JULY - AUGUST, 1967

Electronics Digest

THE ELECTRONICS MAGAZINE FOR HOME AND SCHOOL

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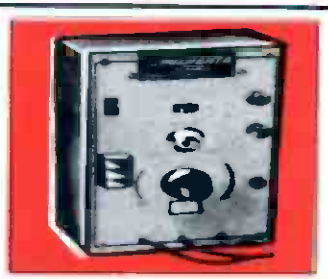

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In This Issue . . .

• A night scene is picked up by a "see-in-the-dark" television camera . . . tiny CR television tubes fitted to each side of pilot's helmet reflect the image onto the lens of special eyeglasses he wears. The image is superimposed without blocking normal vision of the pilot.

• A biographical sketch, with historical photographs, of Guglielmo Marconi, the father of the wireless telegraph—forerunner of our present day radio. It has been only 66 years (this December) since the historic transatlantic test of the wireless telegraph—a breakthrough in world-wide communications. Today, our space scientists communicate with our probing space vehicles as they approach Venus and Mars, millions of miles away.

• The first transmission of television over long distance by wire and radio happened only forty years ago, April 27, 1927. The story of this historic event, with pictures from old prints, depicts the dawn of present day television.

• Build a miniature electronic organ for a summer science project. It's easy . . . build it from the parts list, or you can buy it in a kit. You'll find something new in electronic magazine projects—step by step wiring instructions for accuracy and as a teaching aid for the hobbyist or student.

• Easy Steps to Good Soldering — the first in a special series of articles on basic electronics for students, hobbyists, and experimenters. The four-page section is marked for a ring binder, and it may be pulled out for easy filing.

• The Library of Congress' Talking Books are now available for persons with handicaps other than blindness. You'll find information on how to apply, and a convenient list of the cooperating regional libraries in this article.

• A new era of portable power has dawned via the nickel cadmium rechargeable battery. Read all about its many applications in modern living via cordless tools and appliances.

COVER PHOTOGRAPHS

Photo at top center, courtesy of Bell Helicopter Company; photo in center, courtesy Bell Telephone Laboratories; photo right center, courtesy Weller Electric Company; photo low center, courtesy Radio Shack Corporation.

Electronics Digest

THE ELECTRONICS MAGAZINE FOR HOME AND SCHOOL

Vol. 1, No. 1 **July-August, 1967**

William M. Palmer
Editor

CONTENTS

ARTICLES

REGULAR FEATURES

Vol. 1 — No. 1, July-August, 1967. The ELECTRONICS DIGEST is published bimonthly at 2615 West 7th Street, Fort Worth, Texas by the Tandy Corporation.

Television Eyeglasses See in the Dark

New low light-level television system combines a special eyeglass device and a television camera that can see in the dark

Special Report

A fantastic low light-level television system that can actually "see in the dark" may be mounted in military helicopters for reconnaisance and rescue missions. It also offers unique possibilities in navigation at night for this type of aircraft — landing and take-off in areas surrounded by obstacles or unusual features of terrain, locating landmarks, etc. The new system is being developed by the Bell Helicopter Company, a division of Bell Aerospace Corporation, Hurst, Texas.

One of the advantages of this low light-level television system over radar or infrared devices is that it does not transmit a "beam." Hence, it is undetectable by enemy equipment.

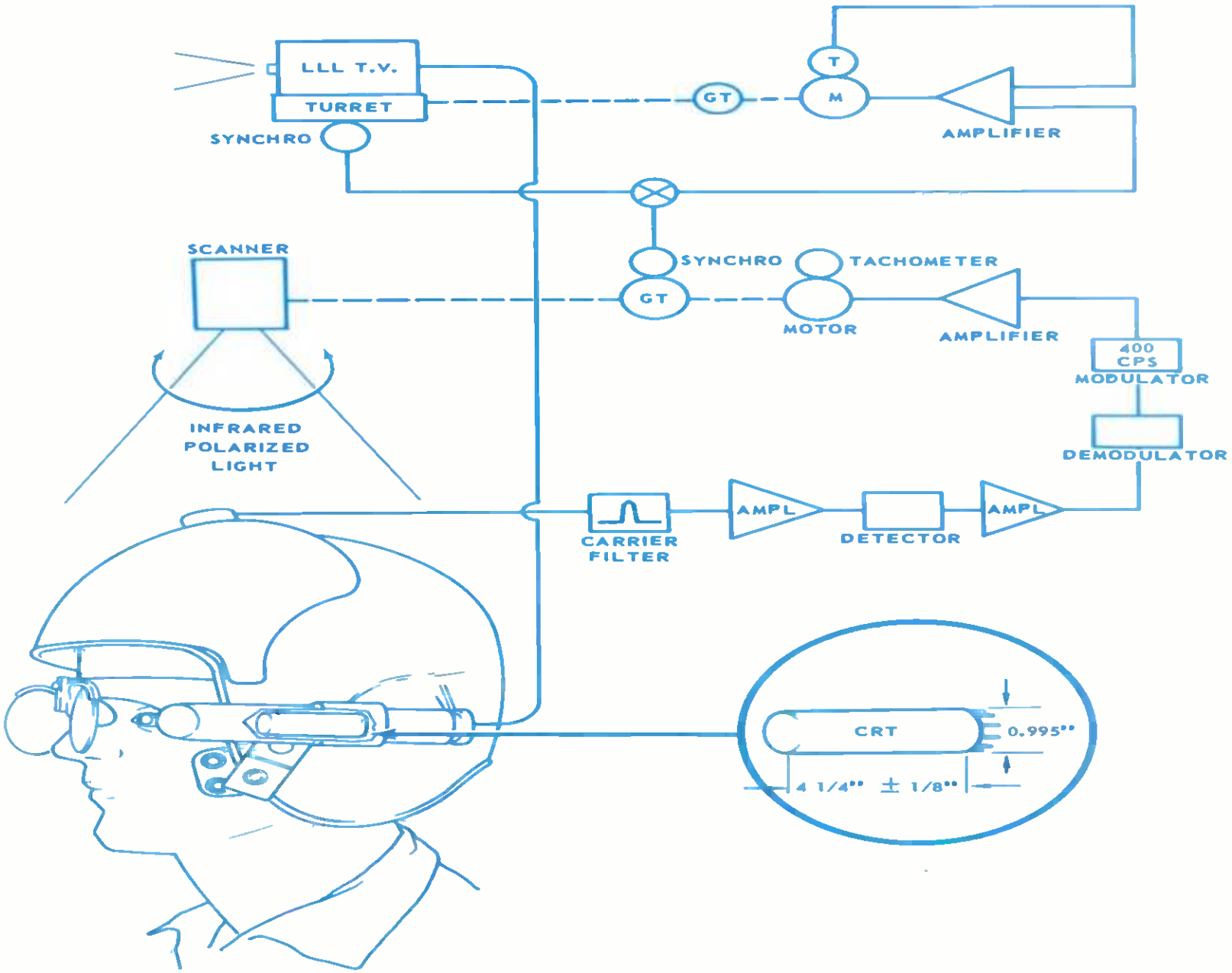
The television camera, which is mounted in a specially designed turret located in the nose of the aircraft, is automatically aimed by a device called the "headtracker." Two types of headtrackers have been designed, one is mechanical the other is electro-optical. The more complex electro-optical type makes use of a modulated infrared signal beamed from equipment above the pilot's head to a receiver on his helmet. It acts as a sensor in following movement of the pilot's head, and it generates a signal to another unit called a "servo" which in turn controls movement of the camera. Thus, when the pilot turns his head — up, down, left or right — the television camera in the nose turret automatically turns in the same direction.

The television receiver section of the apparatus is built into an ingenious eyeglass device and accessories which are worn by the pilot. As may be noted in the diagram on the next page, there is a tiny television tube slightly less than one inch in width and only 4¼ inches long that is fitted to each side of the pilot's helmet. This tiny tube is called a "cathode-ray tube," or CRT for short. The image on the face of the tubes is reflected by a mirror and relay lens arrangement onto the reflecting lens (inside of the pilot's glasses) in such manner as to permit the pilot to see through the lenses. This also permits him to retain his normal field of vision while, at the same time, superimposing it on the television image.

The new system avoids using valuable instrument panel space for a "fixed position" type television screen. It also lets the pilot see a natural view of the area over which he is flying.

Photo Courtesy Bell Helicopter Company

The pilot sees on the special lenses of his eyeglasses the night scene picked up by the camera. At the same time, it does not block his normal vision.



SCHEMATIC. – ELECTRO – OPTICAL HEADTRACKER

Courtesy Bell Helicopter Company

yesterday

HISTORICAL EVENTS IN ELECTRONICS

THE TIME: April 7, 1927--forty years ago

THE EVENT: The first transmission of television over long distance by wire and radio

Murray Hill, N.J.--In the "Roaring Twenties" Bell Telephone Laboratories had its headquarters on New York City's lower west side. And it was there, on April 7, 1927, that television publicly opened its big eye for the first time.

On that sunny, April afternoon forty years ago, guests gathered in Washington, D. C., and New York City to see the first public demonstration of the simultaneous transmission of sight and sound between two U.S. Cities.

There were words of greeting first from American Telephone and Telegraph Company and Bell Telephone Laboratories dignitaries. And the late Dr. Herbert E. Ives gave a "popular explanation" of the system that had been developed under his direction.

Then, in Washington, Herbert Hoover (at that time Secretary of Commerce) took his place before the giant transmitting apparatus.

"Scientists for many years, in many countries, have struggled to solve the problems of television," Mr. Hoover said. "We may all take pride in the fact that its actual accomplishment is brought about by American genius and its first demonstration is staged in our own country."

As Mr. Hoover spoke, his image flashed simultaneously over telephone wires across some 230 miles. The audience in the Labs' New York auditorium could watch with wonder, "such gestures as he made."

(Continued on next page)

TV, CIRCA 1927

Herbert Hoover, then Secretary of Commerce, took part in the first public demonstration of inter-city television broadcasting in 1927. Mr. Hoover, speaking in Washington, was seen on television screens at Bell Telephone Laboratories in New York. Others pictured are Gen. J. J. Carty, vice president, American Telephone and Telegraph Company; A. E. Berry, president, The Chesapeake and Potomac Telephone Companies, and Judge Stephen Davis, solicitor for the Department of Commerce.

A. T. & T. Photo

(Continued from preceding page)

Mr. Hoover's image appeared on two screens in New York. One was large enough for the whole audience to see. The other could be viewed on a small receiving disc by one person at a time.

One by one, other prominent guests in Washington took their places in front of the flickering white light and heard "exclamations of wonder" from their friends in New York.

Later that day, in a second demonstration, it was shown that television signals also could be transmitted via radio waves. Thus, TV's first variety show originated from Bell Labs' experimental radio station at Whippany, N.J., with staff members reciting monologues, singing songs, and telling jokes. Again, the picture appeared on the big screen in New York at the same time the sound was heard.

"Here," it was reported, "was a practical achievement of the television dream: sight and sound transmitted simultaneously by radio for the enjoyment of a distant audience."

Ray Rulison, still with Bell Labs, was one of the 200 engineers, scientists, and technicians responsible for the success of that pioneering system.

Bell Telephone Laboratories Photo

The late Dr. Herbert E. Ives, former Director of Electro-optical Research at Bell Telephone Laboratories, as he stood beside the television receiving screen used during the first inter-city TV broadcast forty years ago, on April 7, 1927. The screen consisted of 50 neon-filled tubes, each divided into small segments. Electrical impulses from the transmitter energized the segments, creating a pattern of light and dark edges to form a picture. Dr. Ives is holding a photo-electric cell from the transmitter, and at the left is early scanning equipment.

GUGLIELMO MARCONI

April 25, 1874 • July 20, 1937

Guglielmo Marconi died thirty years ago this month, July 20, 1937, in Rome, Italy, and was given a state funeral by the Italian government. In keeping with his own request, he was buried at the town of his birth, Bologna. It was there in the year 1874 that he was baptized a Catholic. His father was of the same faith, his mother, the former Anna Jameson, of the Protestant faith.

It is a privilege and an honor, in this the first issue of our magazine, to recognize the significant achievement of the inventor of wireless telegraphy — this marking the thirtieth anniversary of his death.

The world-wide acclaim accorded Marconi at the turn of the century and throughout the remaining years of his life, slipped inexorably into the dim shadows of the past, and is now virtually unknown by many persons of the present generation.

Nevertheless, great achievements of the past, long since obsolete by contemporary standards, are still deeply etched into the history of all mankind. They provide the yardstick by which man measures the extent of his progress. They can be a source of inspiration for the later generations as they advance steadily toward new frontiers in a changing environment.

In the words of an old American proverb: Hats off to the past; coats off to the future!

This is the first in a series of biographical sketches of famous people in electronic technology, which will be featured in the Electronics Digest as an informational program, to better acquaint the young people of our generation with accomplishments that have played a vital role in the progress of our world.

Following is a biographical sketch of the inventor of wireless telegraphy, reproduced from *The World Book Encyclopedia by* special permission:

MARCONI, *mahr KOH nee,* **GUGLIELMO** (1874-1937), MARQUIS, an Italian inventor and electrical engineer, won recognition for his work in developing *wireless telegraphy,* or radio. This led to present-day radio broadcasting. He produced a practical wireless telegraph system in 1895 from basic discoveries that had previously been made in wireless telegraphy (see RADIO [History]). He produced the first transatlantic wireless signal in history on Dec. 12, 1901, and patented the horizontal directional aerial in 1905. He shared the 1909 Nobel prize in physics with Ferdinand Braun for their development of wireless telegraphy. Braun, working independently of Marconi, developed a cathode-ray tube. Marconi invented the beam system of wireless for long-distance communication (see SHORT WAVE).

Early Life. Marconi was born on April 25, 1874, in Bologna, Italy. His father was a wealthy Italian, his mother Irish. He grew up as a delicate and studious child. He read widely as a boy, in the excellent scientific library in the Marconi home, and became interested in the study of electromagnetic waves. He was educated by tutors, and later studied at the University of Bologna.

First Experiments. In 1894, Marconi set up apparatus at his father's estate. With this apparatus, he sent and received signals by electrical waves over a longer distance than had ever been done before. But the Italian government took no interest in the early stages of his work. Marconi went to England in 1896 to seek capital for a wireless telegraph company. He applied for and received from the British government the first wireless patent, the famous No. 7777. The patent was based in part on the theory that the distance of communication increases rapidly as the height of aerials is increased.

Marconi formed the first wireless company in 1897. The company installed wireless sets in lighthouses along the English coast. Marconi sent the first wireless telegraph message across the English Channel, a distance of 85 miles, in March, 1899.

The value of the wireless for emergencies at sea was shown on April 28, 1899. Heavy seas had pounded the Goodwin Sands lightship off the English coast, and parts of the deckhouses had been swept away. The vessel reported the situation to a nearby station by wireless, and help arrived at the ship in time to prevent loss of life.

The First Transatlantic Signal. Marconi decided to try to send signals across the Atlantic in 1901. He built a sending station at Poldhu, Cornwall, England. He sailed to Newfoundland and set up receiving equipment at St. John's. The first signal sent, the letter "S," came through as scheduled, though exceedingly faint, on Dec. 12, 1901.

Marconi showed the next year that wireless signals can be received over greater distances at night than in the day. While aboard the steamship *Philadelphia* bound for the United States, Marconi received signals sent from a distance of 2,099 miles.

Marconi lost his right eye in an automobile accident in 1912. But he continued to work. He volunteered for active service when Italy entered World War I, and became commander of the Italian wireless service. He began experimenting with very short waves at this time.

Marconi's work brought him honors from governments throughout the world. The Italian government made him a senator of the kingdom of Italy for life in 1909. He received the hereditary title of *marchese* (marquis) in 1929.

The Bettmann Archive, Inc.

This picture, from an old photographic print, shows Guglielmo Marconi at the receiving set which he used to detect the first transatlantic wireless signal in history on Thursday, December 12, 1901. Marconi's wireless apparatus was located atop Signal Hill, a lofty point overlooking the port city of St. John's, Newfoundland. The sending station for this momentous experiment was located at Poldhu, Cornwall, England, about 2,000 miles across the vast Atlantic Ocean from the North American continent.
The inventor was assisted by two electricians, G. S. Kemp and P. W. Paget, in setting up equipment for the historic transatlantic test.

Marconi the man — a great mind combining the natural curiosity of an inventor and the vision of a philosopher. The man who reached out beyond the horizon for the elusive miracle of global communication by means of wireless telegraphy.

December 12th of this year will mark the 66th anniversary of that first faint letter "S" heard in St. John's. A success achieved after countless hours of thought and preparatory work . . . intermingled with keen disappointments.

Today, we accept as commonplace such electronic miracles as live television programs from Europe via the communications satellite, or pictures of the Moon's surface transmitted to Earth from apparatus in a lunar landing vehicle.

Thus, man measures the extent of his progress from his accomplishments of the past.

The Bettmann Archive, Inc.

A New Era of Portable Power

The nickel cadmium rechargeable battery cut the cord between our electrical needs and the wall socket

Special Report

New York, N. Y. (Editors Digest)—A new era of portable power has dawned. Battery-operated appliances, machines and gadgets are getting a new charge out of life via a mere plug-in.

Through development of the nickel-cadmium rechargeable battery — the atomic-age workhorse of portable power — we have been able to cut the cord between our electrical needs and the wall socket. It is revolutionizing everything from televiewing at picnics to women's fashions.

Modern as all this sounds, and is, this type of portable power had its beginnings almost 70 years ago. That was when an infuriated Thomas A. Edison suffered a minor setback in his laboratory work when a storage battery turned over, spilling its acid contents over important papers.

Lead-acid batteries, the old master decided, were not only troublesome — they were dangerous. Some 50,000 experiments followed (a nine-year project), resulting in nickel and iron substitutes for the offending acid and lead.

But the real breakthrough came years later, during wartime. Necessity — that maternal force in the world of innovation — was rearing its head during World War II. German and American scientists were striving to solve the problems of operating heavy equipment in tropical and arctic climates.

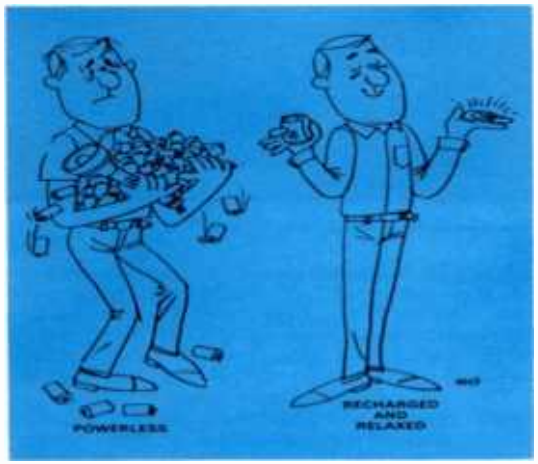
When Allied Intelligence dismantled a downed German fighter plane in France, a unique experimental battery was discovered. It had "sintered" plates in which thin sheets of porous nickel, formed by heating nickel powder, held the active materials for the battery. These produced rugged cells of exceptional power, even at sub-zero temperatures.

Nickel and cadmium became key elements in new batteries for new uses. When General Curtis LeMay, then head of the Strategic Air Command, called for a new method for sending jets aloft faster, on-board nickel-cadmium batteries did the job. Until then, ground units had been supplying starting power plane-to-plane. The new batteries became the magic ingredient in power-packs that started jet bombers at the flick of a switch.

Later developments permitted sealing nickel-cadmium batteries so that they could be charged and used in all positions. The sealed cells required no maintenance, even in the cold and vacuum of outer space. One of the most remarkable uses for rechargeable batteries has been in artificial satellites such as Syncom III. When launched in the summer of 1964, Syncom III was powered by 22 nickel-cadmium batteries that were kept charged by the energy of the sun — through 3,840 solar cells.

Today, down-to-earth applications of nickel-cadmium batteries have become widely accepted and varied. New jetports across the continent use them for standby power in navigation systems; office towers use them for emergency lighting during power failures; surgeons use them to ensure reliability of power in heart-lung machines during open-heart surgery.

The consumer, especially, is finding hundreds of uses for the rechargeable batteries. Through the miracle of portable electric power, hedges are being clipped, portable radio and television sets, typewriters and dictation machines are being operated; turkeys are being carved; cakes are being mixed, rugs are being cleaned; cigarets are being lit;



and even dresses, coats and slacks are being styled with flashing, glowing lights. Rechargeable nickel-cadmium batteries also provide power for cordless tools, razors, movie cameras, and clothes and shoe brushes.

The feature that particularly endears rechargeable batteries to owners of products they power is their simple maintenance. You just plug them in for recharging after use. Modern homes are being equipped with storage consoles in which appliances are constantly on charge when not being used. With nickel-cadmium batteries, there is no need to keep track of recharge . . . in most consumer applications they can be left on charge indefinitely.

Interestingly enough, the world of electricity — which began with a long string that connected a kite, a key and Benjamin Franklin — has taken a gigantic stride forward when another cord — the one leading to the wall socket — was cut . . . thanks to rechargeable nickel-cadmium batteries.

STUDY-GUIDE NO. 1

EASY STEPS TO GOOD SOLDERING

Soldering tools, techniques, chassis and circuit board wiring and soldering

By William M. Palmer

Step No. 1—Soldering Tools

Soldering is used more often, in more crafts and hobbies than any other method of fastening. You'll find that it is simple with the proper equipment, a little know how, and some practical experience.

Naturally, the first step you must consider is a soldering tool. Today there are a number of quality soldering irons and guns on the market at reasonable prices. When shopping for this tool . . . look for quality features such as replaceable tips of plated solid copper, stainless steel barrels, heat resistant handles, etc. A quality soldering gun should feature a fingertip dual heat trigger, a spotlight to light the way into dark areas — speaker enclosures, chassis work, etc. Later on you may want to own both a soldering iron and gun for your student or hobby projects, and for general household soldering work.

If you are a beginner and wish to invest only a small amount of money in soldering tools, you may want to buy a low wattage pencil kit (illustrated in this article) which contains everything needed for low cost home soldering work.

On the other hand, a soldering gun kit of 100/140 watts (illustrated in this article) is an excellent investment, if your initial budget permits. Both types of soldering tools are available at Radio Shack stores.

You also need a pair of diagonal cutters (called dikes) and a pair of needle-nose pliers. The "dikes" are used for cutting the leads of resistors, capacitors, etc., and in cutting hook up wire to proper length. The needle-nose pliers are used for

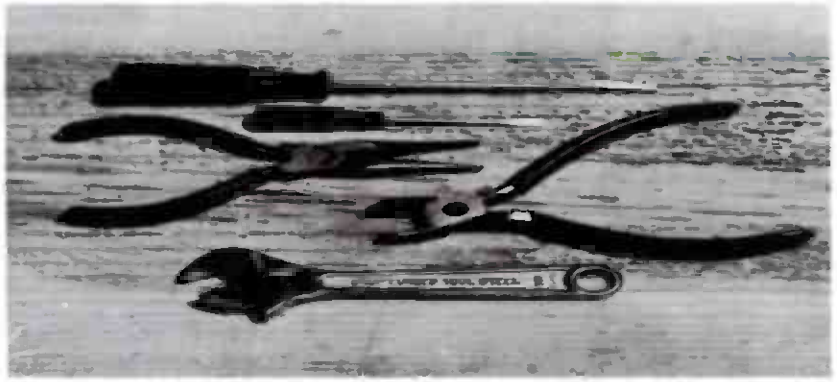
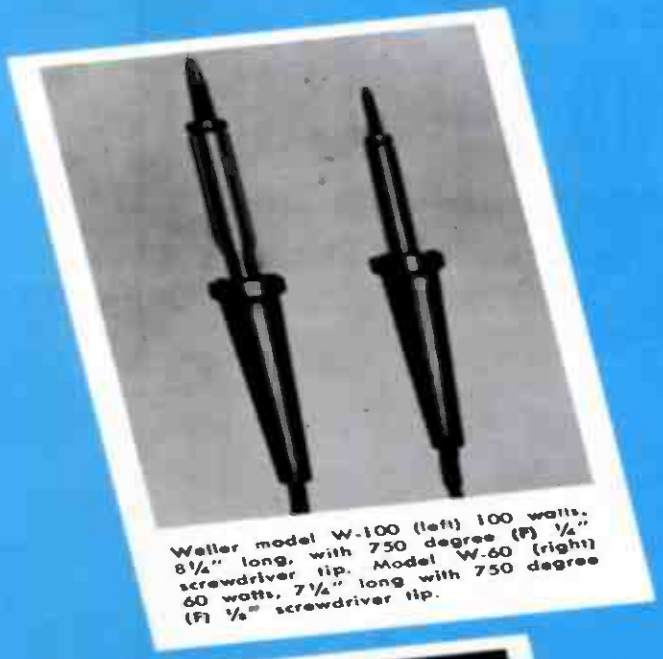


Photo upper right. Pictured are needle-nosed pliers, diagonal cutters or "dikes," small adjustable wrench, and screwdrivers. *Photo lower right.* Kit for homecrafters which includes dual-heat 100/140 watt gun and accessories — ideal for electronic work, and many household repair jobs.



Weller model W-100 (left) 100 watts, 8¼" long, with 750 degree (F) ¼" screwdriver tip. Model W-60 (right) 60 watts, 7¼" long with 750 degree (F) ⅛" screwdriver tip.

Soldering pencil kit, 25 watts, which includes 60/40 rosin core solder, three pre-tinned, plated, solid copper tips and a soldering tool aid. Ideal for the hobbyist or student.

bending and positioning the leads and wires prior to soldering.

You should have at least two sizes of screwdrivers — one with a 3/16" blade for regular assembly work, and one with a ⅛" blade for the knobs and smaller work.

To complete your initial tool set, you will find a 6-inch adjustable wrench (drop-forged) handy to have around. This versatile tool can be used for tightening volume control nuts, panel and chassis hardware, bending brackets to proper shape, as well as household uses.

One final item is suggested — a small fishing tackle box, either metal or fibreglass, low cost. The purpose being to keep your small tools together "where you can find them." Also the small compartments in the tray make ideal places for spare parts, nuts, screws, lockwashers, solder, etc.

This completes the basic tool requirements for most electronic work.

Step No. 2—Clean the Work

Before soldering, be sure that work is free of grease, wax, or dirt. If not, clean with alcohol. Wire leads, or brackets can be rubbed lightly with fine sandpaper to leave "bright" look for best soldering results.

Step No. 3—Use the Proper Solder

Use a good grade of rosin core solder. Never use acid core solder in electronic work. There are three grades of solder most commonly used. For most work "60-40" is recommended because it flows freely at low temperatures.

Step No. 4—Use the Right Soldering Tool

For electronic work and crafts and hobbies a pencil type soldering iron (25 to 80 watts) is recommended. A dual heat gun (100-140 watts) with finger-tip control is also recommended. A gun is more convenient — it heats and cools quickly, and does not require a stand.

Step No. 5—Be Sure Tip Is Tinned

A properly tinned soldering iron or gun tip should be "silver bright." Although some models are "tinned" when you buy it, it is necessary to re-tin the tip occasionally. Oxides which may have formed on the tip may easily be removed with fine sandpaper. Then heat the tip working in new solder as working temperature is attained. Excess solder should be wiped off with a cloth.

Step No. 6—Suggestions

If you are a beginner with no experience in soldering, a half hour's practice with some odd lengths of wire and an old radio receiver chassis will give you confidence as well as experience before starting on a new kit or project.

Note: A poor or cold solder joint will usually look crystalline and have a grainy texture, or the solder will stand up in a blob and will not stick to the joint. In this case, a joint should be re-heated until the solder flows smoothly over the entire junction. It may be necessary to add a little more solder to get a smooth "bright" appearance.

Step No. 7—Chassis Wiring and Soldering

(a) As a general rule, when preparing hookup wire for connection, ¼" of the insulation should be removed from each end, unless the kit instructions state otherwise.

(b) In order to avoid breaking internal connections when stripping insulation from the leads of transformers or similar components, hold the lead with pliers while it is being stripped.

(c) The leads on resistors, capacitors, and similar components are usually longer than needed to complete the connection. Trim the lead for proper length before making the connection for soldering. As a rule, a lead should be just long enough to complete the connection.

(d) Crimp or bend the lead around the terminal with needle-nose pliers to form a tight connection. Do not rely on solder for physical strength. Follow your kit or project instructions concerning special connections.

(e) If possible, place your work so that gravity will assist in keeping the solder where it belongs.

(f) Place a flat side of the soldering iron tip against the joint to be soldered until it is heated sufficiently to melt the solder.

(g) Then place the solder against the heated terminal and it will immediately flow over the joint. Use only enough solder to set the junction. In most cases it is not necessary to fill the entire hole in the terminal with solder.

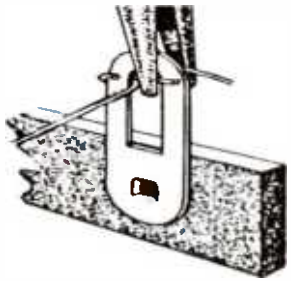
(h) Remove the solder and then the iron from the completed junction. Be careful not to move the leads until the solder has solidified.

Step No. 8—Circuit Board Wiring and Soldering

(a) Before attempting any work on circuit boards, read the following instructions carefully, and study the illustrations.

(b) Proper mounting of components on the board is a requisite for good performance. In general, all components on the board should be mounted tightly to the board. Follow the instructions in your kit or project in special cases. All leads should be kept as short as possible to minimize the effects of stray capacity in the wiring. Note proper and improper methods of mounting shown in the illustrations. Be careful not to damage resistors or capacitors when bending the leads for fitting to the circuit board.

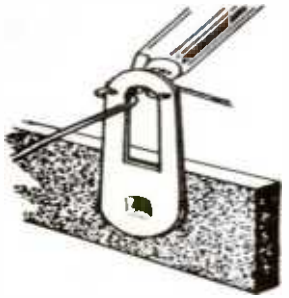
(c) Tubular capacitors and resistors will fit properly if the leads are bent as shown. Disc capacitors will generally fit in place with no lead preparation. However, leads should be straight. The components with lugs seldom require preparation unless they are bent. They can be straightened with pliers.



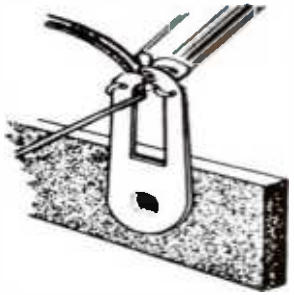
1

CRIMP WIRES

2



HEAT CONNECTION

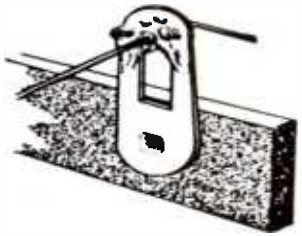


3

APPLY SOLDER

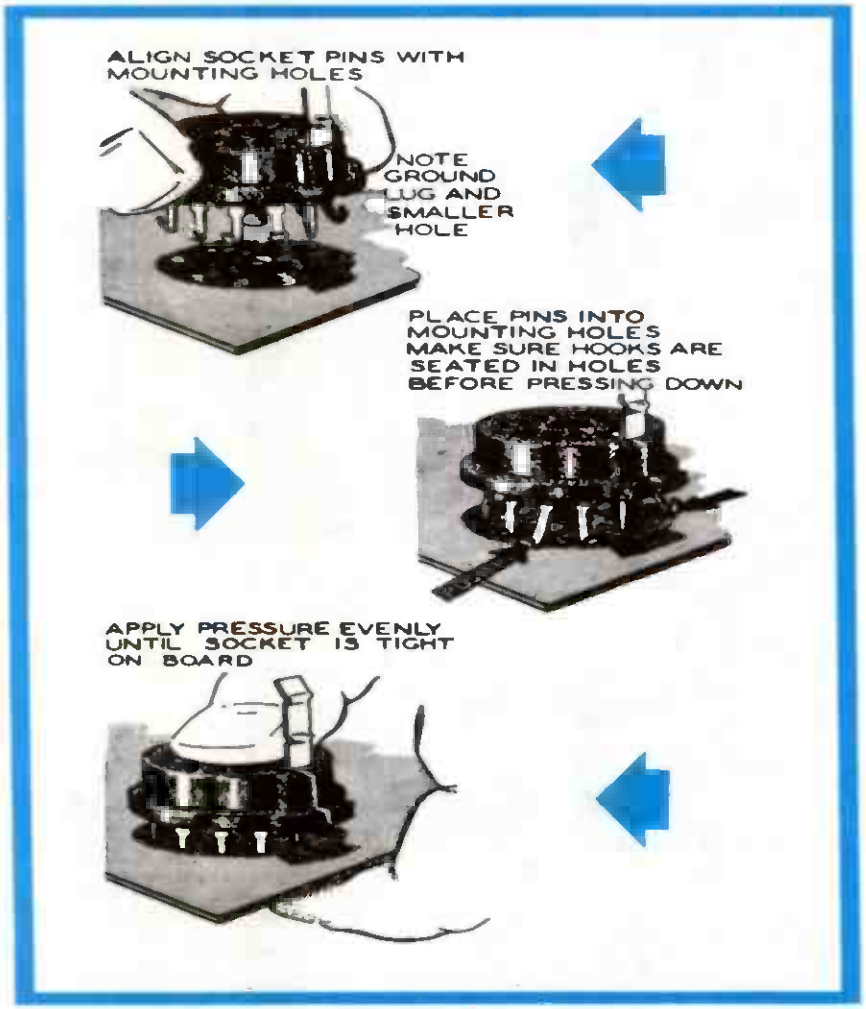
4

ALLOW SOLDER TO FLOW



5

PROPER SOLDER CONNECTION



(d) Parts should be inserted and the leads bent outward slightly to lock them in place, as shown in illustration.

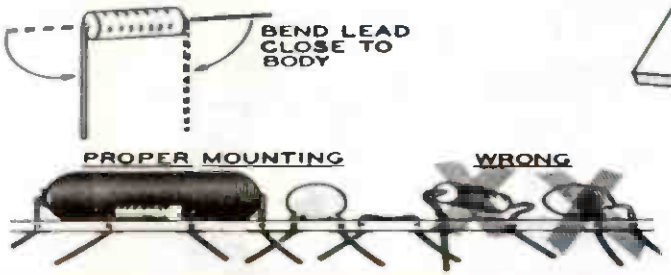
(e) Components are sometimes soldered in groups. Follow the instructions of your kit or project in this case. When they have been soldered, diagonal cutters may be used to cut off the excess leads close to the board.

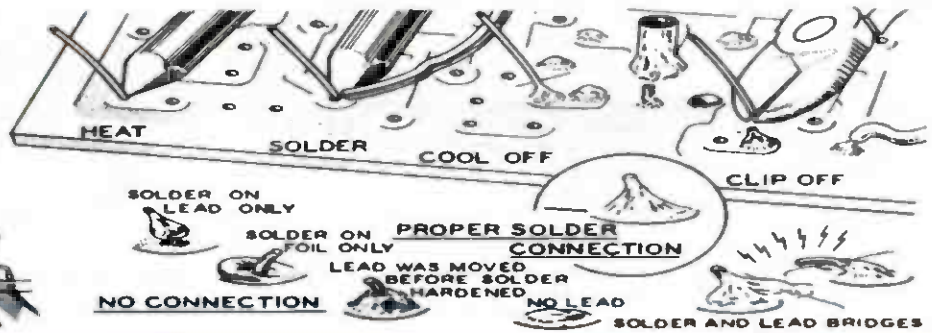
(f) The actual technique of soldering leads to a circuit board is quite simple. Position the tip of the soldering iron so that it firmly contacts both the circuit board foil and the wire or lug to be soldered, as shown in illustration. The iron should be held so that solder is not likely to flow to adjacent foil conductors or connections. The solder should immediately be placed between the iron and the joint to be soldered. Remove the length of solder as soon as its end begins to melt and flow onto the lead and foil. Hold the tip of the iron in place only until the solder begins to flow outward over the foil; then remove the iron quickly.

(g) Avoid overheating the connection. A soldering pencil or small iron (approximately 30 watts) is ideal for use in circuit board work. If a soldering iron or gun with high wattage is used, be careful not to damage the circuit board from overheating.

(h) The use of excessive amounts of solder will increase the possibility of bridging between foil conductors or plugging holes which are to be left open for wires which may be added later. If solder is accidentally bridged across insulating areas between conductors, it can be cleaned off by heating the connection carefully and quickly wiping or brushing the solder away with a soft cloth or clean brush. Holes which become plugged can be cleared by heating the area immediately over the hole while gently pushing the lead of a resistor through the hole from the opposite side, and withdrawing the lead before the solder rehardens. Do not force the lead through; too much pressure before the solder has time to soften may separate the foil from the board. A break in the foil can be repaired with a small piece of bare wire soldered across the break.

Informational Data and Drawings Courtesy Heath Company; Photos of Soldering Irons and Guns Courtesy Weller Electric Company

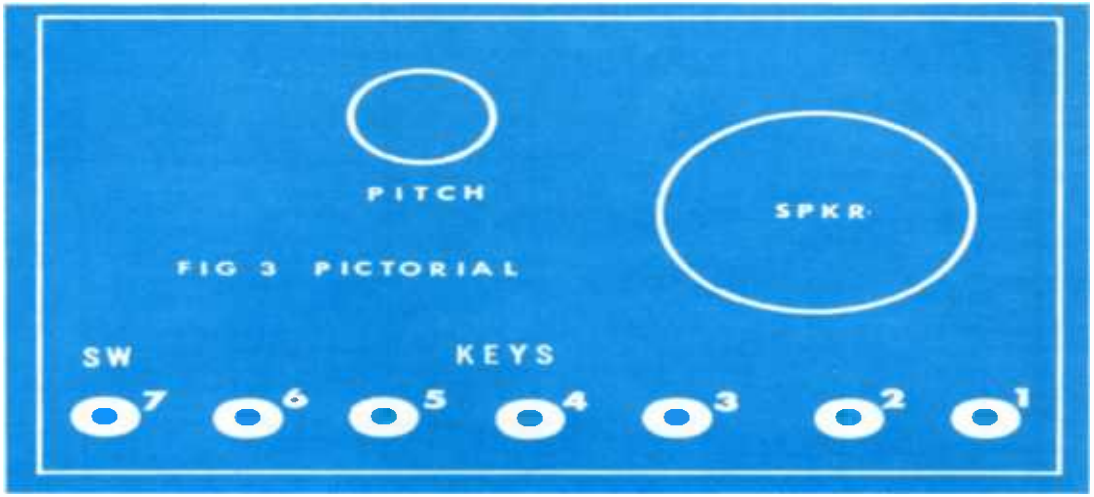




Easy to Build

ELECTRONIC ORGAN

For Fun and Music!



This project embodies the basic principles of feedback and time constant networks. The electronic organ, then, is what you might call an oscillator with switchable resistive and capacitive networks which determine the frequency or note in the music scale.

Depressing a key on the organ causes a varying current to flow through the coil in the speaker (a coil of wire inside a magnetic field). These currents cause the "speaker cone" to vibrate and produce sound waves which we hear as an "electronic organ" tone or note.

Follow wiring instructions carefully. Exercise care in handling the resistors, capacitors, and transistors.

You may build this project from the parts list, or it is available in a kit through Radio Shack electronic stores. The kit is produced by Science Fair Electronics.

Have fun . . . make merry music!

PARTS LIST

DESCRIPTION	RADIO	SHACK NO.
1. Speaker		99-5-003
2. Transistor PNP	Q1	99-4-101
3. Transistor PNP	Q2	99-4-101
4. Output Transformer	T1	99-3-201
5. 5K Ohm Pitch Control		99-6-501
6. Knob		99-8-005
7. Switch (7) Push Button	S1-S7	99-6-001
8. 1K Resistor	R1	99-1-007
9. 2.2K Resistor	R9	99-1-009
10. 2.2K Resistor	R11	99-1-009
11. 3.3K Resistor	R3	99-1-013
12. 4.7K Resistor	R8	99-1-012
13. 6.8K Resistor	R3	99-1-006
14. 10K Resistor	R4	99-1-002
15. 15K Resistor	R5	99-1-008
16. 22K Resistor	R6	99-1-010
17. 180K Resistor	R10	99-1-003
18. 560K Resistor	R7	99-1-011
19. .01mf Capacitor	C2	99-2-004
20. 2mfd Capacitor	C1	99-2-006
21. Perfboard		99-8-004
22. Battery Clip		99-7-003
23. Wire		99-7-005
24. 4-40 Nuts (3)		99-8-001
25. 4-40 ⅜ Screw (3)		99-8-003
26. Speaker Clasps (3)		99-8-002
27. Push in Terminal (2)	A-B	99-7-006

Easy to Build ELECTRONIC ORGAN for Fun and Music

FIG 2

TOP VIEW PICTORIAL DIAGRAM

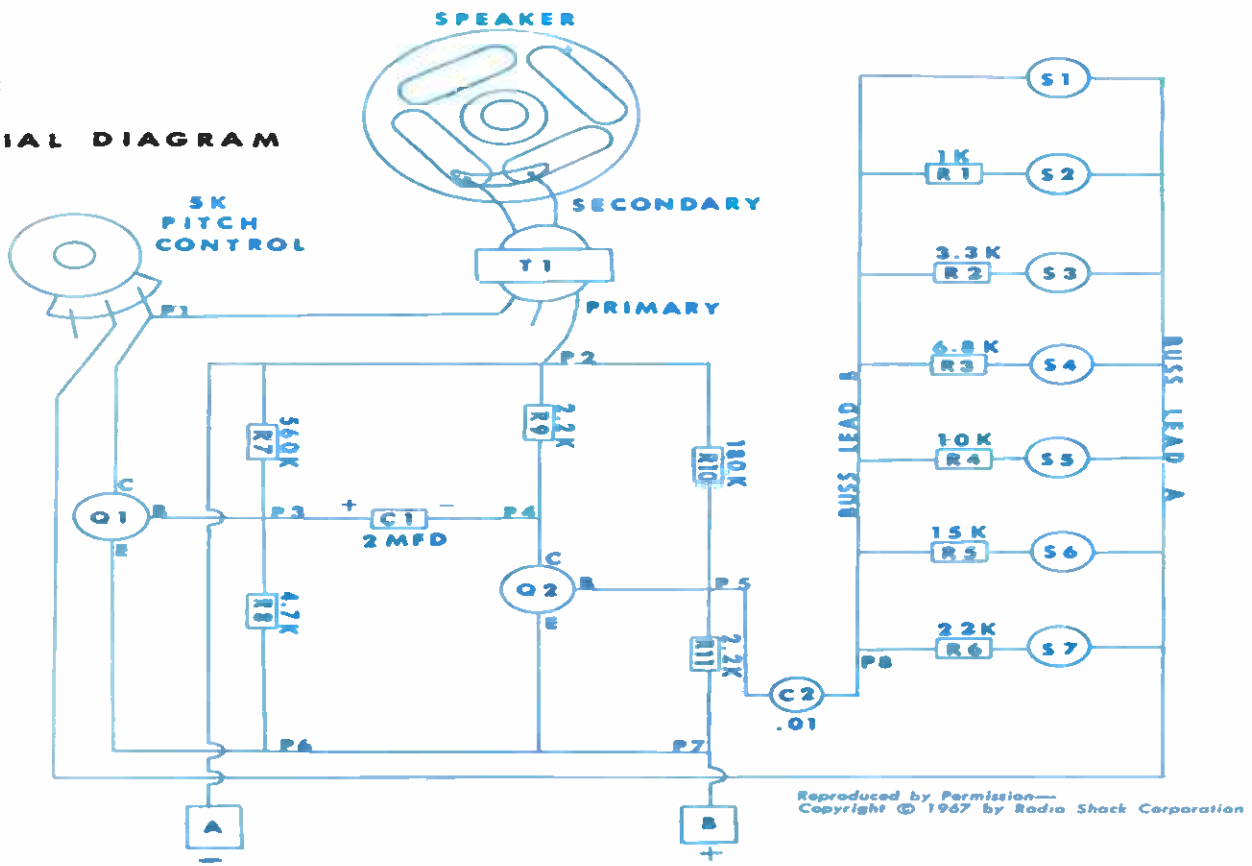
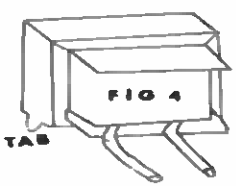


FIG 3 TRANSISTOR
BOTTOM VIEW



ASSEMBLY INSTRUCTIONS

1 ( ) Check the parts to see that everything listed is included. Check each step as you progress (√).

2 ( ) Place the pictorial diagram near the perfboard sd that you can place the parts on the board as illustrated.

3 ( ) Mount the seven push button switches in the position indicated by Figs. 2 & 3. This may be accomplished by a reamer or similar tool.

4 ( ) Mount the pitch control in the position indicated by Fig. 2. Use a reamer to enlarge the hole.

5 ( ) Place the knob on the pitch control shaft.

6 ( ) Mount the speaker in the position indicated by Fig. 3. This may be done by arranging the three clasps, screws, and nuts to form a triangle so that the clasps will hold the speaker to the board.

7 ( ) Mount the transformer (T1) to the right of the speaker so that the side of the transformer that has two leads face the speaker terminals (this is the secondary side). The transformer is made for easy mounting to the board. Fig. 4 illustrates a metal tab which will go through any of the holes in the perfboard. Position the transformer until two holes are found that will accept the metal tabs. Bend back the metal tabs and the transformer will stay in place.

Easy to Build ELECTRONIC ORGAN for Fun and Music

WIRING INSTRUCTIONS

1 ( ) Run a long uninsulated wire (Buss Lead A) from S1 to S7 (See Fig. 2). Solder the lead to each switch terminal.

2 ( ) Run a second uninsulated wire (Buss Lead B) from S1 to S7. Solder at S1 terminal only.

3 ( ) Connect a 1K resistor (R1 brown, black, red) from the terminal on S2 to Buss Lead B. Solder.

4 ( ) Connect a 3.3K resistor (R2 orange, orange, red) from the terminal on S3 to Buss Lead B. Solder.

5 ( ) Connect a 6.8K resistor (R3 blue, gray, red) from the terminal on S4 to Buss Lead B. Solder.

6 ( ) Connect a 10K resistor (R4 brown, black, orange) from the terminal on S5 to Buss Lead B. Solder.

7 ( ) Connect a 15K resistor (R5 brown, green, orange) from the terminal on S6 to Buss Lead B. Solder.

8 ( ) Connect a 22K resistor (R6 red, red, orange) from the terminal on S7 to Buss Lead B. Solder.

9 ( ) Connect a wire from Buss Lead A at S7 to the center terminal of the pitch control. Solder.

10 ( ) Connect the left lead of the primary side of the transformer (T1) to P1 on the 5K pitch control. (Note: The primary side has 3 leads).

11 ( ) Lay out the remaining resistors, capacitors, and transistors in accordance with Fig. 2.

12 ( ) Connect the 560K resistor (R7 green, blue, yellow) the 2.2K resistor (R9 red, red, red) and the 180K resistor (R10 brown, gray, yellow) together to form P2. Connect the right lead of the primary side of the transformer to P2. Run a wire from P2 to push in terminal A. Solder P2 and terminal A.

13 ( ) Connect the collector (C) of transistor Q1 to P1. Solder. (See Fig. 5 for base diagram of the transistors.

14 ( ) Connect the emitter (E) of transistor Q1 to P6.

15 ( ) Connect the base (B) of transistor Q1 to P3.

16 ( ) Connect the other lead of the 560K resistor (R7) and a 4.7K resistor (R8 yellow, purple, red) and the + side of the 2mfd capacitor to P3. Solder. Note: Observe the polarity of the capacitor.

17 ( ) Connect the other lead of the 4.7K resistor (R8) to P6.

18 ( ) Connect a jumper wire from P6 to P7. Solder P6.

19 ( ) Connect a 2.2K resistor (R11 red, red, red) to P7.

20 ( ) Run a wire from P7 to push in terminal B. Solder terminal B.

21 ( ) Connect the emitter (E) of transistor Q2 to P7. Now solder all the leads together at P7.

22 ( ) Connect the other side of the 2.2K resistor (R9) to P4.

23 ( ) Connect the - side of the 2mfd capacitor to P4.

24 ( ) Connect the collector (C) of transistor Q2 to P4. Now solder all the leads together at P4.

25 ( ) Connect the base (B) of transistor Q2 to P5.

26 ( ) Connect the other side of the 180K resistor (R10) to P5.

27 ( ) Connect the other lead of the 2.2K resistor (R11) to P5.

28 ( ) Connect the .01 capacitor to P5. Now solder all leads at P5.

29 ( ) Connect the other side of the .01 capacitor to P8. Solder P8.

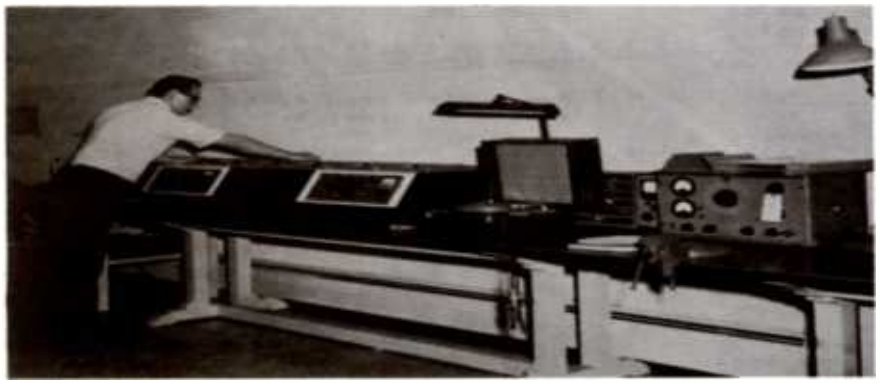
30 ( ) Connect the 2 secondary leads of the transformer (T1) to the 2 terminals on the speaker. Solder.

31 ( ) OPERATION:
Connect the black lead of the battery clip to push in terminal A. This is the negative terminal. Connect the red lead of the battery clip to push in terminal B. This is the positive terminal. Connect a 9 volt batter (Radio Shack Cat. #23-464) to the clip. Press any one of the buttons and rotate the pitch control until the desired note is heard. Each button in turn will produce a different note.

This kit may be powered by either the 9 volt battery (Radio Shack Cat. #23-464) or a suitable A.C. power supply with sufficient voltage and adequate filtering. Available for this purpose is a Science Fair A.C. to D.C. power supply Kit #28-104.

Magazines and Books on Magnetic Tape

Now Library of Congress' Talking Books on records and magnetic tape for the physically handicapped



Library of Congress Photo

Special Report

The famous "talking books" that the Library of Congress has supplied to blind readers for 34 years are now available to people with other physical handicaps.

Public Law 89-522 (July 30, 1966) authorized the Library of Congress to extend its national books-for-the-blind program to residents of the United States and to U. S. Citizens abroad who cannot read conventional printed materials because of physical limitations. Last fall, Congress appropriated $1,497,000 to implement the authorizing legislation, and the President signed the appropriation act on October 27, 1966.

Meanwhile, the Library has changed the name of the Division for the Blind, which has provided braille books to blind readers since 1931 and talking book recordings since 1933, and the division has prepared for increased service, acquired the additional books and phonographs, and developed necessary informational resources.

Now—since January 1967—the Division for the Blind and Physically Handicapped is ready to supply the Nation's new borrowers with books and magazines.

Handicaps besides visual impairment which can prevent normal reading are disabling paralysis, muscle or nerve deterioration affecting coordination and control, and confinement in iron lungs or other mechanical devices. Among the causes of these conditions are cerebral palsy, multiple sclerosis, muscular dystrophy, arthritis, infantile paralysis, myasthenia gravis, and diplegia.

How the Program Operates

Readers with these handicaps may now borrow talking books through 34 cooperating regional libraries in the United States that already serve blind readers by lending the books produced by the Library of Congress. They may obtain phonographs supplied by the Library through 54 machine-lending agencies. The service is entirely free.

To borrow books from his regional library, the individual reader should obtain a brief statement, certifying the characteristics of his physical disability, from a competent authority — such as a doctor, optometrist, registered nurse, professional staff member of a hospital or other institution or agency, or, in the absence of any of these, from a professional librarian. In cases of total blindness, a statement signed by a prominent member of the community is accepted. The statement should be sent to the regional library for the blind in the person's area or, if he does not know its identity, to the Library of Congress.

The books are general in scope, ranging from titles of current and popular interest to classics and vocational and practical materials; there are also well-known magazines, such as *American Heritage*, *Holiday*, *Good Housekeeping*, and *Sports Illustrated*, available.

Individual titles of special or limited interest — recorded on tape by volunteers — supplement the talking books on discs. *Borrowers of taped books must own or have access to a tape player, however, since the Library of Congress does not yet provide these machines.*

Development of such an extensive library program is possible through the generous cooperation of publishers and authors who freely grant permission for their books to be reproduced in embossed or recorded forms for the thousands who otherwise could not read.

Catalogs of the books that are available in the regional libraries and information on national services and resources may be obtained from the Division for the Blind and Physically Handicapped, Library of Congress, (now at) 1291 Taylor Street, N.W., Washington, D.C. 20542.

Now Library of Congress' Talking Books on records and magnetic tape for the physically handicapped

COOPERATING REGIONAL LIBRARIES

In the list below, cross references have been made where certain states are served by a regional library located in another state; e.g., "ARKANSAS"... same as "OKLAHOMA."

Residents of—	Borrow books from—
ALABAMA	Library for the Blind, Alabama Institute for Deaf & Blind, P. O. Box 455, Talladega, Ala. 35160
ALASKA	same as WASHINGTON
ARIZONA	same as CALIFORNIA (southern)
ARKANSAS	same as OKLAHOMA
CALIFORNIA (northern)	California State Library, Blind Section, Courts Bldg., Sacramento, Calif. 95809
CALIFORNIA (southern)	Braille Institute of America Library, 741 North Vermont Ave., Los Angeles, Calif. 90029
COLORADO	Division of Work with the Blind, Denver Public Library, 90 Lowell Blvd., Denver, Colo. 80219
CONNECTICUT	same as NEW YORK CITY
DELAWARE	same as PENNSYLVANIA (east)
DISTRICT OF COLUMBIA	Division for the Blind, Library of Congress, Washington, D.C. 20540
FLORIDA	Florida Talking Book Library, P.O. Box 2299, Daytona Beach, Fla. 32015
GEORGIA	Library for the Blind, 1050 Murphy Ave., S.W., Atlanta, Ga. 30310
HAWAII	Library for the Blind, 402 Kapahulu Ave., Honolulu, Hawaii 96815
IDAHO	same as OREGON
ILLINOIS	Services to the Blind, 4544 N. Lincoln Ave., Chicago, Ill. 60625
ILLINOIS (city of Jacksonville only)	Illinois Braille & Sight-Saving School, 658 E. State St., Jacksonville, Ill.
INDIANA	Service for the Blind, Indiana State Library, 140 N. Senate Ave., Indianapolis, Ind. 46204
IOWA	Library for the Blind, 4th & Keo Sts., Des Moines, Iowa 50309
KANSAS	same as MISSOURI
KENTUCKY	same as OHIO (south)
LOUISIANA	Department for the Blind, Louisiana State Library, State Capitol Grounds, Baton Rouge, La. 70821
MAINE	same as MASSACHUSETTS
MARYLAND	same as VIRGINIA
MASSACHUSETTS	The Library, Perkins School for the Blind, Watertown, Mass. 02172
MICHIGAN (outside of Wayne County)	Michigan State Library for the Blind, 735 E. Michigan Ave., Lansing, Mich. 48913
MICHIGAN (Wayne County only)	Department for the Blind, Wayne County Library, 33030 Van Born Rd., Wayne, Mich. 48184

Now Library of Congress' Talking Books on records and magnetic tape for the physically handicapped

(Continued from preceding page)

Residents of—	Borrow books from—
MINNESOTA	Library for the Blind, Minnesota Braille & Sight-Saving School, Faribault, Minn. 55021
MISSISSIPPI	same as LOUISIANA
MISSOURI	Wolfner Library for the Blind, 3844 Olive St., St. Louis, Mo. 63108
MONTANA	same as WASHINGTON
NEBRASKA	Library for the Blind, State Capitol, Lincoln, Neb. 68509
NEVADA	same as CALIFORNIA (northern)
NEW HAMPSHIRE	same as MASSACHUSETTS
NEW JERSEY	same as PENNSYLVANIA (east)
NEW MEXICO	same as COLORADO
NEW YORK (other than Greater New York City & Long Island)	Library for the Blind, 226 Elm St., Albany, N.Y. 12202
NEW YORK CITY (Greater New York City & Long Island)	The Library for the Blind, 166 Ave. of the Americas, New York, N.Y. 10013
NORTH CAROLINA	Library Services for the Blind, Mansion Park Bldg., Raleigh, N.C. 27601
NORTH DAKOTA	same as MINNESOTA
OHIO (south of Columbus)	Library for the Blind, 617 College St., Cincinnati, Ohio 45202
OHIO (north, including Columbus)	Library for the Blind, 325 Superior Ave. N.E., Cleveland, Ohio 44114
OKLAHOMA	Special Services Section, Oklahoma State Library, 109 State Capitol, Oklahoma City, Okla. 73105
OREGON	Books for the Blind, 216 N.E. Knott St., Portland, Ore. 97212
PENNSYLVANIA (east of Harrisburg)	Library for the Blind, 17th & Spring Garden Sts., Philadelphia, Pa. 19130
PENNSYLVANIA (west, including Harrisburg)	Library for the Blind, Federal & Ohio Sts., Pittsburgh, Pa. 15212
PUERTO RICO	same as NEW YORK CITY
RHODE ISLAND	same as MASSACHUSETTS
SOUTH CAROLINA	same as NORTH CAROLINA
SOUTH DAKOTA	same as MINNESOTA
TENNESSEE	same as OHIO (south)
TEXAS	Texas State Library, State Capitol, Austin, Tex. 78711
UTAH	Division for the Blind, Utah State Library, 1488 S. State St., Salt Lake City, Utah 84115
VERMONT	same as NEW YORK
VIRGINIA	Virginia State Library for the Blind, 3003 Parkwood Ave., Richmond, Va. 23221
VIRGIN ISLANDS	same as NEW YORK CITY
WASHINGTON	Library for the Blind, 425 Harvard Ave. N., Seattle, Wash. 98102
WEST VIRGINIA	same as PENNSYLVANIA (west)
WISCONSIN	Library for the Blind, Milwoukee Public Library, 814 W. Wisconsin, Milwaukee, Wis. 53233
WYOMING	same as UTAH

July-August, 1967

"Take a long look at our world as it exists today--it will never be the same!"

"We are about to take a quantum jump ahead!"

The speaker: Robert W. Sarnoff, president, Radio Corp. of America. The scene: The Westminister Chamber of Commerce, London, England. His subject: Economics and the Information Revolution. Here are highlights from his remarks:

"Today, when you telephone New York or Toronto, or send a telegram or telex message across the Atlantic, you are probably communicating via the Early Bird satellite. This has a capacity of 240 voice or data circuits, or one television channel. By 1973, Transatlantic satellites should provide 42,000 simultaneous voice/data channels or 24 full-time color television channels."

"There will be concurrent expansion of undersea cable capacity, and additional satellite channels across the Pacific...ultimately, there will be laser beams, with virtually unlimited communication capacity."

"There is radical change, too, at the terminals. New electronic methods are being devised to interchange print, picture, and sound, and to establish communication among men. The result will be a system to provide the maximum transmission of knowledge at the moment of maximum need."

"These new technological forces are moving the industrial nations toward a new relationship based as much upon information as upon production and distribution. Information is beginning to achieve the status of a form of currency, readily convertible into goods and services. It is also becoming as basic as energy, with the information-generating computer the present-day counterpart of the steam engine."

"Having served apprenticeship as a clerical genie, the computer now sits in the front office of business management as an informant and consultant. It serves with tireless impartiality any type of business--from the industrial giant to the small retail establishment. Through time-sharing, hundreds, and soon thousands, of organizations and individuals will have simultaneous access to computer service, turning it into an informational utility comparable to electricity or gas."

(Continued on next page)

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(Continued from preceding page)

"The executive...will be able, without leaving his desk, to deal face-to-face over a private television circuit, with representatives in Vancouver, Buenos Aires, or Colombo. Through the split-screen, sight and sound conference calls on a world-wide basis will become standard. In this sense, we will communicate to work daily across oceans and continents..."

"Each point in this international information network will serve as a vital nerve center and command post for the makers of economic policy...computer-oriented communication systems will substantially accelerate the information gathering process, and statistics will become current rather than historical. For you, who are businessmen, as well as for governments, the result will be unlimited flexibility in making decisions, and unprecedented control over economic destinies."

FORT WORTH, TEXAS--A far-reaching $5,000,000 expansion program designed to make Textron's Bell Helicopter Company unsurpassed in rotary-wing research and development capabilities was announced recently.

Bell President E. J. Ducayet said the program, planned to meet research needs over the next decade, will encompass:

--A new multi-facility experimental flight control center at Arlington, Texas, thus providing company researchers with one of the most modern helicopter flight test plants in the nation.

--Inclusion of an airborne and ground data acquisition system at the center, involving the use of computers to obtain performance information on research aircraft and their components.

--Acquisition of a sophisticated hybrid computer system to be used in the designing of new aircraft. This elaborate computer center will be the most up-to-date of its kind in the Southwest.

Data on test aircraft and their components will first be recorded on magnetic tape during air tests. Such information as loads, stress and acoustics will be gathered. This then will be processed into engineering units for subsequent use by design personnel.

The hybrid computer system, a separate and more elaborate one than the flight center's, is scheduled for installation by January, 1968 in the new office building being constructed at Hurst.

It is a hybrid system in that it will consist of a digital computer linked through a high-speed interface or converter to two analog computers. Serving primarily as an engineering design tool, it will have the capability of providing 1,000 solutions per second.

PILOT LIGHT FLASHER

Illustrates Basic Fundamentals of Radar, Computers and Television

Here is an ideal science project for summer-time . . . one that is suitable for both the student and hobbyist experimenter.

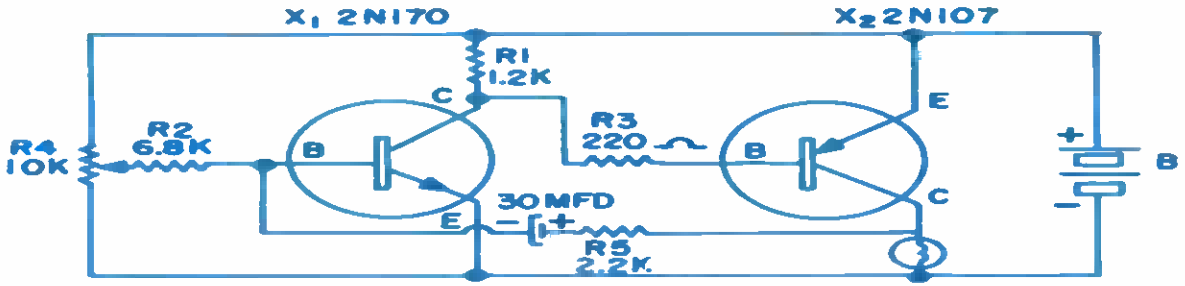
This project, which may be completely assembled and wired in less than one hour, can be utilized as an ornamental device, or for signaling purposes. It is a fine educational tool as well, since it demonstrates basic relaxation oscillator principles. The device can be expanded and become the basis for an automobile or boat warning light. It can also be used for timing circuits by determining the number of cycles per second—much the same way that a clock operates on a certain rate of "ticks" per second.

The schematic below should be followed closely during assembly and wiring. Be especially careful in handling the small resistors, capacitors, and the transistors. They are fragile and may easily be broken or damaged, thereby affecting operation.

It is preferable to use a small soldering iron that is rated between 30 to 100 watts. Soldering irons rated at greater wattage may cause damage to the small components by excessive heating.

The tip of the soldering iron should be kept clean by wiping occasionally with a cloth. Also, be sure to use a good grade of *rosin core* solder.

Good luck on your project!



PARTS LIST

DESCRIPTION		RADIO SHACK NO.
1.2K ½W Resistor	R1	70-0195
6.8K ½W Resistor	R2	70-0195
220 ohm ½W Resistor	R3	70-0195
10K Variable Potentiometer	R4	271-1715
2.2K ½W Resistor	R5	70-0195
30MFD @ 15 Volts Capacitor	C	272-954
2N170 Transistor	X1	276-1703
2N107 Transistor	X2	276-1701
Panel Indicators (Pak of 2)		272-1535
"C" Cells (4 required)		23-467
Double Battery Holder (2 required)		270-1437

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FASCINATING ELECTRONIC PROJECTS . . .

Battery Operated One Tube

RADIO PROJECT KIT

3.95

Build a radio yourself and enjoy long hours of listening pleasure! This tiny radio uses a minimum of components and is designed to give you excellent sensitivity and selectivity. Detailed instructions are included so that you can wire it easily and properly. 28-100

IN THE STORES—NOW AVAILABLE!

Battery-Operated!

ELECTRONIC ORGAN KIT—

PLAYS SEVEN NOTES SEPARATELY!

You can actually play tunes on the organ you built! Each note is separately tone variable. Solid state. Safe—no AC current and on easy perf-board construction which includes pictorial, schematic and numbered instructions. This kit embodies basic principles of feedback and time constant networks. 28-101

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2-TRANSISTOR RADIO KIT

Tune the entire 540-1600 KC AM band with great sensitivity and selectivity with this radio you've built. Can also be used as broadcast band tuner. This project uses crystal detector and a two stage audio amplifier. 28-102

3.95

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AM WIRELESS MIKE KIT

Transmit through any AM radio with this broadcast band wireless mike kit you built yourself! "Broadcaster" microphone works up to 20 feet. It's basically an oscillator and the addition of a "modulator" circuit converts the oscillator into a wireless mike. 28-103

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