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ELECTRONICS TODAY INTERNATIONAL

ROBOTS

they're here !

...for home, education and personal use.

Microbee multiPROM interface

VIC·20 program potpourri

Yamaha MT44 home studio

TOPO
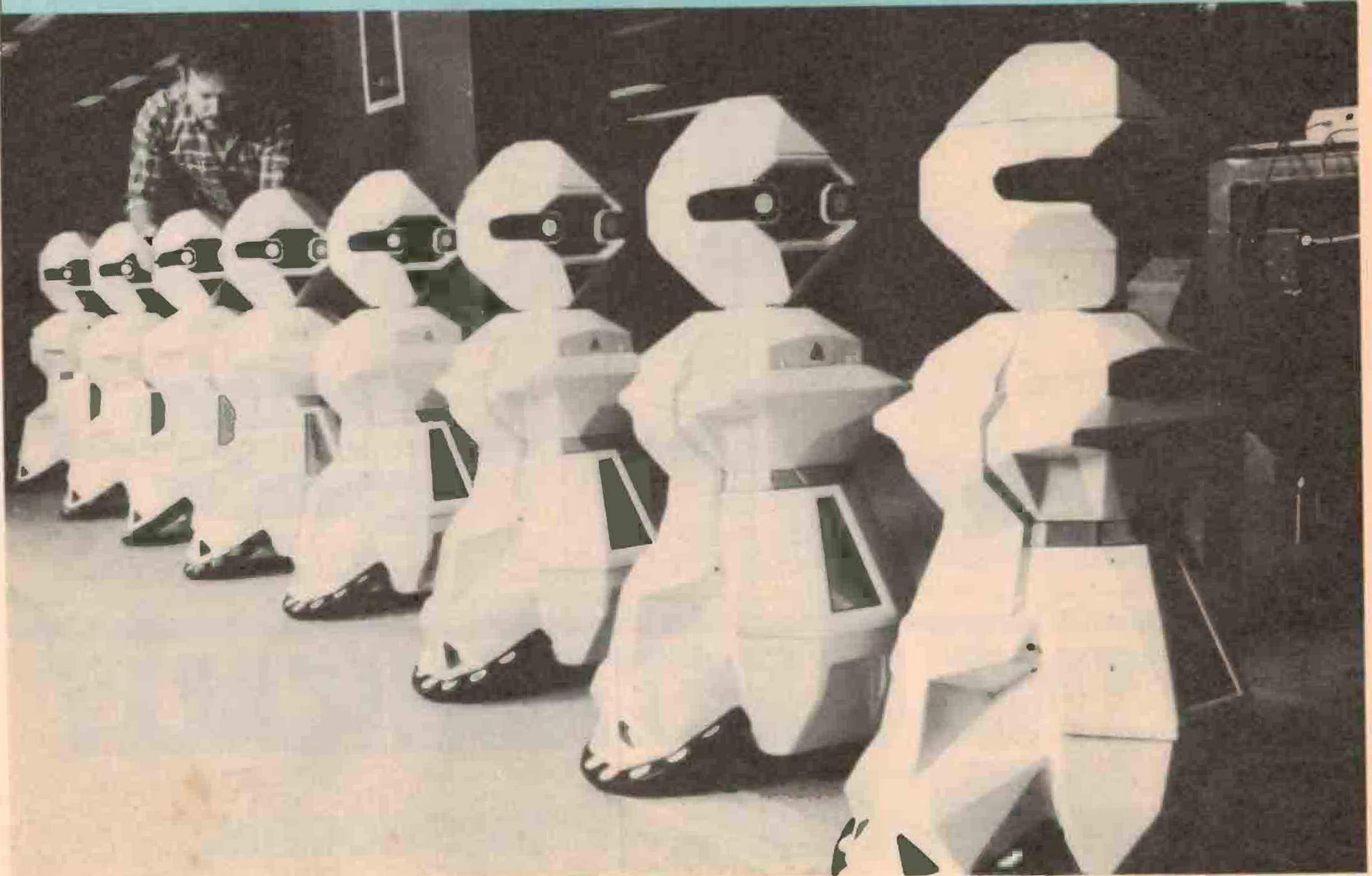
New 25·550 MHz scanner

Perreaux hi·fi system

The robots aren't coming — they're here!

Dennis Lingane

The man who started the electronic games boom and rode the crest of the home computer wave, Nolan Bushnell, the founder of Atari, seems set to repeat his past performance with a venture into personal robots. Dennis Lingane interviewed him at the Chicago Electronics Show in the US a few months back.

WITHIN FOUR YEARS it will be a common sight to see robots of various sizes following their owners down the streets to carry the shopping. At home, the same robot will vacuum the lounge on command or serve savouries and drinks to dinner guests and will even trundle round the swimming pool picking up and delivering frosty beer cans to sunbathing homo-sapiens.

That's the future according to Nolan Bushnell, recognised as one of the top electronics entrepreneurs in this business. He started Atari in a small garage in Silicon Valley and then sold it a few years back to the giant Warner Corporation for $27 million.

Bushnell moved on to open Pizza Showtime Theatres around the US which combined a pizza parlor with an electronic games arcade for the whole family. Two years ago he launched a new company called Androbot and started to develop 'house trained' robots. Some of the top robotics engineers in the US rushed to join him because of his reputation for pioneering new technology and making it work.

In the last few months the first of the Bushnell robots became available on the consumer market. They're capable of doing limited household chores — but they don't do windows.

"They could," says Bushnell, "But I am sick of people asking me if they can, and anyway, why should robots do windows when domestics won't."

Your android pet

With their limited abilities, the robots are being bought now as a novelty by computer hobbyists and as household pets by those who like to have something different.

And why not as pets? Bushnell says that robots could easily replace dogs as a household pet.

"Well, most people buy dogs to take them for a walk as an excuse to meet the opposite sex," says Bushnell. "The robot can be taken for walks instead and is bound to attract more attention than a dog."

The robot would also be able to bark if need be as part of a passive security system, and even call the police (something dogs can't do) if somebody broke into the house. Robots don't need feeding and watering and don't mess up pavements and gardens, all adding weight to Bushnells' argument that robots could replace dogs.

Switching to more serious applications, he says that robots will be used in hospitals in increasing numbers to deliver tablets and medicine to patients. Another robot engineer says that robots will be used by police to go up against armed gangsters, and used by firemen to rescue victims from fires.

Now and the future

The real future of robots is in the home, says Bushnell, and within four years we will be buying them off the shelf with the same enthusiasm we buy video recorders these days.

Bushnell says that in four months of trading he has already sold several thousand robots to computer hobbyists and people who want to be the first on the block.

His current range of robots include: *FRED*, a US$250 250mm high robot that can be controlled either from a home computer or an infrared control; *Topo*, a full-sized robot controlled by a computer, but which can also be voice controlled, and maps out your home; and *BOB*, an independent 'intelligent' robot that comes when it is called and can differ between humans and furniture.

FRED is a beginners robot. He has been developed to help children learn about robots as a cheap add-on to a home computer system. He can hold a pen and has downward facing sensors to make sure he doesn't roll over the edge of a table or staircase. With his pen he will duplicate patterns you draw on the screen of your computer. He can also be controlled by a joystick through the computer. A voice module with a 45-word vocabulary is available as an add-on.

Next up the scale is Topo. He has most of the FRED features but is around one metre high and can memorise the layout of your home. So if you take him over a route all you need is to give the specific command related to that route and off he goes.

For example, if you have guests on the patio you can load up Topo with drinks and snacks in the kitchen and say "Patio Topo" and he will trundle out to the guests with his load following the route you previously 'walked' him over and taught him was 'patio'.

When his tray has been emptied by the guests somebody on the patio simply says "Kitchen Topo" and he returns to the kitchen for his next load or to return the dirty dishes and glasses.

Topo can also be voice-controlled via a home computer to get him through areas that he doesn't know. You tell him forward, back, left, right, etc. Topo sells for around US$500, voice synthesis and voice control lifting the price to around US$750.

Nolan Bushnell, the Chairman of Androbot (above). The 'big daddy' of BOB, Topo and FRED, he is shown revealing the 'brains' of BOB.

Beer, Norm? (below). Norm can now live life to the fullest in front of his TV and won't even have to move, with this friendly robot at his beck and call.
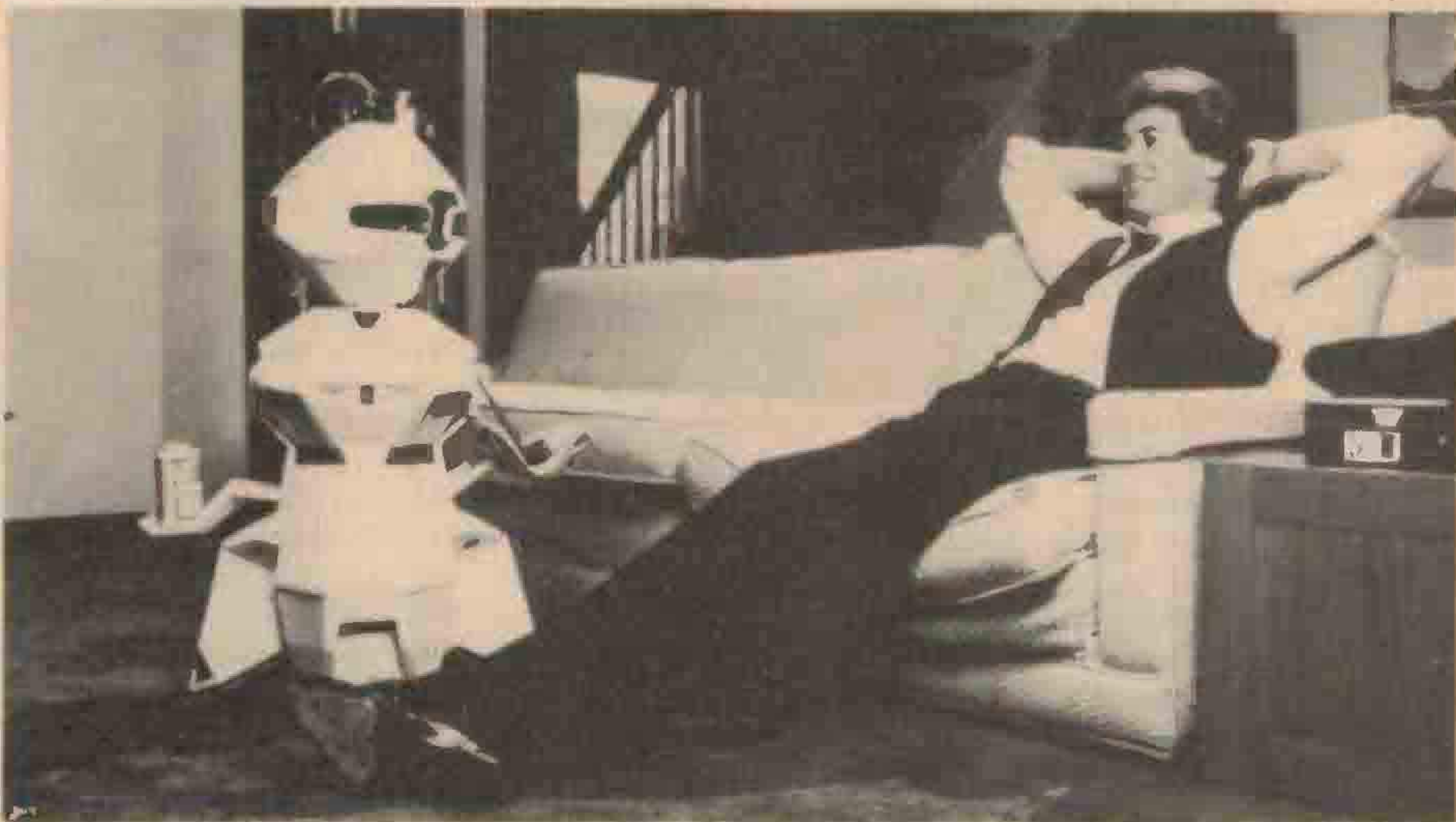
Robots in the classroom. These educational devices can be programmed to teach almost anything. Learning in the schoolroom or at home should be much more fun when the instruction is given by a patient, friendly robot.

But the real *piece de resistance* in the Bushnell line-up is BOB, for Brains-on-Board. Priced at US$3000 this is the truly 'intelligent' robot that can be expanded as technology improves. It doesn't operate as the slave of a home computer, having instead its own intelligence on-board.

Sensors constantly scan around and beneath him (her? . . . it?), plotting where furniture, doors and walls are. BOB can eventually memorise the layout of your home and find his own way around. All he needs is to be told that the fridge is in one place, the vacuum cupboard in another etc. Then, on the command "beer BOB" he figures out where he is in the house, where the fridge is, and what walls and furniture lie between him and the fridge. He then trundles off to it, finding the doorways and going around furniture on the way.

Ultrasonic sensors help BOB analyse objects. But even cleverer are his infrared sensors that enable him to distinguish humans from objects. BOB will trundle right up to you, finding his way round the furniture to do so.

He can speak through three ways: with his own on-board vocabulary, via a keyboard from a home computer or by recording your voice and adding it to his own.

BOB also has a "follow me" mode so, given the command, he will follow his mistress or master down to the shops and uncomplainingly carry the shopping in an (optional-extra) Androbot cart attached to his back.

More to come!

While BOB is amazing even now, he is only

the beginning says Bushnell. A team of 60 engineers, scientists, and computer programmers are working on add-on components for BOB that will make him even more versatile.

He has an electronic belly that, when opened, reveals a number of printed circuit boards. There is currently three megabytes of memory capacity to handle the repertoire of tricks he comes with, but there are a number of vacant slots for extra boards to cater for future development.

For example, BOB currently only has a scoop arm that opens out to catch cans of beer or other objects. As yet, he cannot pick up articles. Add-on arms will be available later that will bend, twist and have hands so he can pick up things. With these he will be able to wash windows, but Bushnell says he won't write the program because he considers it undignified for his lovable robots to have to do something even human servants won't do.

However, BOB will be able to pick up a vacuum cleaner and run round vacuuming the lounge for you, open a door or window, take food from a freezer and place it in the microwave for defrosting, mow the lawn, vacuum the swimming pool, and maybe even wash the car. Bushnell says there isn't much the robots can't do if they are programmed for it.

They can recognise intruders and telephone the police, turn on outside lights when the bell rings, open the door if it recognises a password, and even back itself into a power point to recharge its batteries when they start to run down (BOB has a three-hour battery life at present).

Bushnell's favourite demonstration is to lie by a swimming pool and send BOB off for a cold beer.

BOB trundles up to a specially-made Android fridge that will become a standard patio accessory to team with a barbecue in the more affluent homes. To get a beer out of this specially designed fridge you simply press a button and out shoots a beer. BOB is programmed to roll up to this Android fridge, press the button and catch the beer in his scoop arm. This he carries back to his master languishing by the swimming pool.

The catch!

There is one catch to all this. Bushnell says that a home to cater for a robotic lifestyle should be built as if for a wheel chair. Split levels should be connected with ramps rather than steps. If you have a two-storey home you will have to install a special Androbot lift to get him upstairs to deliver your breakfast in bed.

Bushnell has made his robots friendly looking so they will be accepted as household pets and in time may even take on teaching children of pre-school age.

What the Buck Rogers TV producers make Tweaky do on TV with simple remote control trickery, Bushnell has now made a reality. Given time, robots will be as common place as dogs as electronic pets, replacing the canine as a watchdog and doing all the household chores (like feeding the dog), leaving the family free for other activities.

Best of all, a robot won't need feeding or grooming, and will do the household chores without payment. ●
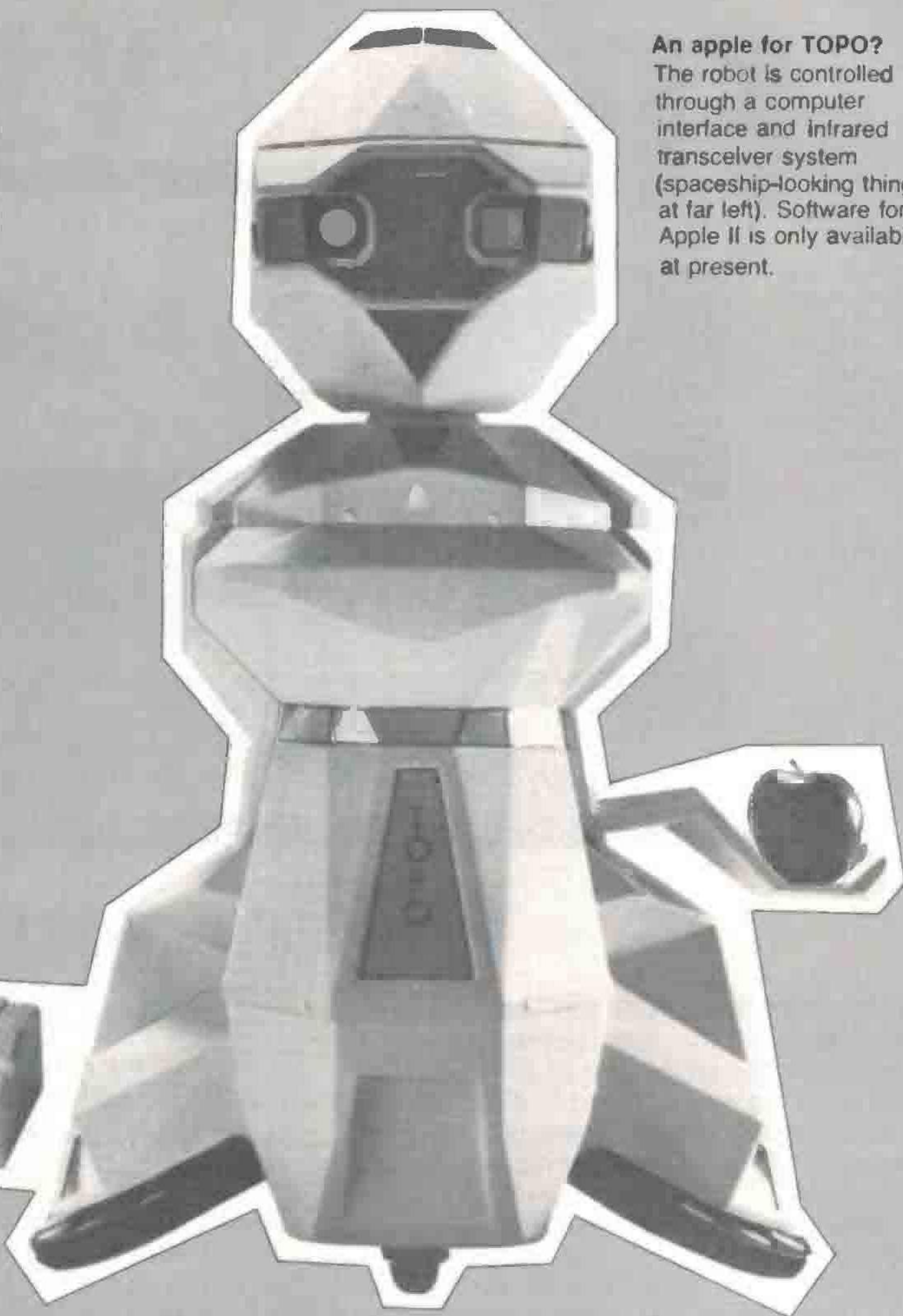
TOPO

A Walking, Talking Robot

An apple for TOPO?
The robot is controlled
through a computer
interface and infrared
transceiver system
(spaceship-looking thing
at far left). Software for
Apple II is only available
at present.

Dennis Lingane

MANY YEARS AGO, a machine such as TOPO was only seen in the movies or was controlled by huge banks of computers. With the incredible increase in technological know-how the machine of the year 2000 is now with us — or is it?

TOPO is a computer-controlled robot costing around $3000. That puts paid to the affordable part. But then that's only one aspect. And it might change if production increases.

After all, we are always being told how calculators and computers are now a fraction of their original price. When the hand calculator came out it had addition and subtration and cost well over $300.

Now the calculator has trigonometric functions, displays letters of the alphabet, is as thin as a credit card and is solar powered. And it costs less than a night at the movies.

If the robot technology is refined at the same rate then we may see an affordable robot by 1990.

But back to the present. TOPO is the offering and unfortunately it really isn't much more than a big electronic toy — although that could change if the inventors keep working on it.

Rocking on

TOPO has a new system of movement which consists of two wheels which sit at an angle of 30 degrees to the horizontal. This new system is called Andromotion. A novel idea which certainly works efficiently. It enables TOPO to turn on the spot or turn through any desired angle.

The only problem with a robot having wheels is that your home must have ramps between all levels so it can visit all the rooms. This is a fault in all robots that use wheels as transportation.

But this style of wheel is certainly a lot more reliable and efficient than that used by previous robots which had wheels like shopping trolleys and usually went where they wanted to, rather than where you wanted.

The sloping wheels enable TOPO to turn on the spot and very accurately at that. But there is a problem with forward and backward movement.

When moving forward TOPO has no front wheel for balance so it has a tendency to rock backwards and forwards. This unsteady movement is TOPO's main weakness. However, it is only a prototype problem and will most probably be fixed in later

models.

Even though the rocking movement is only slight it stops TOPO from carrying objects. We had visions of it fetching coffee for the office staff, but most of the coffee was spilt on the floor so we eventually had to fit TOPO with flippers.

However, Androbot has found a way around this. Put the drink in a can — and our editor agreed, nodding happily at the thought of a Fosters for morning tea.

The TOPO hand is shaped to carry cans; in fact, in Chicago at the Electronics Show last year BOB (the most intelligent member of TOPO's family) was able to waddle to a special fridge, collect a cool drink and bring it back.

Theoretically, TOPO can do the same trick but you'll need to buy the special Androbot fridge.

TOPO is a friendly creature. When you turn it on it answers by repeating its name four times, followed by a big hello in a southern accent.

On the top of its head is a switch pad. This is for when you do not have a computer. It allows TOPO to behave like a radio controlled car. When you press the button

At the moment this computer-controlled robot isn't much more than a big electronic toy. It doesn't wash windows, but it is a programmer's dream come true. Promised add-ons will make it less of a gimmick and more useful.
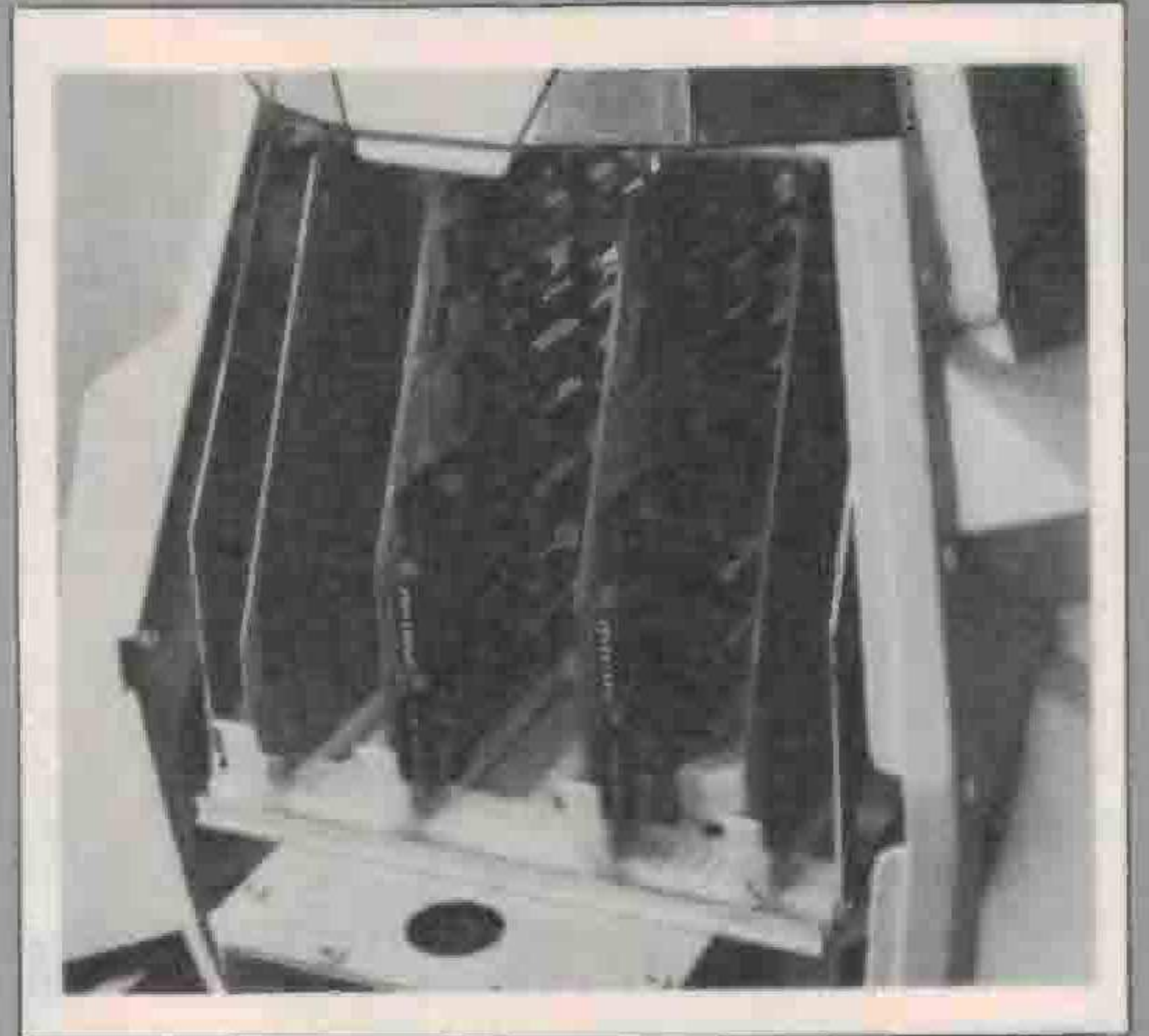
Above. The electronics slots inside the robot's body.

The guts of the matter. At left is the founder of Androbot Inc., Nolan Bushnell, who started the giant Atari company. He's with BOB (for Brains On Board), TOPO's up-market sibling.

Traction system. The unusual drive system puts the wheels at 30° to the horizontal, giving exceptional lateral stability.

at the front of its head it pronounces the word 'forward' and commences forward motion.

When pressing the left and right buttons TOPO pronounces the corresponding word and turns in the correct direction. To stop it you press the rear switch and it says 'stop' and comes to a halt.

TOPO can also combine the three major functions, forward, left and right, together so that it arcs to the left or right.

You might think that is a rather expensive way to do nothing significant. It is from these basics that TOPO can do more of the type-cast robotic chores. It is true that on its own it doesn't do much and it is more like a radio controlled car. However, when you plug it in to your computer the world is your oyster.

Speak to me
At the moment TOPO only runs on an Apple II with 48K of RAM, using the Super Serial card with an RS232 interface. But programs will soon be available for the Atari and Commodore computers.

When plugged into a computer TOPO can say anything you want. It does this with a phonetic alphabet which it uses to analyse what you typed in.

This format has its faults. To say a word like psychiatrist TOPO must read it as "sy ky uh trist". This is no different to most voice synthesisers. The problem will arise when ordinary people want to use the speech facility. They might find it rather difficult to find the set of letters which makes the right sound.

Androbot has come to their aid, to a degree, by including several tables of the correct letter sequence so you can create the right sound. These tables will be vital to the novice user of voice synthesisers.

The advantage of using phonetics is that TOPO is multilingual. It can speak in many languages such as French, German, Spanish, Italian, Chinese, Japanese and Arabic. No matter where you are in the world TOPO will 'parlez-vous'.

TOPO can be programmed using a language called TOPOSOFT. It is very similar to Logo but was originally developed as a FORTH-based applications program. It adheres very closely to the FORTH-79 standard, and was written to be easy to transfer to other computer systems.

If you want TOPO to move fifty centimetres forward then you type in '50 FWD'. If you want it to turn 117 degrees to the left then type '117 LEFT'. Simple, isn't it?

Whole statements can be strung together by placing spaces in between each command. You can name such procedures, then every time you call the name TOPO will go through that procedure.

Commands such as GET-POSITION and SET-SPEED can give the programmer a great deal of control over TOPO. The commands can test for which switch is being pressed on its head, test to see if TOPO is talking or not, and so on.

Applications which TOPO is capable of include teaching in an educational situation, going to the bar and getting a drink, escorting guests to the dinner table and vacuuming the floor.

That's some of the things that TOPO can do, but what can't it do?

Well, he can't wash windows, but who wants to?

In brief, TOPO is not ready for the average home user, as indeed the average home user is not ready for TOPO. And neither is ▶

their home, unless it has ramps instead of stairs. TOPO cannot travel between rooms of different levels which do not have ramps joining them.

Its arms are not really capable of carrying unusual or heavy objects. Its batteries only last several hours before they need recharging. And it has a voice synthesiser which requires a lot of patience to get it sounding just right.

A gimmicky toy?

With its faults some might think that TOPO is an overpriced toy.

But it is cute looking, good with kids and has all the patience in the world. It is the programmer's dream come true. It is light and can be carried from room to room.

Special devices will eventually be built so that it can carry heavy or unusual products. In fact, there is a robot trolley that fits to its back for carrying shopping; this also steadies the robot in its rocking and rolling during motion.

It might need some refining but what could you expect from a world-first that so far the world has only seen in science fiction movies?

Wasn't the Apple first considered to be a millionaire's toy when it first came out? The fact that this robotics company is
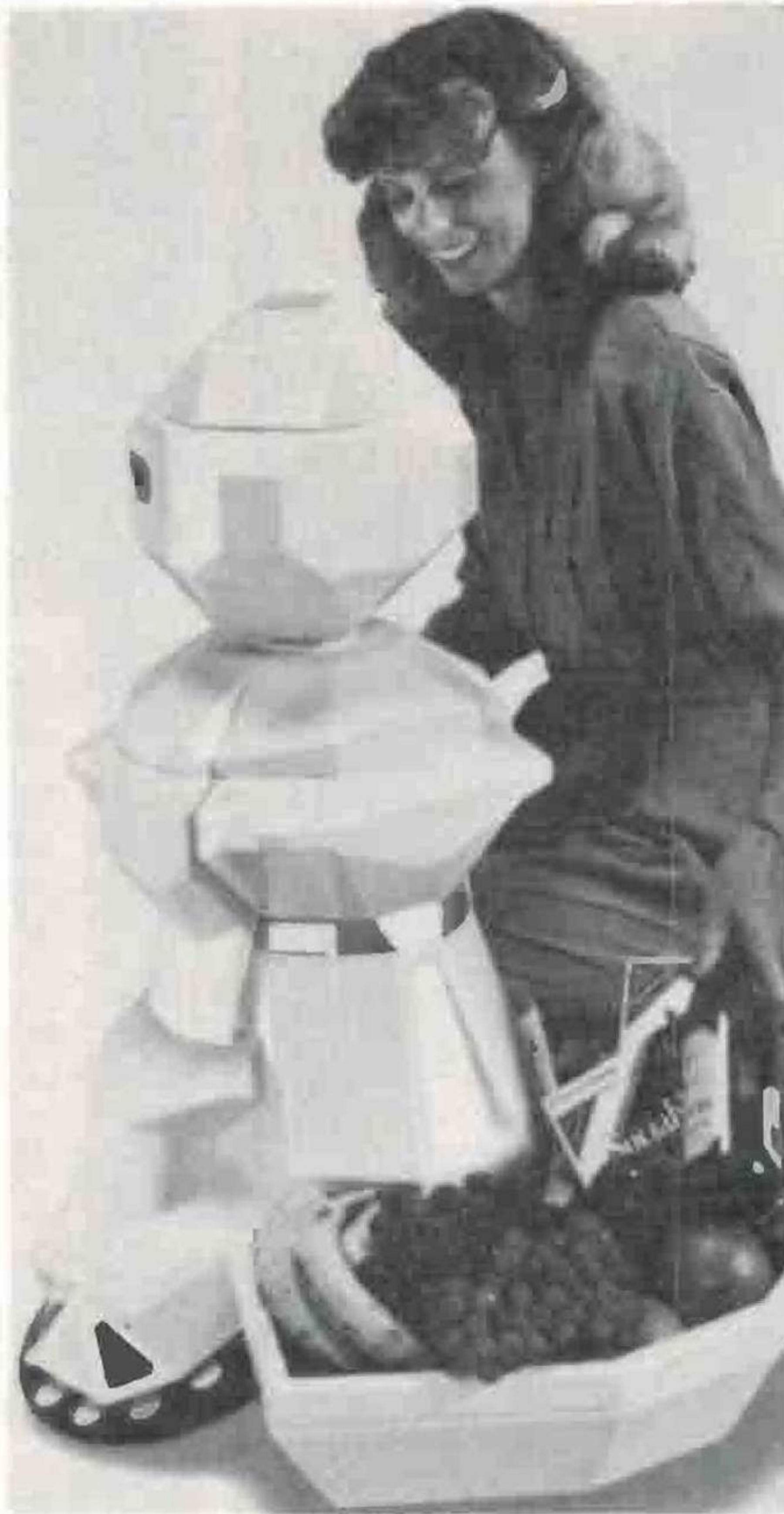
Home, Jeeves! TOPO with the special carry cart.

headed by the US electronics industry's leading entrepreneur, Nolan Bushnell, (who started Atari in a garage in Silicon Valley and then sold it a few years later for $27 million to Warner) is an indication that this company has the talent to convert science fiction to reality.

Bushnell himself admits that his robots are a bit of a gimmick now. But he promises that new add-ons will follow to make them less of a toy.

These add-ons will be for TOPO and its big brother BOB. BOB has a microprocessor on board so that it doesn't need to be in constant sight of an infrared remote control module.

I leave you with a quote from the manual (due to its length some of it has been omitted): "In 1950 science fiction author, Isaac Asimov, published a book called 'I, Robot'. In the introduction Asimov stated that the major manufacturer of robots would be in existence in 1982.

"He was right about the date, but not about the name. Our name is Androbot Inc, not US Robot or Mechanical Men Inc. There is, however, a major difference between the two products — we are real and so are our products. Robots are just science fiction.

"So allow us to welcome you to a new era — the Age of Androbotics." ●