

Einstein Magazine

& ALL MICRO NEWS

Number 106



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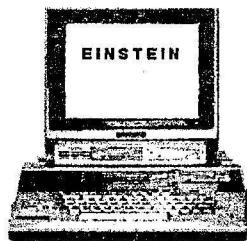
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Number 106

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Editorial

Found it! Or should I shout eureka? I refer to the Graphic Digitiser part 2 missing from last issue - John pointed out - however, you will have to wait for the missing figures, they don't translate to A5 at this moment in time. Naturally, I never throw anything away - is that the problem - so I knew I still had the master sheet somewhere. It took two attempts to unearth and an evening sorting, keeping and discarding a pile of papers and envelopes - straight for the moment at least. I've cobbled some stuff together, in this issue, on the subject of memory materials; if like me, you were unaware of this particular technology you will no doubt be intrigued by these advances which, in the field of mechanics, probably parallel what the microchip is to electronics, in importance.

Errata 105: Stan Gibbs article on composite video has the pin numbers reversed, it should read, pin 5 is 0 volts and pin 2 is green.

---@@@---

Soldering Tips

The following was spotted: pertaining to the joining of copper, brass and other metals of various sections. If applied to the task of fixing electronic components to circuit boards points 1, 2 and 4 are usually skipped but worth considering along with the others, especially when encountering problems.

Tips for success-

1. Clean the parts thoroughly with an abrasive.
2. Ensure parts fit closely (solder is not a good filler).
3. Ensure soldering iron is clean and hot.
4. Apply adequate flux to the joint.
5. Apply iron to joint and leave just* long enough to ensure solder flows freely. * If electronic component.
6. If the joint does not make, separate the parts, clean up and start again.
7. PRACTICE!

-----@@@-----

Graphic Digitiser Revisited Part 2

John Marriott March 2001

Right, it wasn't the two hours walk in the wind and rain which brought on the 'flu, but it effectively laid me out for four days, resulting in the mental rewriting of Part 2 as I struggled with "...should it be machine coding - or look up tables..." and what with some of the fantasy plot lines my poor old overcooked brain was concocting - a poor man's LSD trip? But strangely enough, quite a bit of 'deck clearing' went on, at that time.

A number of points to clarify - a 7-bit input would only allow a number up to 127 on the GRAY disk, it needs more fingers and toes to count higher. Whilst I intend to have 360 sectors on my digitiser disk, I only intended it to go no further round the scale than 255 and only 'colour in' the sectors on the disk, which the program would use. Seems a great idea to colour in all 360 sectors - until you've spent 3 hours, suddenly realising you've made a simple mistake, which has snowballed...

...my Dad never wallpapered behind those heavy oak wardrobes, said there was no need, only the mice and spiders would see it wasn't - but Mum knew otherwise!

There is a fatal flaw to the GRAY disk, and that is the 360/0 boundary - as from the following you can see 6 values changing on the 'same edge'...

GRAY-0 00000000

GRAY-360 11101110

...which destroys the whole concept of the GRAY Scale. I've no doubt that an ancillary circuit could be 'tabbed' on to create a 'positive boundary reset', but that problem is beyond the intention of this article - just take heed and be warned.

As outlined in Part 1, was the 'converting the GRAY number inputted to a DECIMAL number for program use' to be M.Code or a look up' table. From the start I'd seen nothing but a mass of numbers churning into the User Port - until the sanity of the

insanity due to the 'flu temperature clearly pointed out the fact that for either the 'X' or 'Y' readings that number was always going to fall into the 0-255 range...

...some 'number crunching problem' if ever there was one. Skulking through 'Lethenthall and adding up the bytes required, then the BASIC set-up Commands - all needing Computer verification - a look up table' won, hands down! The following two programs are virtually the same, could be merged, but I didn't do so on two counts - it was just as easy to change the first into the second where I could plainly see what the programs were doing, and the other by the way the second program does its 'sorting' - and to be honest, I can't say I've come across such an obvious way of sorting a simple numeric list before - plenty of 'bubble' and 'shell' sorts - but a 'one pass 100% sort', ..see, having your brains pseudo LSD fried ain't all that bad?

```

10  T=0                      : Counter loop start
20  CLEAR 32767              : Protect memory
30  P=32768                  : Table 1 start (sorted Decimal)
40  POKE P,T                 : Build it
50  G=T XOR INT(T/2)         : Convert to a GRAY value
60  POKE (P+300),G          : Table 2 start (unsorted Gray)
70  P=P+1                   : Next RAM location
80  T=T+1                   : Increment counter loop
90  IF T>255 THEN END        : What to do
100 GOTO 40                 : Keep building

```

fig. 1

```

10  T=0                      : Counter loop start
30  P=33068                  : Table 2 start (unsorted Gray)
40  A=PEEK(P)                : Get value from Table 2
50  D=PEEK(P-300)           : Get value from Table 1
60  POKE 33368+A,D          : Put value into Table 3 + offset
70  P=P+1                   : Next RAM location
80  T=T+1                   : Increment counter loop
90  IF T>255 THEN END        : What to do
100 GOTO 40                 : Keep building

```

fig. 2

If you drop back into MOS after running these programs, all we're interested in is the table running from 33368+255, which should be

00 01 03 02 07 06 04 05 OF OE OC OD etc.

So simple BASIC lines within the digitiser program could read

```
10 CLEAR 33367
20 LOAD "GRAYDEC.OBJ"
30 INPUT G
40 PRINT PEEK(33368+G)
50 GOTO 30
```

Okay, whilst the initial set up of the tables took time - Line 40 would be even more quicker acting with $D = \text{PEEK}(33368+G)$ with the Variable D now containing an Angular Value just ready to be 'exploited' in a TRIG function by the Digitiser Program.

If you want to save the program line comments within the program, put a REM after the : and before the comments. I prefer to, as it's a very good reminder of what the program does/intends at a glance - especially years hence! Yes, I forgot - save Table 3 off with SAVE "GREYDEC.OBJ",&8258, &8357<e>. Other than, it's my habit to run Spectrum+3 m.code programs from &8000 (ROM/RAM bank switching problems), Table 3 can be placed elsewhere in RAM provided the figure in Line 40 is changed as well.

At one stage, I considered a construction project involving XOR Gate I/C's so that a 'mechanical' conversion was derived from the GRAY disk, but I think you'd agree that's hardly cost effective when presented with such an easy programming route. Those considering the 'full 360' trail number-wise, the use of DEEK and DOKE become a must, but so far with 'sample testing' into that territory it is the think-before-doing that'll get you along the road quicker.

The following/enclosed fig.3 is a tenth-section of a blank 8-bit encoder wheel - my apologies to those who looks like it only took me 10 minutes to make, it took 6 - 2 sheets of A3 paper (one as a 'flat' compass with a centre point & etc, roller ball pen and

school ruler), so make up 10 and glue up for a full 360 ring, although I'd suggest that 'temporary fix' double sided tape as it'll reduce an 'scrapping errors' to that section.

---@@@---

Letters 106

Ken Ross writes:

Well after many adventures involving intensive care for all of December (so that's why no xmas cards!), and all that entails in after effects then having to deal with a few gov. depts. since Feb that actually involved moving paperwork 'tween two offices at a speed unmatched since before Hadrian (average speed worked out at 1.19mph 'tween Dover & Newcastle - don't ask!) I'm glad to announce I'm back online again (BT permitting?) .

Tripod has changed its name so the einstein site has had to modify its name to http://members.lycos.co.uk/tatung_einstein

Contact info email: cbm8032@bigfoot.com

Phone/fax: 07092 022719

The fax line is used to scan stuff to put up onto the website - so draw your WebPages idea on A4 paper, and it'll end upon the wobbly web for the world to see!

The Internet address for the Einy site: "<http://members.lycos.co.uk/albertstc01>". The site has been hastily put up just to get something online so the process search engines use to locate and document them can get started. Yahoo takes about 3 to 6 months.

Chris Coxall writes:

The site provider does not seem to have the best uploading software especially as my monitor hasn't the higher resolution that most Internet services expect surfers to have now. One page I tried to put up wouldn't be entertained by the host. I've put a link to another site I have and the page went in OK there.

General Ideas for the Site - all Einstein Computer related, of course.

I want every thing that goes up there to be public domain. So, others if they wish can copy the pages onto there own site or create a mirror site. The idea being that if unseen circumstances come along and stop me managing the site and it closes the content and information can still be found on the web. If there is an EM reader who wants to try their hand at a web site creation but not sure what put on it and also needs experience of up loading ready made pages please encourage them. They can download "albertstc01" pages for putting on their own site. Poaching from "albertstc01" is perfectly legitimate. Only proviso is that they give acknowledgement to authorship.

To support the Einstien Magazine I want to put the contents of the current mag. on the web site's front page. If an article is technically novel and a bit of a breakthrough, which would be of use to other 8 bit computer users, a more detailed description would be helpful.

Selling and giving away Einsteins. The adds. in EM are usually "free take away come and get it" or "buyer collect". OK if you're just around the corner, otherwise carriage is expensive. The other problem is EM readers generally already have Einsteins. Surfers to the web site could be other 8 bit computer enthusiasts. They may not of heard of Einy or only just heard but never seen one available to try. If permission is given I can copy EM adds onto the web site. A good home for your unwanted Einstein could be just around corner. Einy's 3" drives seem to last and last and they can with the right software be used on the PC to read Amstrad CPC6128, Spectrum+3 as well as Einstein 3" disks. So don't bin them advertise them.

I would like the site in the future to hold all the technical detail it can on the Einstein. I have for example scanned in graphic files of the TC01's wiring on the motherboard, the Einstein ROM in binary and a text file disassembly of it. I've only just learned how to create a file download facility. I'm still on the learning curve.

Creating web pages and articles has a demand on my time especially as I'm learning as I go. This means I don't have the same time available to create hard copy out put for EM. Web page publishing doesn't quickly translate it's self to hard copy publishing. I have an idea that might sort this later. In the meantime, therefore there are articles up on the site that hasn't been covered by EM. Specifically "INSTALLING A 3 INCH FLOPPY TEAC DRIVE "B" ON A PC AND USING CPDRead, CPDWrite AND 22DISC TO READ & WRITE EINSTEIN DISCS" This is an important step forward for Einy users. If another Internet connected contributor to EM can turn these to hard copy, or do its own review for the mag., it would be less pressure on my time.

Another article on the site not in the mag. is bbcbasic program for getting Keyboard input from win95 terminal to run BBCbasic on the Einstein. I've put a text adaptation below so you might be able to use it for the mag. It has been a bit rushed.

-----@ @ @-----

ADAPTED TEXT
EXTRACT FROM
WEB PAGE:

PCKEYS

By Chris Coxall

Loading a bbcbasic listing from a text file on the PC. The Hyper Terminal can be used as keyboard input for the Einstein loaded with bbcbasic. This might be done by poking address &3a4b. It works with BBCBASIC Version 2.31 & XtalDOS 1.31 try the command below

?&3A4B=&A1 <ENTER>

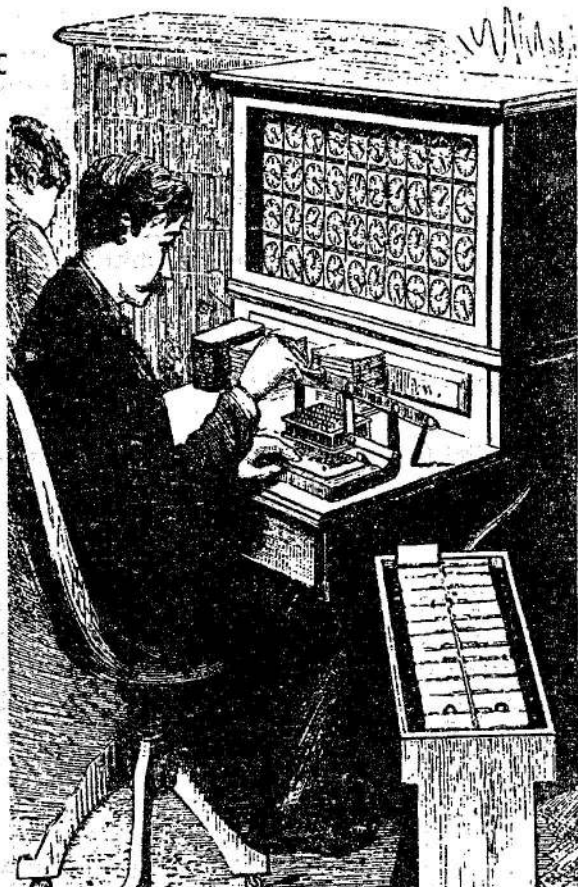
Press some keys on the PC keyboard if the characters appear on the Einstein screen it has worked. If you type the "*OPT 1" <ENTER> on the PC keyboard out put from the TC01 will be displayed on the terminal screen. Unfortunately although ok for key presses there is not any hardware handshaking and the transfer is too fast to make it suitable for downloading ascii text listings. Try typing in the PCKEYS.BBC program into the Einstein first.

PCKEYS.BBc listing

```

1 HIMEM=HIMEM-&2C
10 GOSUB 70
20 PRINT"START "
30 GOSUB 80
50 STOP
70 BEGIN=HIMEM+1
80 CODE=BEGIN
90 P%=CODE
100 [
110 PUSH AF
120 LD A,&27
130 OUT (&11),A
140 POP AF
150 LD (&FBB2),A
160 RST &08
170 DEFB &A1
180 PUSH AF
190 LD A,&07
200 OUT (&11),A
210 POP AF
221 RET
230 ]
240 SECOND=&3A47
241 CODE =SECOND
242 P%=SECOND
250 [
1891 .SECOND CALL BEGIN
1892 RET
1900 ]
1910 RETURN
9000 REM goto 9010 to get input from the Einstein keyboard.
9010 SWOP=HIMEM+&B:?SWOP=&9C
9020 STOP
9100 REM goto 9110 to get inputfrom PC keyboard.
9110 SWOP=HIMEM+&B:?SWOP=&A1
9120 STOP

```



Hollerith's Tabulator

When run PCKEYS assembles a new machine code routine for hardware hand shaking above HIMEM and creates a jump from within the bbcbasic program. Keyboard input is now from the PC.

Only run PCKEYS once otherwise HIMEM will keep being altered. Use "GOTO 10" for additional runs if desired. Clear PCKEYS from bbcbasic before sending basic listings files from the terminal. Programs loaded this way are put into bbcbasic as if typed on the keyboard. Old program line numbers which are not over written will be inserted into the downloaded program if the "NEW" command is not used first.

In note pad, write these Bbcbasic commands without numbers

*KEY

0

SWOP=HIMEM+&B:SWOP=&A1:&FA39=&A0:&FA3D=&9E

&FA39=&9E

SWOP=HIMEM+&B:SWOP=&9C

Save to a file Einkeys.text. Then from the PC terminal use "SEND TEXT FILE" to send it to Einy. Keyboard input will now be from Einy. If Einy is in 40 column mode press "F0" key <ENTER> you should then have full screen and keyboard emulation on the PC terminal to run bbcbasic on Einy. On the PC keyboard try toggling <Ctrl> "P" keys on and of and watch the Einstein's Screen.

----@@@----

Shape Memory Materials

In 1965, the first of a series of metal alloys of nickel and titanium was produced by the Naval Ordnance Laboratory. These alloys are called Nitinol, for Nickel Titanium Naval Ordnance Laboratory. Many of the alloys have a rather remarkable property: they remember their shape. This "smart" property is the result of the substance's ability to undergo a phase change a kind of atomic ballet in which atoms in the solid subtly shift their positions in response to a stimulus like a change in temperature or application of mechanical stress. A simple demonstration involves bending a sample, then exposing it to a

source of heat like hot air or hot water. The sample recovers its original shape as its temperature is raised above the temperature corresponding to the phase change. This temperature may be tuned by varying the ratio of nickel to titanium atoms in the solid by a few percent relative to a 1:1 ratio.

The ability to change overall shapes to a much greater degree than conventional polycrystalline alloys appears to be the breakthrough that will allow single-crystal, shapememory alloys to realise their full potential in mechanics.

The alloy elements, which can deliver large amounts of force in small spaces, are expected to have applications in robotics and, while speeds of movements are limited by the times required to transfer heat into metal wires and rods, there are a great many other mechanical movement uses to which these devices can be put.

Shape-memory alloys, as their name implies, change their shape back to their original shape when heated. They can be bent, extended or compressed, and then recover and remember their original shape upon the application of heat above a certain transition temperature.

By going all the way down to atomic levels, scientists are learning to make hybrid "active" substances with a host of unique abilities Kaushik Bhattacharya was in the office of University of Minnesota materials science professor Richard James 15 years ago discussing potential research topics. James bent a small strand of nickel titanium in half, and then dropped it into a mug of warm coffee whereupon it snapped straight - he had his topic, the research of smart materials.

The ability to regain its previous form is a characteristic of a class of alloys that can "remember" a physical shape with the help of external stimuli. Because of that ability, such materials have been dubbed "smart."

These substances hold significant promise for everything from creating smaller and efficient optical switches, to building

highways that can report when their surface needs repair. The materials cut a broad swath across chemistry, engineering, and physics - and have such a wide range of uses that they're difficult to pigeonhole. This is why Bhattacharya hates the term smart materials. "In anything I write, I would never use the word. The connotation is that these materials are smart and other materials are stupid," he says. Rather, Bhattacharya defines these alloys as "active materials — because they actively change their microstructures."

Active materials have ended up in everything from specialized coatings on silicon transistors to exotic carbon materials in fighter planes. They were originally developed for applications in space, because they allow actuators to be made without fluids, seals or rotating parts, all potential areas of poor reliability. They were then promoted for wired bras, which could be bent during washing and recover their shape when worn. A Japanese company has designed a type of paint that incorporates active materials able to emit an electrical signal when a building is in danger of collapsing. Cell-phone antennas are another use, which need to recover their shape if bent. Though now rendered obsolete by advances in electronics producing ever-higher frequencies - the aerial is inside. Nickel titanium wire is used in cardiac stents. These are welded assemblages of wires, which are inserted in their collapsed state into blocked human arteries. Later to be triggered to open out, and expand the artery. This already saves thousands of lives every year. Despite being a more obviously important technique of which many people will be aware, most - as I was - are probably ignorant of the principles behind it - thinking that perhaps springs were involved.

The wealth of new materials comes courtesy of rapid advances in pure research. Scientists have begun to think in terms of atomic-level manufacturing, thanks to experiments in which electron-scanning and -tunnelling microscopes have been used to form tiny switches from atoms. Silicon chips are now measured at molecular levels of thickness and coating.

We are at a period of convergence with the kinds of fabrication techniques available today, when microstructures can be made

that weren't possible five years ago. It's suddenly possible to visualise materials and measure at scales previously unimaginable. In another 5 to 10 years, that same ability will fuel a new wave of designer materials designed for specific properties and tendencies much in the same way that scientists now design hybrid genes for agricultural products. Those materials will be manufactured or altered to augment or incorporate active behaviours that could cause a surface to change angle if an electrical charge is passed through it.

That's precisely what NASA hopes to do with future space telescopes, which it may build with shiny surfaces coated with thin films of materials that, when an electrical charge passes through them, will subtly bend and focus the mirror. The benefit No glass means lighter payloads, a significant concern with large telescopes.

Consider advanced optical switches. These devices currently rely on so-called electrostatic comb drives to position sets of mirrors, which in turn reflect and target beams that carry data and voice information. Researchers now foresee that they'll soon bump up against the physical limits of these tiny motors. They draw too much power and take up too much space. The geometry of the mirror is intricate and the smallest size for this technology is being reached.

That's where "Ferro-electric" materials might come in. These crystalline structures have electric poles, similar to magnetic poles as in iron. The difference, however, is that they react to electric fields (voltage) rather than magnetic fields and thus are far easier to use. Scientists envision coating the backs of these mirrors or connected actuator arms with thin films of Ferro-electric material. Applying an electrical charge to them would cause a repulsive or attractive force at the atomic level. That in turn, could translate into more finely tuned movements of tiny optical mirrors in the switches. And it would use a fraction of the energy. The upshot is, faster, cheaper optical switches.

For all the promise of active materials, it's doubtful that they'll replace traditional ones for a while. Rather they'll augment

existing materials - and make big differences in niche areas. Like in an average modern motorcar use is made of plastics and alloys its basic structure is still steel.

So how, you might be wondering, can rocket science assist the average Einsteiner? This next extract might give some ideas in the area of simple computer/Albert control projects, gleaned from the railway modelling fraternity. Indecently this was where I first witnessed the memory materials phenomenon.

There is currently a lot of interest amongst members of the Model Electronic Railway Group (MERG) in using 'muscle wire' or 'memory wire' for point actuators. This wire has the unusual property of contracting when heated to about 70 degrees Centigrade. The change of length is typically 4%, so that the 2mm of movement required for 'N' Gauge point blades can be achieved with 50 mm of wire. Because the wire conducts electricity and is resistive, applying an electric current will generate the necessary temperature rise. The resultant actuator is silent and the rate of movement is more prototypical. The wire used in the actuator described here is Flexinol 100 obtained from Milford Instruments (Telephone 01977 681465). It is rather expensive at £11.75 for one metre but this should be enough for ten actuators. The 100 refers to the diameter of 100 micrometers, 55mm of memory wire (allow a little more to ensure sufficient movement) is positioned on the baseboard alongside the point. A Gem angle crank is used to activate the tie bar when the wire contracts.

Memory wire requires a return spring to pull the wire back to its as-cold length and to return the point blades to their rest position. The 100-micron memory wire exerts a force of about 150 grams and the return spring must exert a force of about half this value.

Building the Actuator, one end of the memory wire is crimped between pieces of 5thou. phosphor-bronze strip. This strip is soldered to a piece of copper clad printed circuit board, which in turn is pinned to the baseboard. The other end of the memory wire is attached to a short length of brass wire, which is hooked

into the angle crank. The angle crank is also attached to a piece of copper clad board and pinned to the baseboard. A piece of thin copper wire (unravellled from a length of flexible cable) is attached to the brass wire and to the copper clad board to provide a flexible electrical connection. The main electrical leads, which provide power to heat the memory wire, are soldered to the copper clad boards rather than directly to the memory wire. A piece of brass wire connects the other end of the angle crank to the tie bar. The memory wire could be concealed beneath some plastic channelling painted to represent concrete trunking.

Modifying the point: The diagram above relates to an Electrofrog Peco Streamline point and some of the necessary modifications are illustrated. The toggle spring, which normally ensures that the moving blades are pressed firmly against the stock rails, is removed. Two alternative forms of return spring are shown, an expansion spring and a length of music wire.

A slight difficulty in using memory wire is making an electrical connection to it. It is an alloy of nickel and titanium which, like nickel-chrome resistance wire, does not take solder very readily. The suppliers of the wire recommend crimping, but several members of MERG have reported that the wire pulls itself free from a simple mechanical crimp. However, solder can be used with a suitable flux, for example, Carrs Brown Label. To attach the memory wire to a brass wire, first clean the memory wire by rubbing the end 3 or 4 mm with 600 grit carbide paper. Then bind the wire to the clean brass wire with a strand of fine copper wire taken from some flexible connection wire (i.e. 10/0.1mm wire). Apply some flux and solder with a small iron. Alternatively, 5thou. brass or phosphor bronze strip may be folded and crimped around the memory wire (cleaned first) and secured with solder, again using the Brown Label flux.

To heat the wire it is simply a matter of applying about 180mA. Since we are only heating the wire, the supply can be AC or DC. The simplest solution is to use a low voltage AC supply. Many transformers are available with 6V-0-6V at 1 or 2A per winding. Remember that unlike solenoid operated point motors the power must be maintained for as long as the point setting is required.

Thus with perhaps 10 or more points being set at any one time the transformer has to provide 2A or more. The resistance of the 50mm of memory wire is approximately 7ohms, so that if the 6V were to be applied directly the current would be about 850mA. This is too large and therefore, it is necessary to use a resistor in series with the wire. A suitable value with a 6V supply would be 27ohms. This should be wire wound rated at 1 Watt.

There are many possible alternative designs. If the tie bar moves very freely, then a shorter length of memory wire may be used with a mechanical lever of say 1.5:1 or even 2:1. Thus, the 1mm of movement produced with 25mm of memory wire could be amplified to 2mm with a 2:1 lever. Additionally the expansion spring can be replaced with a compression spring placed around the memory wire and between the angle crank and the fixed connection of the memory wire. The compression spring presses against the crank to push the rail back to its rest position (the spring must not touch the memory wire). An important requirement of any design is to ensure that the amount of free movement in the linkages is reduced to a minimum. This article first appeared in N Gauge Journal 3/98. How does it work?

Nitinol is the name given to the alloy wire material a Nickel-Titanium alloy, which, depending on the temperature can be in one of two crystalline states. One is called martensite, the other austenite. The transition temperature can be varied quite precisely by varying the exact composition of the alloy. When it is in the martensite state, it is very easily deformable. However, when it is warmed and turned into austenite, it recovers its previous shape with great force. Austenite is a very strong metal, as strong as steel, but martensite is much weaker, (<http://www.sma-inc.com>) this allows a very simple way of moving objects without any moving parts. Dynalloy Inc. makes a type of Nitinol called Flexinol, which is designed to operate at room temperature and to contract when a small electrical current is applied. The commercial uses of Nitinol are mostly for precise medical devices, though a Nitinol wire was used on the Sojourner Mars Rover to operate a small sensor, which tested the amount of dust in the Martian atmosphere. ----@@@----

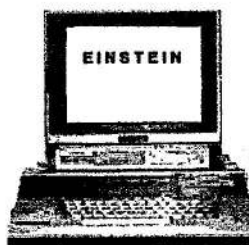
JULY SUPPLEMENTARY PAGE

St. Nicholas Church
New Romney

SUMMER FETE

Saturday 20th July
from
10.00 am until 2.00 pm
in
The Old School Garden





Einstein Magazine

& ALL MICRO NEWS

Number 106

Published for users of Einstein (and other) computers
by RPM Society.

Publisher and Secretary:-

**A E Adams, Ivy Cottage, Church road, New Romney,
KENT TN28 8TY**

Apologies for the lateness of this issue, due entirely to problems at New Romney. If it's not trying to sort out the District Council's serving a totally illegal repairs notice on the owner of a listed building, requiring the elderly lady owner to implement a physically impossible restoration scheme or have her home compulsory purchased from her, it's a printing machine that dies just as you start a major print run on your only free weekend.

The details have gone astray as we close for press, but John Marriott has set up some 3.5" disk drives to work with your Einstein as 720Kb 2-sided boot drives. These will save wear and tear on your 3" drives, give you data storage space on the same disk as your program, and let you use standard PC disks. Contact John at 121 HILL BARTON RD, EXETER, EX1 3PP, or phone 01392 469206 for full info: