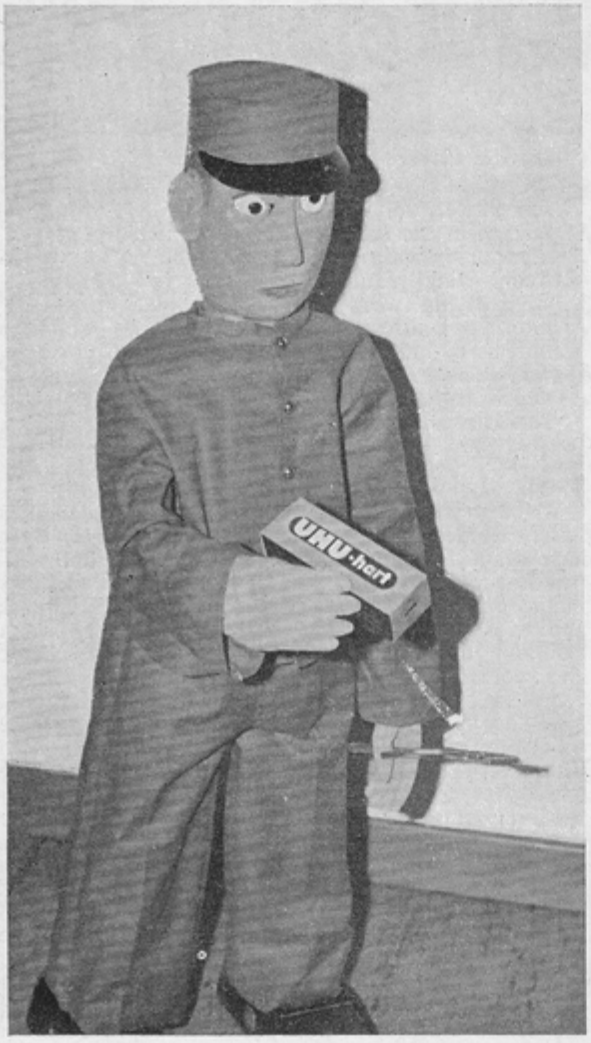
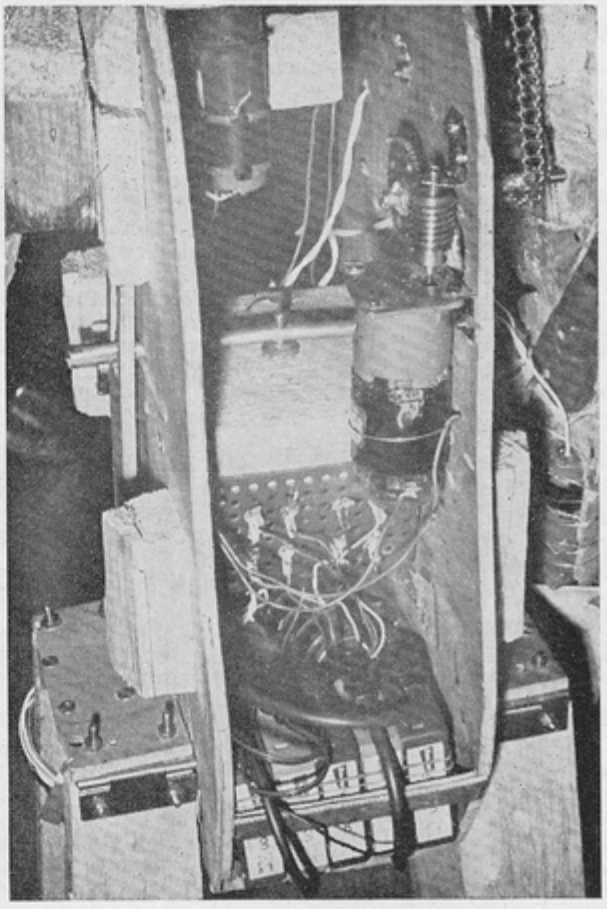


KUNIBERT

The R/C Robot . . . 14 Control Functions from a Grundig 8 Outfit

By the late L. Hilderbrand

Left: "Kunibert" operates the right hand, left is not powered. Below: "Kunibert" in the nude, head motor can be seen top left, shoulder motor centre right. Tag board and DEAC in the dining room area with the Grundig R/C system in the "sitting room".



THERE was a polite tap on the door and a discreet whirring sound, in walked "Kunibert". He wore a blue uniform with brass buttons and a pill-box hat . . . he was nearly 3 ft. high. "Kunibert" is a robot and was built by L. Hildebrand a German radio control enthusiast. To be waited upon by a robot "butler" can really make one's evening!

Your editor, himself a robot enthusiast, immediately asked for more details, the *Model Maker* Mr. Robottom was tame indeed by comparison, even the radio controlled version could only walk and steer and "Big Brother Robottom" could write his name. Kunibert has "muscles" in his shoulder, forearm, wrist and hand. He can shake his head, move backwards or forwards and steer left and right. All this is accomplished with a standard Grundig 8 outfit and some very crafty additional relay "switchcraft". The right arm is motorised the left merely hangs free. The uniform which he wears covers the mass of machinery necessary to move the upper and forearm and wrist.

A similar principle to that employed on the "Mr. Robottom" robots has been used for operation of the legs. Two parallelograms of balsa form a stiff kneed leg mechanism, secured each end with small brass hinges fixed at the upper end to plywood hip

brackets which are additionally reinforced with block balsa. The upper ends of the forward leg "bone" carry plywood levers which engage in a transverse motion equaliser tube. This, as in the Robottom model, bisects the angle of deflection of both legs; so by halving the motion thereof, maintains the trunk in a vertical position.

The hinges at the lower end of the leg "bones" are screwed to ply plates which form the top of two box like feet which run on 2½ in. diameter wheels. Both wheels on each foot are chain driven from a geared Milliperm. The foot motor batteries are also carried in these boxes.

The trunk houses the receiver and relays, a DEAC 225 pack, a Milliperm and gearbox which operates the right shoulder and a Microperm and gearbox which moves the head. The two side cheeks of the trunk are $\frac{3}{16}$ in. plywood and top, centre and lower ½ in. sheet balsa spacers make a rigid structure.

The shoulder gearbox output shaft carries a worm which drives a 40 tooth gear mounted on a shaft which projects through the side cheek. A chain drives a large sprocket wheel on the upper end of the right arm and produces a fore and aft motion from the shoulder. The arm cannot move out away from the body sideways, to do so would unbalance "Kunibert" if he carried anything heavy. The upper arm has another Milliperm gearbox and worm reduction drive this time with an 80 tooth gear. A flat metal hinge forms the joint here an additional bearing surface is offered by a brass tube to which the gear is soldered (part 55). Operation of the elbow motor bends the elbow in the same plane as the upper arm, no lateral twist is incorporated.

The forearm carries a Microperm motor and gearbox which rotates the hand axially via 1:1, 10 tooth spur gears (62 and 63). The hand turns on a piano wire spigot and a brass tube (65) in the forearm, its joint with the hand is reinforced with a brass strap (66) soldered to the spigot.

In the palm of the hand there is a "Servo Auto-Matic". The thumb (59) reinforced with a ⅛ in. ply centre lamination is screwed to the output lever of this servo and moves inwards to grip articles.

The head is mounted on a ⅛ in. diameter rod running in a brass bush which has a flange for fixing it to the top trunk spacer (44). Additional 5:1 gearing turns the head.

All seven motors (14 functions) are controlled by the use of simultaneous operation of pairs of the eight channels available in the Grundig outfit. These may be obtained as follows (see Fig. 1).

Channels 1 and 2 operate two 4 pole changeover relays (RL3, RL4).

Channels 3 and 4 operate the foot motors (one to each channel).

Channels 5 and 6 operate two additional relays (R01, R02), these switch the foot motors in reverse (one channel to each foot).

Channels 7 and 8 operate the head motor turning it from left to right or right to left depending on which channel is operating.

The remainder of the controls are operated simultaneously with either channel 1 or channel 2 so that with channel 1 in operation:

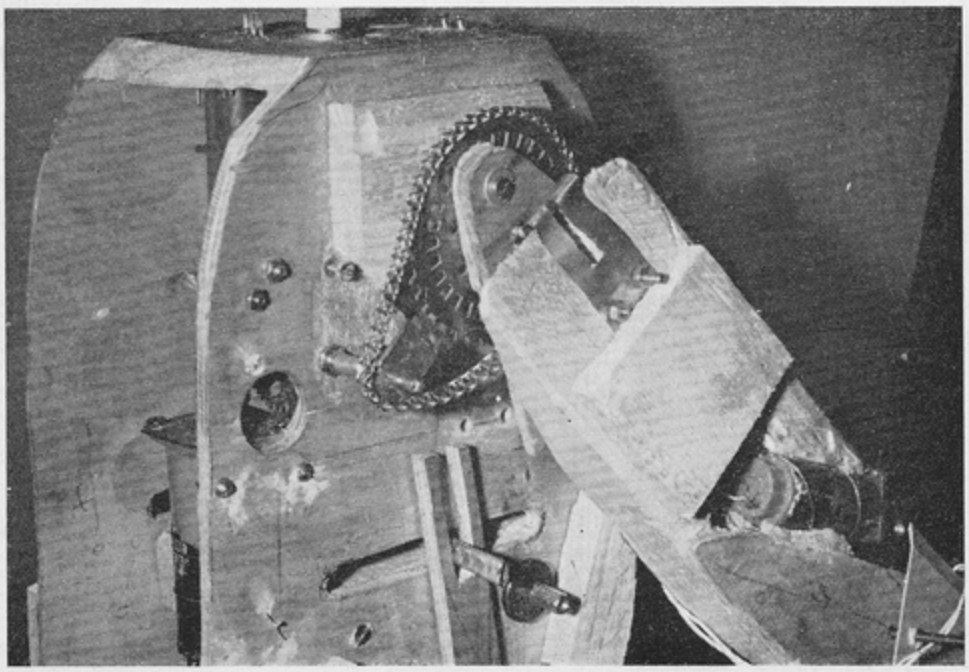
Channel 5 is transferred to rotating the wrist clockwise and channel 6 rotating it anti-clockwise (via the N.O. contacts of RL4).

Channel 7 opens the hand and channel 8 closes it (via the other pair of N.O. contacts of RL4).

Operating channel 2 (RL3) channel 5 raises the upper arm, channel 6 lowers it (via N.O. contacts of RL3).

Channel 7 lifts the forearm and channel 8 lowers it via the N.O. contacts of RL3.

All this may sound complicated but when it is remembered that the control levers move the selected motor in one direction, and in the opposite direction when the same lever is moved in the opposite direction. The only additional commands to remember are the two "change function" channels (1 and 2) which working on the same modulator as the foot motor controls it can be operated simultaneously with the hand, arm, wrist, shoulder and head commands.



Right: Shoulder drive shows well in this shot, the elbow actuator can be seen right and the leg motion equalising lever engaging in the slotted upper leg extension can be seen lower centre.

None of the motors self centre, so any control can be left in the selected position while others operate.

Bi-simul systems offer great possibilities for multiple controls in robots and other associated devices, the simple change function relays might be worthy of copying in the more sophisticated model warships where in the past Uniselectors and stepping selectors have been employed. One could in fact have nearly 30 functions from a triple select 12 channel bi-simul outfit but just think what you could do with a triple simul system such as Metz 10/4 or Telecont.

Multiple pole changeover relays are readily available, the Radiospares type 21 has 4 pole changeover contacts and 150 ohm coil. They are used in some of the boat control circuits which appeared in the March issue of *R.C.M. & E.*

PARTS LIST

Ref.	No. off	Item	Material	Size (mm.)
1	2	Body sides	Plywood	315 x 155 x 5
2	1	Top spacer	Balsa	105 x 80 x 10
3	1	Middle spacer	Balsa	155 x 80 x 15
4	1	Bottom spacer	Balsa	125 x 80 x 10
5	1	Hip plate	Plywood	180 x 35 x 5
6	4	Small hinge		35
7	4	Large hinge		40
8	2	Extension lever	Plywood	230 x 50 x 5
9	1	Bolt	Mild steel	30 x 5 dia.
10	1	Tube	Aluminium	170 x 7 dia.
11	2	Front leg	Balsa (hard)	360 x 60 x 20
12	2	Back leg	Balsa (hard)	360 x 60 x 20
13	2	Foot base	Plywood	275 x 65 x 5
14	4	Foot side	Plywood	213 x 58 x 5
15	2	Toe block	Balsa	66 x 65 x 40
16	2	Foot top	Plywood	93 x 75 x 5
17	2	Walking motor	Monoperm	With gearbox (32:1)
18	2	Chain wheel	Commercial	10 teeth
19	4	Chain wheel	Commercial	40 teeth
20	4	Axle	Brass	75 x 4
21	8	Spacer tube	Aluminium	5 inside dia.
22	2	Top	Plywood	75 x 50 x 5
23	1	Switch	Commercial	Double pole
24	2	Chain	Commercial	18/19
25	4	Wheel	Commercial	60 dia.
26	1	Shoulder motor	Monoperm-Super	With gearbox (32:1)
27	1	Motor bracket	Aluminium	62 x 42 x 1
28	1	Drive shaft brkt.	Aluminium	25 x 12 x 2
29	1	Shoulder spacer	Balsa	63 x 63 x 15
30	1	Shoulder axle	Alumin./brass	50 x 6 dia.
31	1	Output shaft bracket	Alumin./brass	95 x 20 x 2
32	1	Output shaft bearing	Alumin./brass	15 x 6 dia.
33	1	Axle	Brass	40 x 4 dia.
34	1	Worm	Commercial	
35	1	Gearwheel	Commercial	40 teeth
36	1	Chain wheel	Commercial	10 teeth
37	1	Chain wheel	Commercial	40 teeth
38	1	Chain	Commercial	Meccano or equivalent
39	1	Spacer plate	Plywood	40 dia. x 5
40	1	Shoulder plate	Plywood	60 x 60 x 5
41	1	Head motor	Milliperm	(32:1)
42	1	Pinion	Brass	10 teeth
43	1	Head bearing	Brass	20 x 6 dia. with flange
44	1	Head axle	Brass	25 x 5 dia.
45	1	Gearwheel	Iron	50 teeth
46	1	Head top	Balsa	170 x 130 x 20
47	2	Head front & back	Balsa	170 x 110 x 20
48	2	Head side	Balsa	150 x 95 x 20
49	1	Top of arm	Balsa	130 x 60 x 30
50	1	Elbow motor	Milliperm	(32:1)
51	1	Worm	Commercial	
52	1	Gearwheel	Iron	80 teeth (zu No. 51)
53	2	Elbow bearing plate	Plywood	85 x 48 x 5
54	1	Elbow axle	Aluminium	30 x 4 dia.
55	1	Bush	Brass	20 x 5 dia.
56	1	Forearm	Balsa	135 x 55 x 25
57	1	Right hand	Balsa	157 x 55 x 25
58	1	Thumb motor	Servo automatic	
59	1	Thumb	Plywood	80 x 30 x 5
60	1	Shoulder spacer on arm	Balsa	60 x 60 x 20
61	1	Wrist motor	Milliperm	(32:1)
62	1	Pinion	Brass	10 teeth
63	1	Pinion	Brass	
64	1	Wrist axle	Piano wire	
65	1	Wrist bearing tube	Brass	1 mm.
66	1	Hand support	Brass	15 x 90 mm. (soldered to 65)

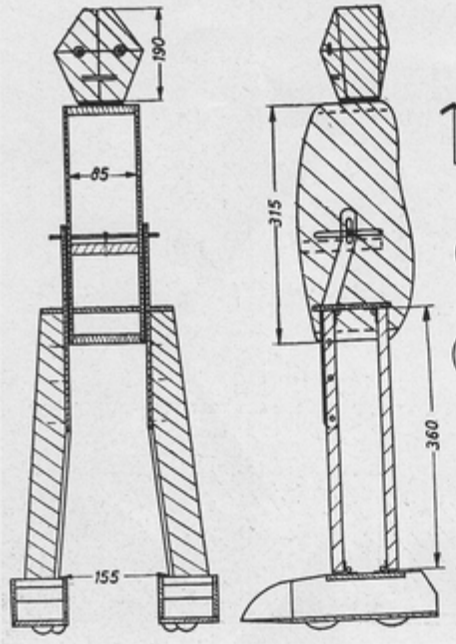
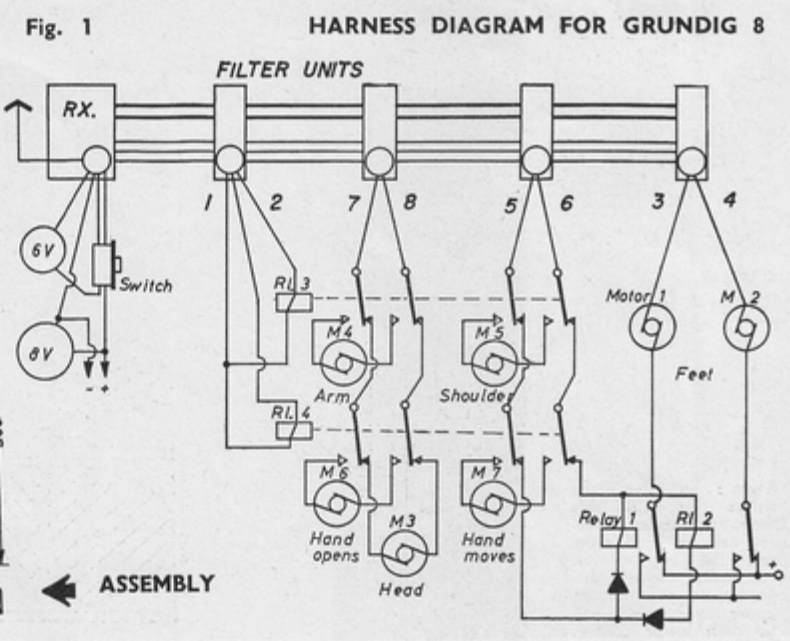
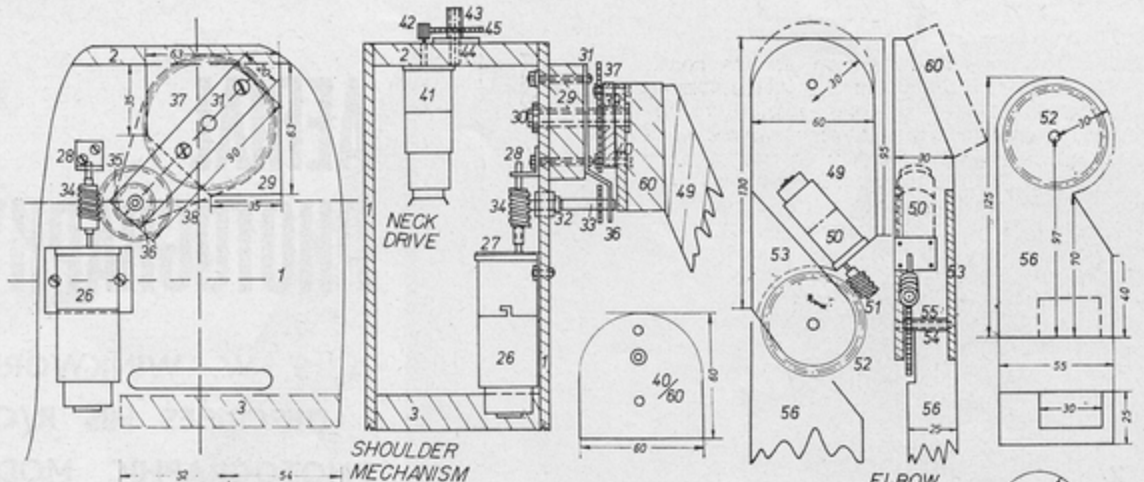


Fig. 1





PARTS AS USED ON

"KUNIBERT"

See list opposite.

Scale : ¼ full size.

Dimensions in mm.