lower abutment surface 6 in engagement with a lower stop member 9. 25 In the upper pivot position, on the other hand, the upper abutment surface 7 lies against an upper stop member 10. In the lower pivot position, furthermore the outer part of the load latch, in the radial direction of the latch hood 4, projects beyond a cylindrical outer surface 11 of the 30 latch hood 4, thus presenting a support for a displaceable ring 12 to rest upon. The displaceable ring 12 extends around the cylindrical outer surface 11 of the latch hood 4 and is movable with respect to the same in a vertical direction (cf. the right side in fig. 1).

When the load latch 5 is in its upper pivot position, shown

at the left in fig. 1, it does not project beyond the cylindrical outer surface 11 of the latch hood 4. Consequently, the load latch 5 in this pivot position no longer presents a support for the displaceable ring 12 which thus can 5 slide under gravity into a lower position in a vertical direction. In this position the displaceable ring locks the load latches 5 in their upper pivot position by entering into form lock engagement with rear abutment surfaces 13 of the same.

10 The first adapter device 2 further comprises a centering sleeve 14 which surrounds a ring contact socket 15.

The second adapter device 3 which is firmly joined to the electrical tool (not shown) that is adapted for remote handling, comprises a pin member 16 formed in its upper 15 part in fig. 1 with a guiding sleeve 17 which is radially spaced from and surrounds a ring contact plug 18 disposed centrally in the guiding sleeve 17. The inner diameter of the guiding sleeve 17 is greater than the outer diameter of the centering sleeve 14. The guiding sleeve 17 is 20 crowned at least at its upper end 19 so as to cause its centering upon being introduced into the bore 20 of the latch hood 4. At the foot of the guiding sleeve 17 the pin member 16 passes over into a frustoconical run-up surface 21 which is followed by a holding collar 22. When the 25 pin member 16 is fully inserted and the load latches 5 are in their upper pivot position the holding collar 22 engages in the recesses 8 formed in the load latches 5.

The pin member 16 further is formed with a storage collar 30 23 the diameter of which increases from a lower to an upper region thereof. As will be explained below with reference to figs. 2 and 3, this storage collar serves to deposit the second adapter device 3, when uncoupled from the first adapter device 2, on a storage device.

It is evident from the description of the structure of the embodiment shown in fig. 1 that upon lowering of the first adapter device 2 with respect to the second adapter device 3 first the upper end 19 of the guiding sleeve is given some initial centering by a lower conical entrance aperture 24 in the latch hood 4. Further centering is effected by the gliding engagement with the load latches 5 before the crowned upper end 19 of the guiding sleeve 17 slides into the bore 20 and the run-up surface 21 enters into engagement with the upper area, as seen at the right in fig. 1, of the recess 8 formed in the load latch 5. As the latch hood 4 is lowered further, the pivoting motion of the load latches 5 results in their engagement with the holding collar in the area of their recesses 8. Thus finally engagement is established in the areas mentioned when the upper abutment surface 7 of the load latches 5 comes to rest against the upper stop members 10. When in this position, the displaceable ring 12 drops into its lower position which is illustrated in the left half of fig. 1, and causes the locking already described of the load latches 5 in their upper pivot position. Hereby the adapter devices 2,3 are interlocked and, in this condition, the two plug members, namely the ring contact plug and the ring contact socket 15 are coupled.

Merely looking at the embodiment of fig. 1, a person skilled in the art will realize that the first adapter device 2, when interlocked with the second adapter device 3, can be separated from the latter only if first the locking of the load latches 5 is released by raising the displaceable ring 12. That requires a separate device which will be explained below with reference to figs. 2 and 3.

The storage device 25 shown in vertical sectional elevation in fig. 2 and in top plan view in fig. 3 is generally designated by reference numeral 25. It comprises a deposit rack 26 having a plurality of tool deposit hollows 27 to

receive a plurality of tools which are to be coupled alternatively. Each tool deposit hollow 27 is adapted in shape to the storage collar 23 of the second adapter devices 3. The deposit rack 26 is provided with an upright guide tube 28 for each tool (not shown) to be deposited, a counterweight 29 for a substantially U-shaped fork 30 being guided in the guide tube. The fork 30 is connected to the counterweight 29 by a wire rope 31 passing around a guide pulley 32. The U-shaped fork 30 is supported for vertical displacement along the guide tube 28 by means of a guide bushing 33. As may be seen in Fig. 1, the displaceable ring 12 is formed with a circumferential groove 34 the outer diameter of which substantially conforms to the inner diameter of the fork 30.

To unlock the two adapter devices 2,3 from each other, the displaceable ring 12 is moved so that the groove 34 thereof engages the fork 30 of the storage device 25 by horizontally shifting the crane hook block holding the means 1. Thereupon downward movement of the crane block will lower the means 1 until the storage collar 23 of the second adapter device 3 rests in the tool deposit hollow 27 of the deposit rack 26, thereby relieving the load latches 5. By means of the weight of the counterweight 29 the fork 30 causes the displaceable ring 12 to be shifted into its upper stop position. Now the relieved load latches 5 can fall by gravity into their lower pivot position, releasing the pin member 16. The subsequent lifting of the crane block will separate the first adapter device 2 from the second adapter device 3, and next horizontal displacement to the right in Fig. 2, will separate the fork 30 from the displaceable ring 12. Then the first adapter device 2 is ready to receive another tool from the magazine-type deposit rack 26.

Although the means according to the invention has been described with reference to a particular remote handling technique in

nuclear installations, the field of application of the means according to the invention is not limited to such installations. The means may be used in any application where it is desired to take up an article by remote handling and to establish a connection for signal transmission or power supply.

Claims:-

1. Means for the remote grasping and safe transporting of an article and for remote coupling of an electric plug connection comprising a first adapter device connectable to a crane block and including at least one load latch lockable in a locked position by a locking device and a first, centrally disposed plug member, and further comprising a second adapter device connectable to the article to be transported and including a pin member engageable with the load latch and a second plug member disposed centrally within the pin member.
2. Means as claimed in claim 1, wherein the locking device comprises a displaceable element movable under gravity from an upper position into a lower position as the at least one load latch is pivoted into an elevated pivot position when the first adapter device is coupled to the second adapter device, the displaceable element in its lower position locking the at least one load latch in the elevated pivot position by form-locking engagement therewith.
3. Means as claimed in claim 2, wherein the first adapter device is formed as a latch hood having a substantially cylindrical outer surface, the displaceable element is a displaceable ring movable in a vertical direction on the said cylindrical outer surface, and the at least one load latch projects in a radial direction of the latch hood beyond the cylindrical outer surface thereof when in its lower pivot position, but does not project beyond the said cylindrical outer surface when in its upper pivot position.
4. Means as claimed in any one of claims 1 to 3, wherein the load latch is retained in its lower pivot position by a lower stop member.

5. Means as claimed in any one of claims 1 to 4, wherein the pin member comprises a guiding sleeve surrounding and being radially spaced from the second plug member and extending into a frustoconical run-up surface provided at a holding collar which enters into engagement with the load latch in the upper pivot position thereof.

6. Means as claimed in claim 5, wherein the first adapter device includes a centering sleeve which encloses a ring contact socket and having a smaller outer diameter than the inner diameter of the guiding sleeve, and in that the second plug member is a ring contact plug.

7. Means as claimed in any one of claims 1 to 6, wherein the pin member includes a storage collar by means of which the second adapter device, when being uncoupled from the first adapter device, can be placed on a storage device.

8. Means as claimed in claim 7, wherein, upon depositing of the second adapter device on the storage device, the locking device is adapted to be shifted, against gravity, into an upper position in which the at least one load latch is unlocked.

9. Means as claimed in any one of claims 1 to 8, wherein the second adapter device is linked to an electrical tool.

10. Means for the remote grasping and safe transporting of an article and for remote coupling of an electric plug substantially as herein described with reference to the accompanying drawings.