

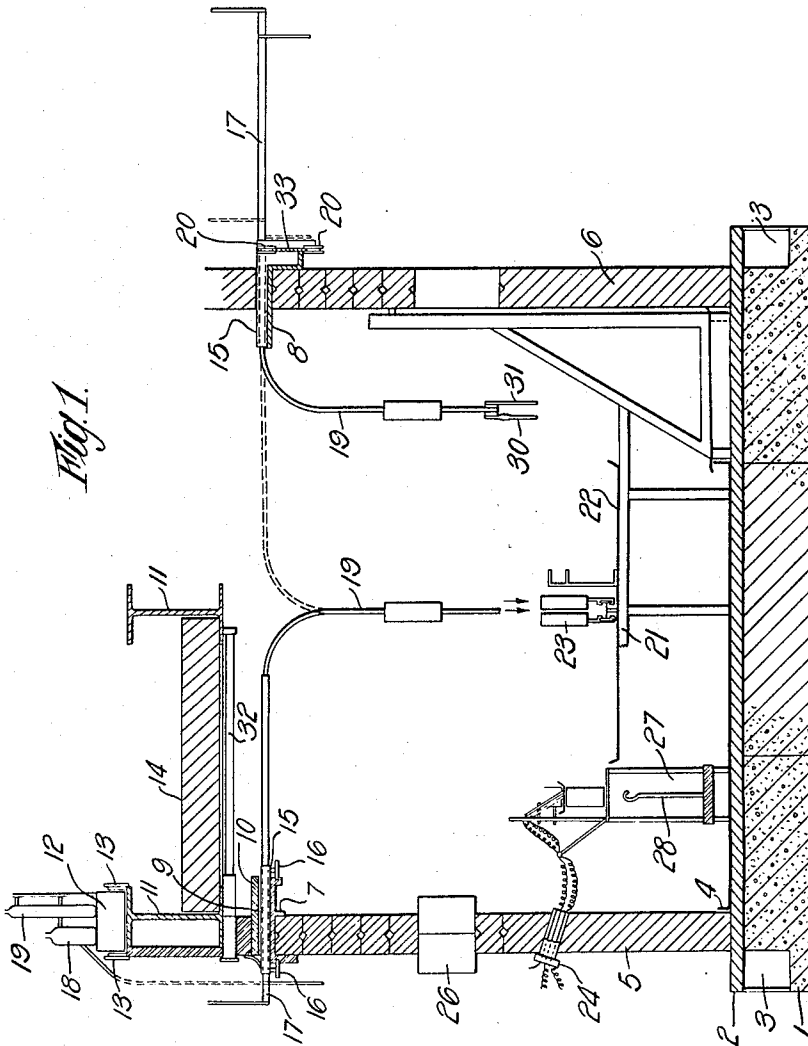
Oct. 4, 1960

A. J. HOWARTH ET AL
REMOTE HANDLING MANIPULATORS

2,954,880

Filed July 17, 1957

4 Sheets-Sheet 1



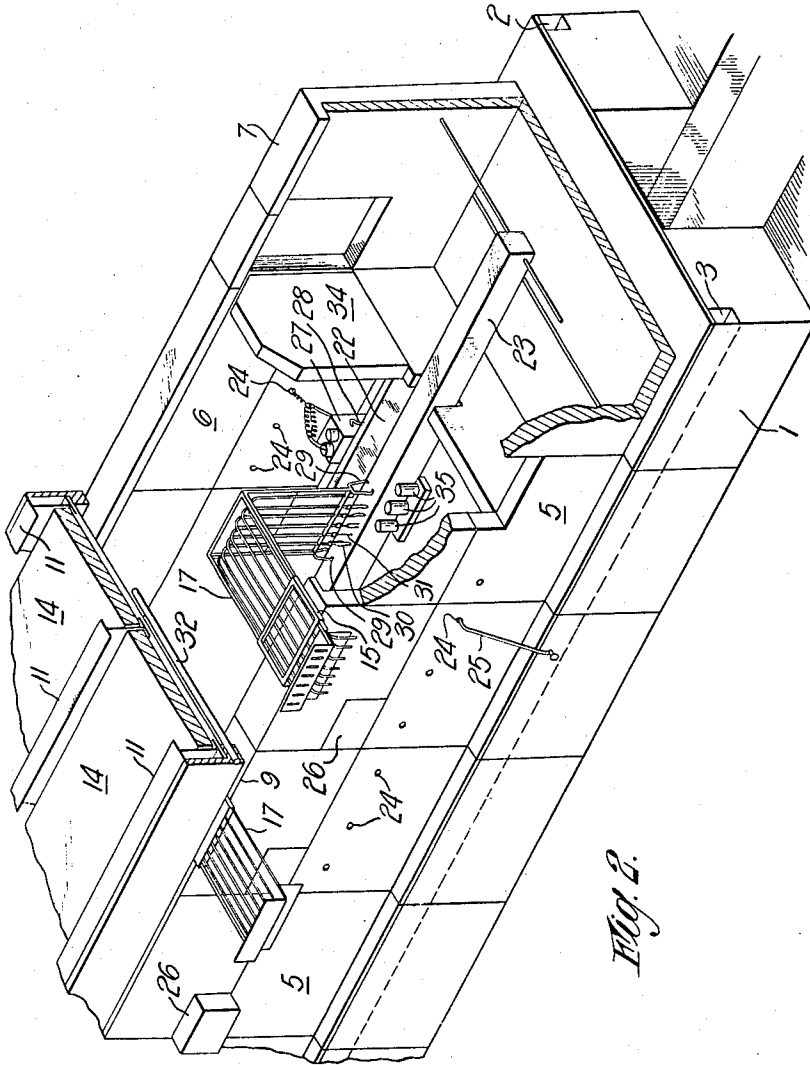
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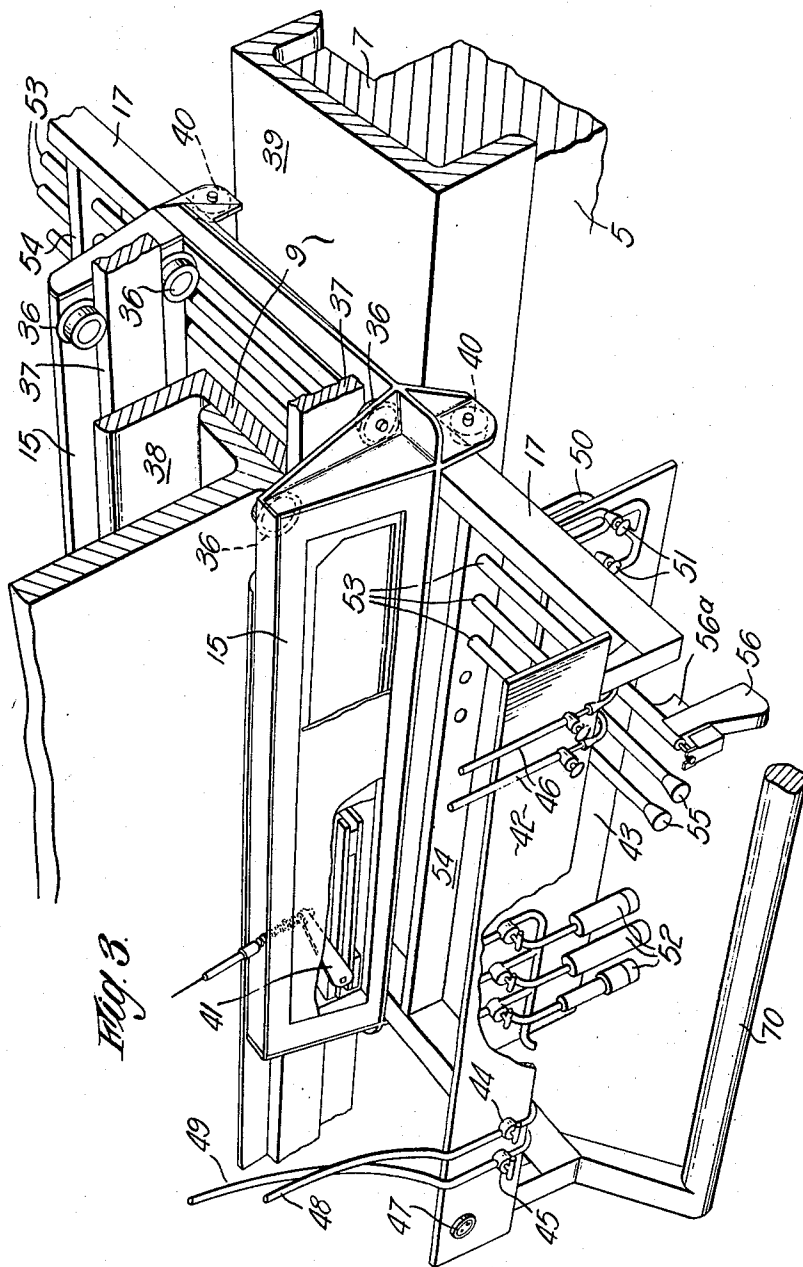
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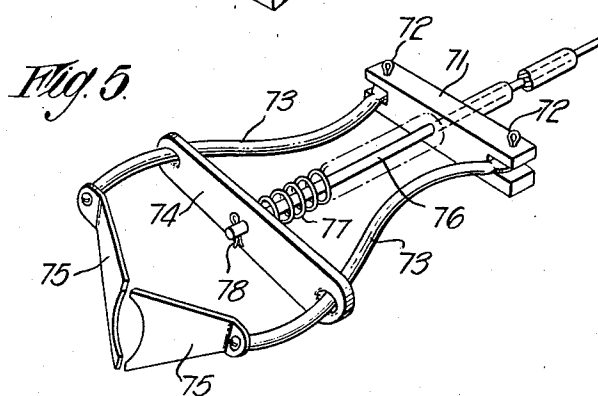
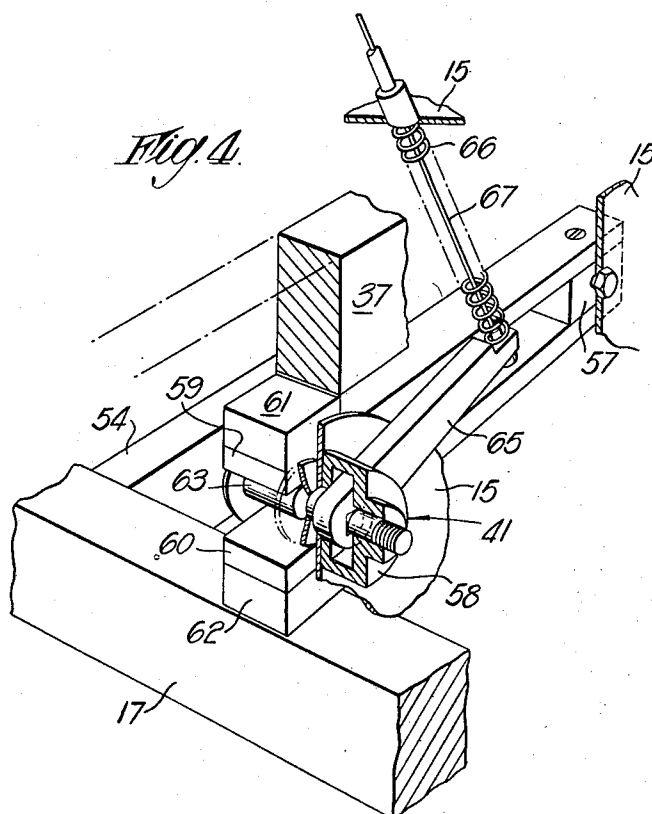
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REMOTE HANDLING MANIPULATORS

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5 Claims. (Cl. 214—1)

This invention relates to remote-handling manipulators for handling radioactive materials, and is particularly concerned with such manipulators for handling substances emitting gamma rays in shielded cubicles.

The usual remote-handling manipulators for dealing with substances emitting gamma rays are provided with shielding material, such as walls of concrete, steel or lead of appropriate thickness to attenuate the gamma rays to a safe level. Handling of the substances is carried out with tools operating through the shielding through the medium of a ball and socket device. The range or degrees of freedom of such tools are limited and where shielding walls exceed about four inches in thickness or are made of lead, their use is not satisfactory. Complicated devices have been developed which provide seven degrees of freedom of movement simulating nearly all the motions of the human arm and hand, which devices are of use only for gripping purposes, but the devices are very expensive.

The object of the present invention is to provide a relatively simple and inexpensive remote-handling manipulator which is suitable for use with shielding walls of lead or other materials exceeding 4 inches in thickness.

In accordance with the invention a remote-handling manipulator for handling radio-active substances comprises a shielded cubicle, a carriage moving on rails and supporting a gantry, which carriage moves in an elevated narrow horizontal slot in a shielding wall of the cubicle, the gantry carrying a number of flexible controls, operable from the outside of the cubicle, and being capable of movement transverse to the direction of movement of the carriage.

The gantry carries a number of vertical slides provided at their ends with handling or treating equipment, for example tongs, hooks, pipettes, or gaseous or liquid feed points. Some of the equipment, for example pipettes may be operated by air movement and may be picked up or put down at will by means of a detachable head.

The vertical slides may be operated by a row of push buttons. Other controls, for example taps to control liquid flow, valves or pistons to control pressure lines are mounted on operating panels above or below the push buttons.

The manipulator is normally held in any desired position by braking means, and is released for movement by a twist grip control on the handle.

The manipulator carries a lighting system fed by a travelling power feed line on the outside of the cubicle. Any liquid reservoirs and other services may be fed and carried on a trolley linked to the manipulator but mounted separately on rails fixed to the roof of the cubicle.

The cubicle slot ends in a servicing bay at the "cool" end of the cubicle and the manipulator is so arranged that the cross slides can be withdrawn from the carriage for maintenance purposes. Other designs of handling equipment may be introduced accordingly, for example lifting devices for introducing or removing heavy objects.

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The following are examples of ways of carrying the invention into effect reference being made to the accompanying drawings in which:

Fig. 1 shows in vertical cross-section a diagrammatic form of cubicle provided on front and back walls with a remote handling manipulator.

Fig. 2 is a cut-away perspective view of the cubicle of Fig. 1 and

Fig. 3 is a perspective view of the gantry and carriage on a larger scale showing some controls of the handling equipment and an alternative mounting of the wheels of the carriage.

Fig. 4 is a detailed perspective view of the brake mechanism.

Fig. 5 is a perspective view of tongs which may be employed with the invention.

Referring to Fig. 1, concrete base blocks 1 support a mild steel plate 2 which constitutes the floor of the cubicle. Ducts 3 in the base are provided for services. A tray 4 of stainless steel or polythene covers the whole of the floor within the walls 5 and 6. The latter may be built of inter-locking lead bricks 4 inches in thickness at the hot portion of the cubicle while at the cool end the bricks may be of cast iron of the same thickness. At the top of the walls 5 and 6 are provided iron copings 7 and 8, the upper faces of which define the lower face of a slot 9, which is approximately one inch wide and at about six feet from the level of the operational floor (Fig. 2). The upper face of the slot 9 is defined by a lintel 10 attached to the upper wall portion of the cubicle, which upper wall portion is suspended from the left hand girder 11 which is one of the supports of roof blocks 14, which may be of cast iron, 4 inches thick. The girders 11 run the length of the cubicle and are supported by the end walls of the cubicle. The left hand girder 11 supports a trolley 12 running on wheels 13. The trolley serves to carry supplies of liquid reagents 18, or gases 19, to desired points on the working face of the cubicle, and is preferably linked by a light chain (not shown) to a carriage 15.

Within the slot 9 is arranged the carriage 15 which in the case of the carriage at the left hand side of Fig. 1, is provided with two pairs of horizontal wheels 16 which run in slots in the coping 7. The carriage takes the form of a flat rectangular box, the transverse walls of which are open to receive freely a gantry 17 carrying vertical slides 19.

In the alternative arrangement at the right-hand side of Fig. 1, the coping 8 is provided with a rail 33 to engage vertically disposed wheels 20.

Within the cubicle a bench 21 is provided as shown and on it a working tray 22 of stainless steel or polyethylene. A rail system indicated at 23 allows of substances for treatment or examination to be moved along the length of the cubicle.

The arrangement of the gantry and the slides is shown in Fig. 2, the left-hand gantry 17 being shown withdrawn and the other gantry 17, being shown pushed in. At the ends of the vertical slides are indicated handling equipment, for example tongs 29, and pipettes 30. Vessels 35 contain solutions to which reagents may be added for the pipettes.

Plugs 24 are provided to enter holes in the walls 5 and 6, the plugs having openings through which cables for carrying electric current may be passed into the cubicle for example as at 25.

Windows of lead glass 26 in the wall allow of operations being watched by an operator. Internal lighting is obtained from fluorescent tubes 32, entering openings in the upper walls above the slot 9.

At 27 is indicated a complete treatment unit, which is

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provided with hooks 28 which may be engaged by similar hooks from a gantry carried by a carriage of the kind described and moved along the cubicle.

The wall 34 is a permanent wall, which serves to shield the "cool" end of the cubicle.

In the form shown in Fig. 3, the carriage 15 is mounted within the slot 9 and is provided with four pairs of vertically disposed wheels 36 (two pairs only being shown), which engage on rails 37 mounted on a rolled steel channel 38 the web of which also forms the upper face of the slot 9. The lower face of the slot 9 is provided by a similar channel inverted and resting on the coping 7 of the wall 5.

The carriage 15 which moves along the slot 9 is provided with two pairs of rollers 40 (one pair only being shown) which support the gantry 17 and permit a lateral movement of the said gantry carrying the horizontal and vertical slides.

The operator's end of the gantry 17 has mounted upon it an upper fascia 42 and a lower fascia 43 for carrying controls and facilities.

In the arrangement shown the upper fascia 42 carries control taps 44 for the supply of liquid reagent by way of tube 48, and control tap 45 for the supply of gases by way of pipe 49 to desired points on the working bench. Calibrated reservoirs 46 and electrical point 47 may also be carried.

The lower fascia 43 carries the compressed air feeds 50 and 51.

Between the fascias 42 and 43 and within the gantry framework, control means 53 for the vertical slides 19 are located by and attached to a series of transverse tie members 54. The controls 53 have push buttons 55 which are pushed desired amounts to position or actuate a device within the cubicle. The link from the push button 55 to the vertical slide 19 is a continuous rod having a flexible section to facilitate movement round the bend to the vertical. Coil springs (not shown) concentric with the rods are provided to return the rods when finger pressure is removed. The pistons 52 are air controls to pipettes carried on the vertical slides from which pipettes measured volumes of reagent may be injected into vessels on the working bench, by actuation of the piston by a screw or push rod. A pistol grip 56 may actuate handling equipment, for example, tongs 29 and pipettes 30.

Referring to Figs. 3 and 4, a brake 41 is mounted on the carriage 15 by the fixing block 57 and the support bush 58. A fork member having an upper arm 59 and lower arm 60 carries at its outer ends friction pads or brake shoes 61 and 62 which are in surface contact with the rail 37 (Figs. 3 and 4) and the gantry 17.

The arms 59 and 60 normally deflect inwardly towards each other and away from the friction surfaces 37 and 17.

A cam 63 located between the arms 59 and 60 tends to keep the friction surfaces 61, 62 in engagement, the cam 63 being actuated by the lever 65 under the action of a compression spring 66 located in the carriage 15.

A "Bowden" wire control 67 is provided to compress the spring 66 and allow the fork members to move inwardly and the brake shoes 61, 62 to move out of engagement with the surfaces 37 and 17.

The support bush 58 fixed to the carriage 15 has a cut-away portion (not shown) to allow for angular displacement of the brake lever 65 which is keyed to the cam 63.

The brake is thus normally in the position to prevent

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movement of the carriage and gantry and is released by the operator by a twist grip control on the handle 70 when he wishes to change the position of either of these.

By way of example a form of tongs which may be employed is illustrated in Fig. 5.

The tongs comprise a saddle portion 71 slotted at each end to receive cotters 72 which pass through openings in the ends of arms 73. The latter pass through chamfered openings in a slide 74 and are attached by screws to jaws 75. The saddle 71 and the slide 74 each have a central hole to receive freely a rod 76 which is drilled towards the jaw to receive a cotter 78. A compression spring 77 bears on the saddle and slide. A portion of the rod 76 extending above the saddle is brazed to the core of a "Bowden" cable the other end of the core being attached to pistol handle 56 (Fig. 3) so that when the actuator 56a is pressed backward by the finger of the operator the slide 74 will be drawn against the action of the spring 77 to spread the arms 73 and open the jaws 75. Release of the actuator when the jaws are about an object will result in the object being held. By movement of the carriage and the gantry the object may be moved to another position on the working bench.

We claim:

1. A remote-handling device for handling radioactive substances and the like, comprising a shielded cubicle having an elevated narrow slot in a side wall thereof, a carriage mounted for movement in said slot, rails mounted on the cubicle for supporting said carriage during its movement, a gantry mounted on said carriage and movable therewith, a plurality of control means mounted on said gantry for movement with the gantry and for movement transversely to the direction of movement of said carriage, a manipulator associated with said control means within said cubicle, said control means including mechanism operable from the outside of said cubicle for operating said manipulator.

2. A remote-handling manipulator as claimed in claim 1 wherein the carriage and the gantry are provided with releasable braking means operable from the outside of the cubicle to simultaneously hold the carriage and the gantry in any desired position.

3. A remote-handling manipulator as claimed in claim 1 wherein a supply trolley mounted on rails fixed to the roof of the cubicle is provided, the supply trolley being linked to the carriage so as to follow the movement of the carriage.

4. A remote-handling manipulator as claimed in claim 1 wherein one end of the slot provides access to a servicing bay and the gantry is arranged so that the flexible controls may be withdrawn for maintenance within the servicing bay.

5. A remote-handling manipulator as claimed in claim 1 wherein a rail system is provided within the cubicle and arranged so that substances for treatment and examination may be moved along the length of the cubicle.

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