

Dec. 2, 1969

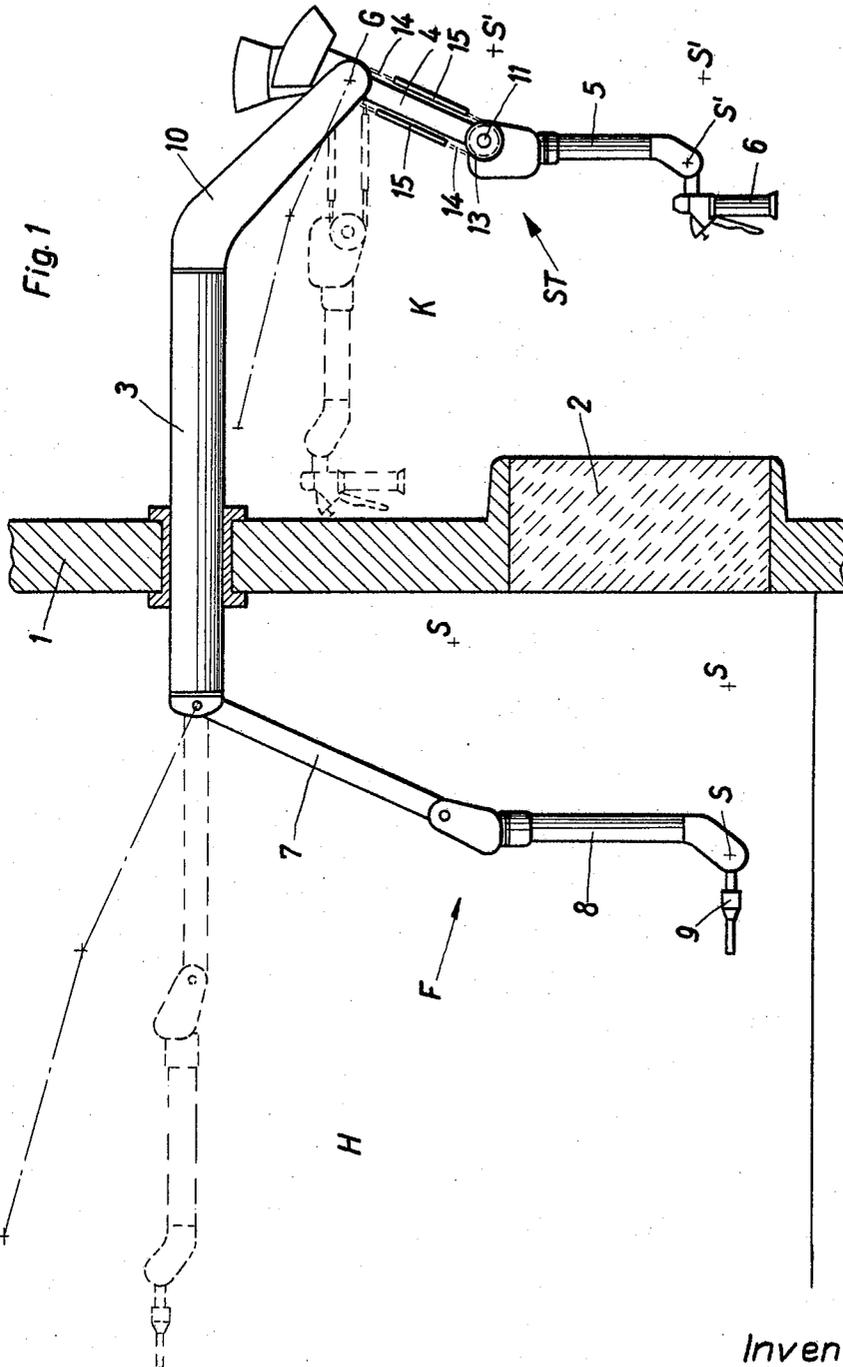
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3,481,494

REMOTE OPERATING DEVICE FOR WORK IN INACCESSIBLE SPACES

Filed Aug. 28, 1967

2 Sheets-Sheet 1



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REMOTE OPERATING DEVICE FOR WORK IN INACCESSIBLE SPACES

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Filed Aug. 28, 1967, Ser. No. 663,856

Claims priority, application Germany, Aug. 27, 1966,
W 42,291

Int. Cl. B25j 3/00

U.S. Cl. 214—1

3 Claims

ABSTRACT OF THE DISCLOSURE

A remotely operating device for working in non-accessible spaces, which comprises a hollow carrier containing transmission means and adapted to be guided through a protection wall. A control-arm and a follower-arm is pivotally connected by pivots with the hollow carrier. Each of the arms includes an angular pivot and divides the arms into an upper arm and a lower arm and permits parallel movements thereof. The angular pivots permit a bending of the control arm in the direction of the protection wall, and a swinging with its upper arm beyond a horizontal position into a chamber defined by the hollow carrier. The pivot connecting the follower arm to the hollow carrier has a small distance from the protection wall and the control-arm is shorter than the follower-arm.

The present invention relates to a remotely operating device for working in non-accessible spaces, in general, and to such devices having a hollow carrier guided through a protection wall and containing transmission means, on which hollow carrier a control-arm and a follower-arm are pivoted, each of which arms is divided by means of an angular pivot into an upper arm and a lower arm and which arms perform parallel movements.

The useability of such devices depends knowingly to a great extent upon the possible working range of the follower arm in the hot cell. In the known remotely operating devices of the mentioned type, the hollow carrier projects comparatively far with the follower arm into the cell space, whereby the ranges disposed below the hollow carrier are accessible such, that the angular pivot permits a bending in the direction towards the protection wall. It is, thereby, a presumption, however, that the distance of the pivot point of the follower arm is greater than the length of the upper arm of the follower arm and that, as already mentioned, the hollow carrier projects correspondingly far into the cell space.

In spite of these measures, a dead space, inaccessible by the follower arm, remains still, however, and in particular, in the direct vicinity of the protecting wall above the cell bottom, thus, within a range, which would be particularly favorable for the observation through the protecting wall window. In order to remove this drawback, the cell bottom and the setting plate, respectively, is disposed higher, whereby, however, the total height of the space is limited and the operational activity is rendered more difficult.

It is one object of the present invention to provide a remotely operating device for working in inaccessible spaces, wherein the device is equipped with a control and follower arm, each of which arms is divided by means of an angular pivot into an upper arm and a lower arm, and which arms perform parallel movements, in order to remove the mentioned drawback, and simultaneously to obtain additional structure and functional advantages.

It is another object of the present invention to provide a remotely operating device for working in inaccessible spaces, wherein the arrangement is made such, that the control arm is bendable in the direction towards the protection wall and is swingable with its upper arm beyond

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the horizontal position into a space defined by the hollow carrier, whereby the pivot point of the follower arm on the hollow carrier has a smallest possible distance from the protection wall and the control arm is designed shorter than the follower arm.

Since, in this structure, the follower arm is pivotally connected in the vicinity of the protection wall on the hollow carrier and reaches the range below the short part of the hollow carrier projecting into the cell by inward swinging of the lower arm, first of all also the lower disposed locations of the space can be covered by the gripper of the lower arm. On the control side, the control arm can be operated in a favorable working position and in the direct vicinity of the observation window, whereby due to the shortening of the control arm, the masses to be moved are reduced in favor of a release to the operator. Furthermore, a horizontal stretching position of the total control arm and, thereby, also of the follower arm can be set, which is quite advantageous, for instance, for pulling out the follower arm from the hollow carrier during a disassembly of the device.

The swinging of the control arm beyond the horizontal position could be made possible also such, for instance, that the upper arm is passed laterally on the horizontal hollow carrier. This formation would, however, render very difficult the formation and provision of the transmission means and also increase the structural requirements.

It is, therefore, still another object of the present invention to provide a remotely operating device for working in inaccessible spaces, wherein the hollow carrier is on the control side equipped with an angular formation, so that the pivot point of the control arm is arranged so far beyond the horizontal axis of the hollow carrier that the upper arm is swingable beyond the horizontal position. This formation makes possible an adjustment of the upper arm and of the lower arm reaching far beyond the horizontal, without thereby rendering more difficult the arrangement of the transmission means.

In embodiments, in which it is to be worked in a low cell space, in accordance with the present invention, the hollow carrier is opened on the control side within the range of the swinging plane and has a vertical reception space for the control arm, respectively, whereby the transmission means are guided above the control arm which swings into the space. Here, it is possible to arrange the hollow carrier low without interference for the operator.

With these and other objects in view which will become apparent in the following detailed description, the present invention will be clearly understood in connection with the accompanying drawings, in which:

FIGURE 1 is a schematic elevation of the device having an angular hollow carrier; and

FIGURE 2 is a schematic elevation of the device having a receiving chamber in the hollow carrier.

Referring now to the drawing, the same numerals have been assigned to the same parts in both embodiments shown in FIGS. 1 and 2. The device projects through a protection wall disposed between the hot cell H and the working space K. The protection wall is equipped with an observation window 2 and with a hollow carrier 3 which is guided through the protection wall, and also a control arm ST consisting of an upper arm 4 and a lower arm 5, which includes an operating grip 6. The device comprises further a follower arm F including an upper arm 7 and a lower arm 8, which is equipped with a gripping tool 9.

In the embodiment disclosed in FIG. 1, the hollow carrier disposed in the working space K is equipped with an end piece 10 which is angularly bent downwardly, on

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which end piece 10 the upper arm 4 of the control arm ST is pivoted by means of a pivot G. Between the upper arm 4 and the lower arm 5 is disposed the pivot point 11 which renders possible a bending in the direction towards the protection wall. For a parallel transmission of the bending and swinging movements of the follower arm F serves a chain drive, which comprises sections 14 of a flat link articulated chain within the range of reversing rollers 13, while intermediate connecting rods 15 are provided which simultaneously serve as tensioning members. The other transmission means (not shown) comprise in known manner rollers and pulling ropes.

The structure as disclosed in FIG. 1 permits, without difficulty, to swing the control arm ST and, thereby, also the follower arm F into the shown horizontal position and, as indicated in dotted lines, to swing beyond that and to reach from the top to the bottom the entire range of the hot cell with the gripper 9. It is essential thereby, that also the space below the hollow carrier 3 still can be covered as it is indicated by the position of the swinging points S of the gripping tool 9. The points S' of the control arm ST correspond to these positions.

While, in the embodiment disclosed in FIG. 1, corresponding with the lower position of the pivot point G for the control arm, the hollow carrier 3 is disposed at a certain minimum height and is thus suitable for working in cell spaces which are designed particularly in vertical direction with a long follower arm, in accordance with the arrangement of FIG. 2, the hollow carrier 3 can be disposed lower, since here the pivot point G for the control arm ST is arranged about in the axis of the hollow carrier.

In order to make possible that the control- and the follower-arm can swing as much as possible in upward direction, in this embodiment the hollow carrier is open at the bottom on the control side and is equipped with a receiving chamber 18 for the upper arm 4 and a portion of the lower arm 5. By this arrangement, the upper arm 7 of the follower arm F can be moved upwardly beyond the horizontal, so that the lower arm 8 with the gripping tool 9 can reach from the top to the bottom in a wide range of the cell. The positions of the gripper designated with S indicate the uppermost and the lowermost acceptable range in the immediate vicinity of the protection wall. The points S' of the control arm ST correspond with these positions. Corresponding with the lower position of the hollow carrier 3 relative to the embodiment according to FIG. 1, in the embodiment disclosed in FIG. 2 the follower arm can likewise be shorter than in the previous case.

The transmission of the swinging movements takes place here likewise by means of a chain drive 13, 14 and 15 and jointly with the rotary gripping movements by means of pulling ropes 19 and rollers 20 and 21 to the follower arm. The rope pulleys 20 are disposed at such height in the chamber 18, that the control arm can swing without difficulty in this chamber 18.

The embodiments of the present invention disclosed in FIGS. 1 and 2 indicate, first of all, the advantage that

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in small measurements of the main parts, all practically important ranges of the cell space are accessible, whereby the operator is continuously in the vicinity of the observation window and due to the shortened control arm only short working movements have to be performed. Furthermore, the device requires little structural space, is easily assembled and disassembled and is hardly subject to any disturbances.

While I have disclosed two embodiments of the present invention it to be understood that these embodiments are given by example only and not in a limiting sense, the scope of the present invention being determined by the objects and the claims.

I claim:

1. A remotely operating device for working in non-accessible spaces, comprising
 - a hollow carrier containing transmission means and adapted to be guided through a protection wall,
 - a control-arm and a follower-arm pivotally connected by pivots with said hollow carrier,
 - each of said arms including an angular pivot and dividing said arms into an upper arm and a lower arm and permitting parallel movements thereof,
 - said angular pivots permitting a bending of said control arm in the direction of said protection wall,
 - and a swinging with its upper arm beyond a horizontal position into a chamber defined by said hollow carrier,
 - the spacing between the protection wall and the follower arm pivot on the carrier being substantially shorter than the spacing between said wall and the control arm pivot on said carrier,
 - said control-arm being shorter than said follower-arm.
2. The remotely operating device, as set forth in claim 1, wherein
 - said hollow carrier forms an angle downwardly on the control side, so that the pivot point of said control arm with said hollow carrier is disposed so far below the horizontal axis of said hollow carrier, that said upper arm thereof is swingable beyond its horizontal position.
3. The remotely operating device, as set forth in claim 1, wherein
 - said hollow carrier defines a chamber open within the range of the swinging path of said control-arm, and said transmission means are disposed above said control-arm swinging into said chamber.

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