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YEAR BOOK



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1923 Edition

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Mechanical Card Tricks and How to Perform Them.
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Hello Boys!
REG. U.S. PAT. OFF.

Before you read this book I am going to ask your indulgence while I take a little space to tell you something of my own story.

My reason for this is that I want my boy friends (and I think I may count more of these in the world than any other single individual) to know what I have been through myself and why I feel that every boy should be trained for skill, adeptness, knowledge, popularity and leadership.

I am not very far past boyhood myself. It seems only yesterday that I landed at the little university in Oregon from my boyhood home in northern Idaho.

I was interested in three outside things: athletics, sleight-of-hand and scientific experiments.

In the Northwest I went in for wrestling, got beaten the first year, and the second year won the Pacific Coast championship.

I also went in for pole vaulting and broke the Northwest record, besides winning the track championship of that section.

Then I went to Yale, won the "Y" in three different branches, took the wrestling championship of the United States, took first honors as all-round gymnast, and twice broke the world's pole vaulting record.

But all the time I devoted every possible spare moment to my scientific experiments. This work of making science understandable, fascinating and useful to boys helped me earn my way through college and led me into my life work of making mechanical toys.

This is a lot for a man to talk about himself, you will admit. But I want you to know these things to see therein where I got the inspiration to build the many Gilbert Toys which are shown in the back part of this book.

Cordially yours,

A.C. Gilbert

President.



FIG. 1
BROOKLYN BRIDGE

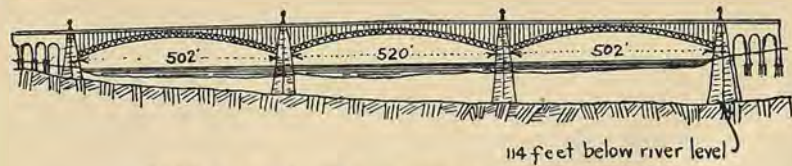
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Designed by John A. Roebling, Civil Engineer. Completed in 1883. Lower New York City in background. Woolworth building to the left and Municipal building to the right.

NOTED CIVIL ENGINEERS AND THEIR WORK

Do you know, boys, that some of our greatest men and most of our great civil engineers who have designed bridges, tunnels, railroads, etc., first learned to survey and make maps? George Washington was a surveyor. He made a very good map of his father's farm in Virginia. Abraham Lincoln was another who learned to survey.

John A. Roebling, designer of the Brooklyn Suspension Bridge, surveyed the line of the Pennsylvania Railroad over the Alleghany.



EADS BRIDGE OVER MISSISSIPPI RIVER
ST. LOUIS - MISSOURI.
FIG. 2

Mountains. He was the first man to manufacture wire and wire cables in America, and great factories in Trenton still bear his name.

He designed a number of bridges to carry water pipes across rivers, and in 1851 began the famous Niagara Suspension Bridge,



FIG. 3
HELL GATE ARCH

© Edwin Levick

Being erected by cantilever methods. Steelwork used in counterweights was removed and used elsewhere in the bridge after the arch had been closed and could support itself.



FIG. 4
HELL GATE ARCH

© Edwin Levick

Completed 1916. Designed by Gustav Lindenthal, Civil Engineer

the first railroad suspension bridge in this country. In 1868 he designed the Brooklyn Bridge. While superintending the building of some of the first stonework his foot was crushed and he died of the injury.

His son, W. A. Roebling, returned from Europe, where he had been studying methods of putting in foundations under compressed air, to take charge of the work. In 1871 he was prostrated with a caisson disease caused by working in compressed air. Determined to finish the work, he hired a house from the windows of which he could see the bridge, and retained full charge until the bridge was completed in 1883.

Look at the picture (Fig. 1) of Brooklyn Bridge, and think of Mr. Roebling living in some house along the water front towards which

you are looking. At that time the Woolworth building and various others which you see had not been built. The four large cables which you see in the foreground of the picture are each made up of a number of smaller wire cables. These smaller cables, each made up of a number of small wires, were securely tied together and then covered with several covers so that no water could leak in to rust them. In the picture each cable looks like a single strand. When the first wire had been carried across the river in a boat and hoisted over the towers, Mr. Roebling insisted on being hauled across the river in a basket to test the wire before he asked any of his men to go across.

Captain James B. Eads is another of our noted civil engineers.

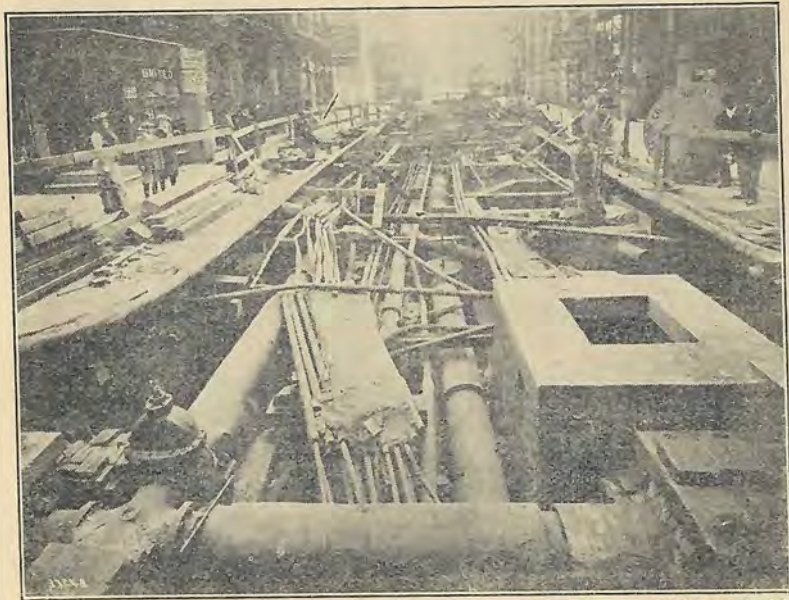


FIG. 5

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SUBWAY EXCAVATION. DEY STREET, LOWER NEW YORK CITY

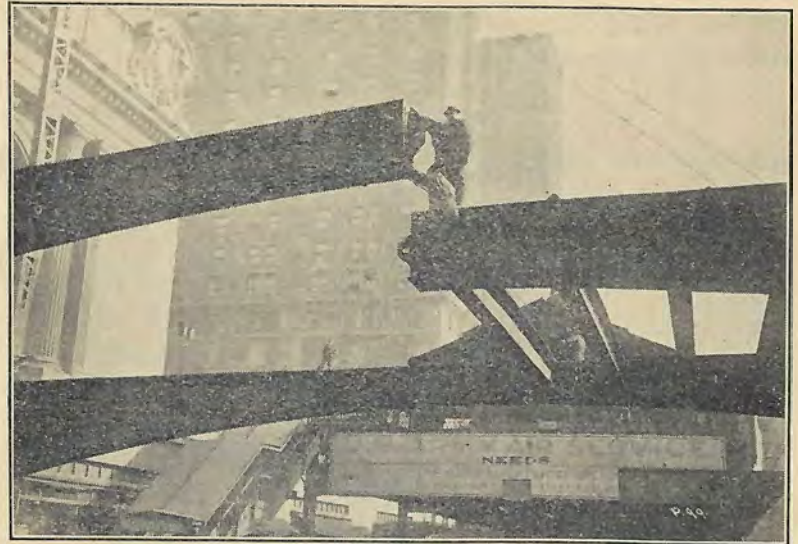


FIG. 6

© Edwin Levick

Guiding 80-ton girders into place with the touch of a human hand. Arch over 42d Street, at Grand Central Station, New York City.

In 1867 he was engaged in building an immense steel arch bridge (see Fig. 2) across the Mississippi at St. Louis. At that time there were no testing machines large enough to crush the most important steel members he was to use in his bridge. He had figured that they would stand the strain, but as no pieces as large as these had ever been used before, he wanted to be safe rather than sorry. He found a quarry which had firm walls of rock just about wide enough to take one of the steel members. He put it in horizontally with a hydraulic jack at one end and stressed the steel beam until it gave way. By the pressure on the dial of the jack he knew how many pounds his beam would stand. The bridge was completed in 1874 and is still standing.

Most of us think of steel as something that has always been used in bridges, yet this, the first steel bridge ever built, was completed

less than fifty years ago. This bridge was also the first steel arch bridge to be erected by the cantilever method.

A cantilever bridge is similar to two see-saws, one on each side of a stream. If you could put enough boys on the sides of the see-saws towards the shore to hold them to the ground, you could build out the other ends till they met over the center of the stream. If it were not done this way a temporary wooden bridge would have to be built across the stream under the steel bridge to hold it up while it was being built. This is very often impossible on account of the cost and difficulty of putting in the middle of a river anything which the current might easily sweep away during a flood.

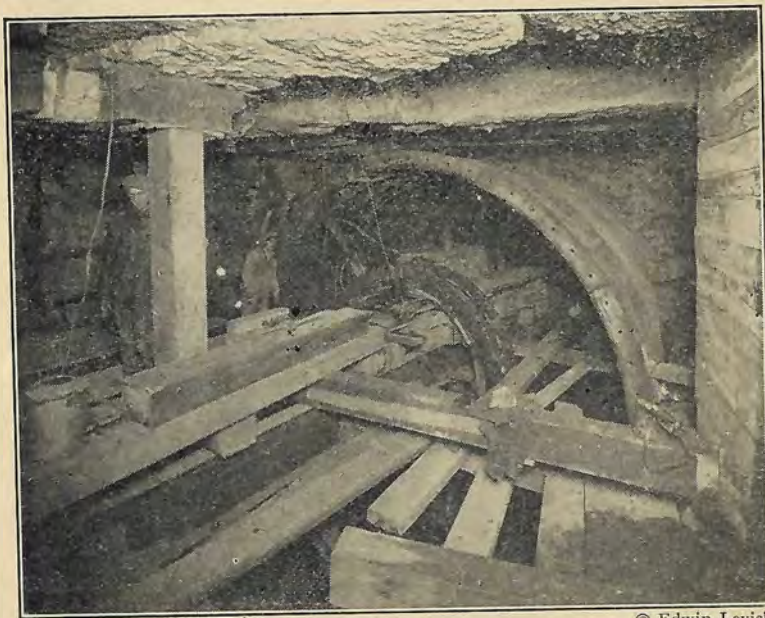


FIG. 7

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Subway being built under St. Paul's Church, New York City. Civil Engineer in foreground, tape in hand.

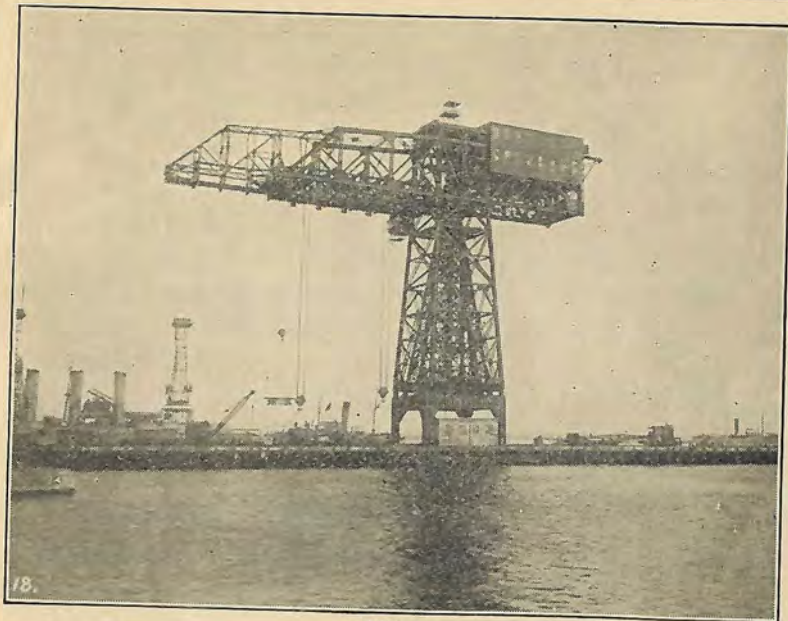


FIG. 8

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LARGEST CRANE IN THE WORLD

League Island Navy Yard, Philadelphia, Pa. Will lift 350 tons, equivalent to about 35 road rollers.

In 1874 Captain Eads proposed to Congress that he could deepen the mouth of the Mississippi River to twenty-eight feet, and that the river would maintain this depth. Many scoffed at the idea and said it could not be done. Nevertheless, Congress said go ahead.

He first drove a double row of piles on either side of the channel, and then fastened blankets woven out of willows to these piles. This gave him a thick wall of piles fastened together with willows on either side of the channel. The water ran so fast through this channel that it picked up the mud and silt and carried it out to sea. The mighty Mississippi could bend the tiny willows but could

not break them. The scouring action of the river, confined in a narrow channel, was helped out by dredging, and when a survey was made in 1884 the minimum depth found was thirty-four feet, an excess of six feet over what Captain Eads had guaranteed.

Gustav Lindenthal was the designer of the Hell Gate Bridge (see Fig. 3), which, with the aid of the Pennsylvania Railroad tunnels, enables trains from New England to come into the heart of New York, and then go on under the Hudson to the south and west. For eighty years there had been only one railroad coming into the heart of New York except by means of ferries.

The bridge stands as a monumental portal for all steamers entering New York Harbor from Long Island Sound. The floor of the bridge is 135 feet above the water, so that the tallest of boats can easily sail underneath. It was built as a cantilever, some of the

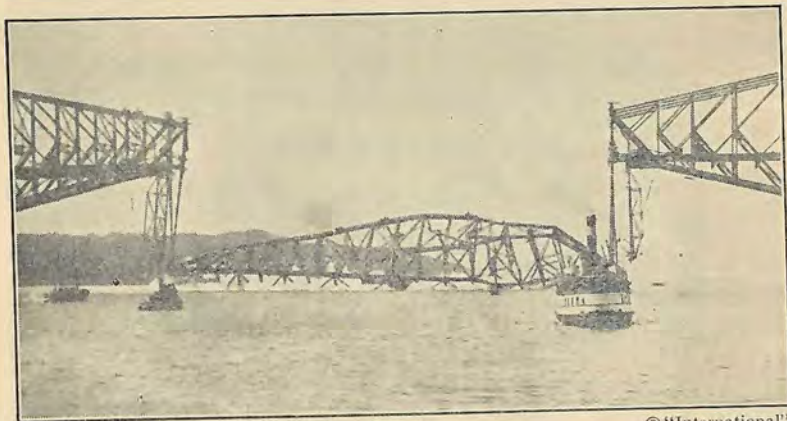


FIG. 9

QUEBEC BRIDGE (1916)

A chance photograph. Middle span of Quebec Bridge falling into the St. Lawrence River. A bearing at one corner gave way after the 640-foot span had been successfully lifted from the scows and hoisted part way into place. Sept. 11, 1916. The bearing that broke had been carefully designed and had previously carried more weight than it was carrying when it gave way. It was generally considered that there was a flaw in the metal.

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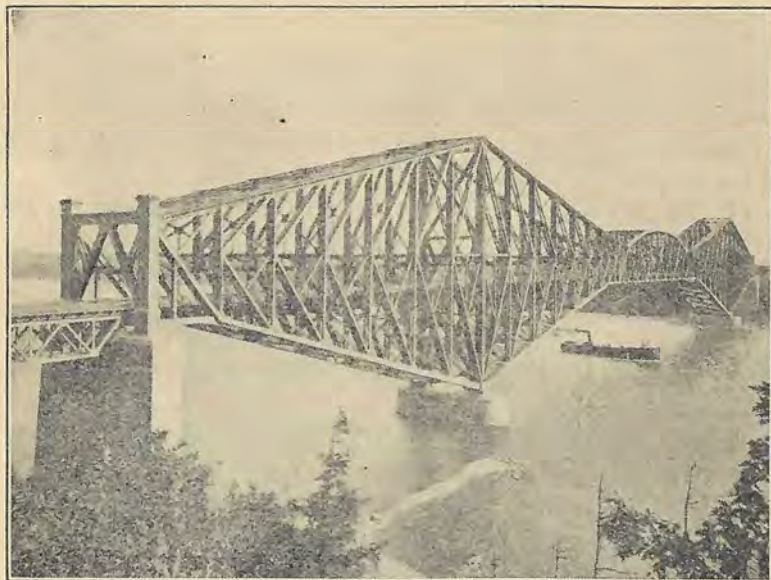


FIG. 10

St. Lawrence Bridge Co.

QUEBEC BRIDGE (1917)

About one year later, a new center span successfully fitted into place. The Quebec Bridge has the longest span of any bridge in the world. The two piers which come in the river are 1800 feet from center to center.

steel which was later to go into other parts of the bridge being used to weight down the ends and counterbalance the ends which you can see being built out over the river. In the second view (Fig. 4) you see that the bracing and counterweights at either end have been removed and used somewhere else.

Some of the most difficult engineering and surveying work of modern times has been done in connection with the New York subways and the Grand Central Station. The work has been especially difficult because the surveying, digging, and blasting could not be allowed to interfere with the regular traffic.

How would you like to start your first survey by making a map of the New York street (Fig. 5), showing all the pipes, telephone conduits, sewers, etc.? If there happened to be a sewer in the middle of the street, they had to build two sewers, one on either side of the subway, and then discontinue the original sewer in the middle.

Trolley cars and autos had to run on the streets while the subways were being built underneath. Thousands of passengers had to be handled every day in the Grand Central Station while it was being constructed.

Figure 6 shows a man with his hand guiding an eighty-ton steel girder into place. These girders were used to make a bridge over 42d Street, so that autos going north and south could go over 42d Street and around the Grand Central Station without interfering with autos and trolleys going east and west on 42d Street. The girders were pushed together in the middle and fastened by a large steel pin. If the surveys had been the least bit wrong they would not have come together so nicely.

Figure 7 shows the subway partly completed underneath St. Paul's Church in New York. In the foreground of the picture you can see the engineer with steel tape in his hand and his note-books and hatchets off to the right.

Among celebrated civil engineers who started their career doing survey work was Alfred Noble, whose chief characteristic aside from his engineering ability was his modesty.

It was Alfred Noble and four other members of a committee of twelve who convinced ex-President Roosevelt and Congress that the Panama Canal should be made with locks and not as a sea-level canal. He was in charge of the East River Tunnels by which the Pennsylvania Railroad comes into New York City from Long Island, and also the foundations for the Pennsylvania Station. This work called for some very accurate surveys so that tunnels started from both sides of a river would meet in

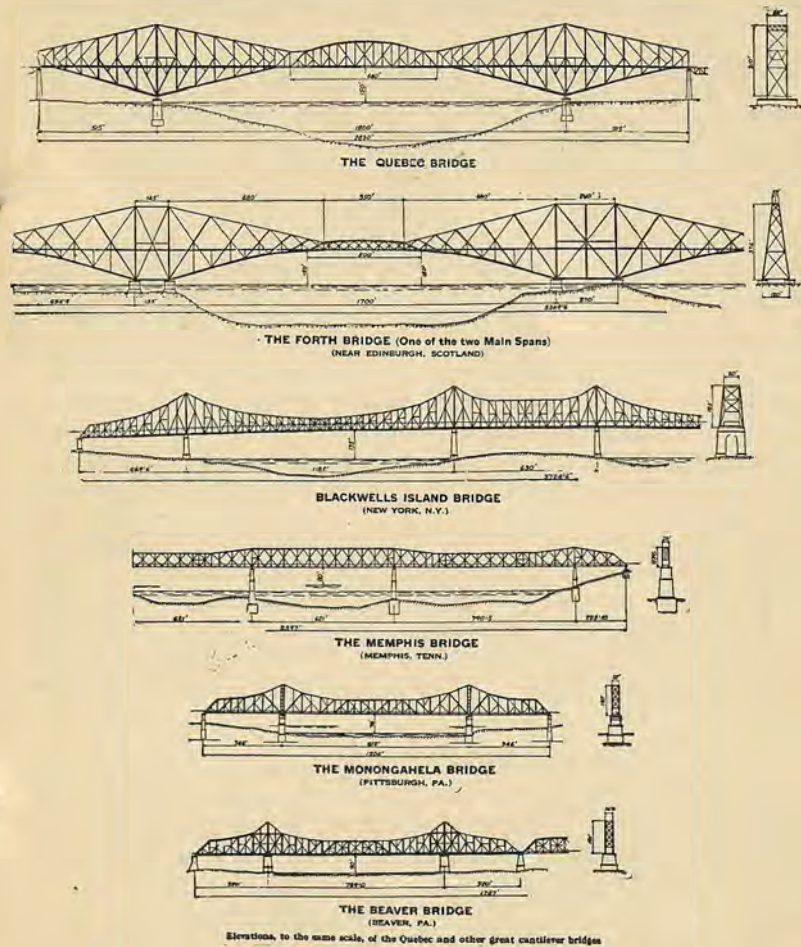


FIG. 11

Illustrated are various types of cantilever bridges with elevations to the same scale as the Quebec Bridge.

the middle, and subways dug under the busy streets of New York would not undermine buildings, etc.

His advice was sought on various parts of the Catskill Aqueduct, which brings water into New York and ranks as one of the great engineering feats of the present day.

25 Practical Experiments in Chemistry That You Will Find Useful

Experiment 1. How to Cement Broken Glass. By means of a small camel's hair brush, paint the broken surfaces of the glass with Water Glass. After the water glass starts to harden, which will require a few minutes, press the two broken surfaces together and allow the glass to remain this way for a day or two. If on pressing the two surfaces together a little of the water glass squeezes out, rub this off with a damp cloth. Notice after a day or two that the pieces are held very firmly together. Glass mended with water glass will not hold together in contact with water, since water glass is soluble in water.

Experiment 2. How to Mend Broken China or Porcelain. Make a paste by putting a half spoonful of Water Glass and 6 measures of Calcium Carbonate in the mortar and mixing with the pestle. Now mend the pieces of china or porcelain by painting with a brush the broken surfaces with this paste. This paste when dry is white and resembles exactly the color of the china or porcelain.

Experiment 3. How to Mend Black Crockery. To cement together pieces of black chinaware or porcelain make a paste, using a half spoonful of water glass and 6 measures of Manganese Dioxide. Then mend the broken pieces together.

Experiment 4. How to Mend Blue Chinaware. To mend broken pieces of blue chinaware make a paste, using one-half teaspoonful of Water Glass, 4 measures of Sodium Ferrocyanide and 2 measures of Ferric Ammonium Sulphate.

The blue color is formed by the action of Sodium Ferrocyanide on Ferric Ammonium Sulphate.

How could you make a red cement, a brown cement or a green cement?

Experiment 5. Another Household Cement. A very good cement for mending chinaware may be made by making a paste, using a half teaspoonful of the white of a fresh egg and 6 measures of Calcium Carbonate. To mend pieces of broken china with this paste brush some of it on the broken surfaces of the china and quickly press the broken edges together and allow the mended pieces to stand for a day or two.

Experiment 6. How to Mend Metal Vessels. Make a paste out of the following substances by mixing them together in the mortar; 2 measures of Ammonium Chloride, 6 measures of Powdered Iron, 1 measure of Sulphur and a few drops of water. Fill the crack or hole with this paste and allow the paste to harden for a day. Then heat the vessel on the stove so that the cement will have a chance to fuse somewhat and set.

Experiment 7. How to make Envelope or Postage Stamp Mucilage. Put 5 measures of Sugar, 2 measures of Gum Arabic and 2 measures of starch in a test tube $\frac{1}{2}$ full of water. Shake the contents of the tube and allow the tube to stand for 5 or 6 hours. Then heat the contents of the tube to boiling and allow the tube to cool. With a soft brush paint some of this mucilage on a piece of paper and allow it to dry. Now when moistened with water you will be able to stick the paper to any surface. Postage stamp and envelope mucilage is made similar to this. In order to keep this mucilage from going bad, a drop or two of some preservative, such as oil of sassafras or wintergreen, must be added.

Experiment 8. A Common Household Adhesive Paste. Make a starch paste by shaking 12 measures of powdered starch in a test tube $\frac{1}{4}$ full of water. Stir a little with a stirring rod if necessary. Now to this paste add half a test tube full of boiling water containing 3 measures of Calcium Chloride. Pour this solution into the test tube containing the starch paste and heat the contents of the test tube to boiling. Allow the test tube to cool. This gives a paste which is very good for ordinary household use, such as pasting on labels.

Experiment 9. How to Make Sachet Powder. Mix together in the mortar 1 teaspoonful of cloves, 1 teaspoonful of cinnamon, 1 teaspoonful of allspice and half a teaspoonful of vanilla extract. Now obtain a cupful of dry geranium or sage leaves and grind them up into a powder by means of the pestle.

Mix the ground geranium or sage leaves with the mixture of cloves, cinnamon, allspice and vanilla extract and place the powder thus formed in a jar with a cover. Notice the fragrant odor produced from this powder. You can vary the odor of this powder somewhat by using the dried petals of different flowers.

Experiment 10. How to Make Incense. Place together in the mortar 4 measures of cinnamon, 3 measures of allspice and 5 measures of cloves. Grind this mixture by means of the pestle.

Now pour this mixture on a sheet of paper and mix it with 8 measures of Potassium Nitrate. Do not grind this mixture.

Heat a little of this mixture in a spoon over a flame and notice the fragrant odor given off which resembles that of burning incense.

Experiment 11. How to Make Wintergreen Extract. Place some wintergreen berries in the mortar and grind them up by means of the pestle. Pour the oil obtained into a test tube and notice the fragrant odor. Taste a little of the oil and satisfy yourself that it is oil of wintergreen.

Experiment 12. How to Make Lemon Extract. Remove the skin from a lemon by means of a sharp knife and grind it up in the mortar the same way as you did in the preceding experiment. Pour the oil into a test tube and notice the fragrant odor. Taste a little of the oil.

Experiment 13. How to Make Orange Extract. Remove the skin from an orange, using a sharp knife, and grind it up
Notice the fragrant odor. Taste a little of this oil.

Experiment 14. How to Remove Ink from Wool. First rub the spot lightly with a bleaching solution. This is made by dissolving 4 measures of Calcium Hypochlorite in a test tube half full of water. This will change the spot to a yellow color. Then pour a little hydrogen dioxide on the spot and again rub lightly. Notice that the spot is now entirely removed. This is a case of bleaching.

Experiment 15. How to Remove Iron Rust. Obtain a small amount of oxalic acid and dissolve 4 measures in a test tube half full of water. Rub the spot with some of this solution and notice that the stain is removed. Dilute hydrochloric acid can be used in place of the oxalic acid. Silks are attacked by acids, therefore do not use these acids on silk goods. Remove the oxalic by washing with water.

Experiment 16. How to Remove Acid Spot. If acid is accidentally spilled on the clothing, pour a little ammonia on the spots and rub lightly with a cloth. Wash the spot with water in order to remove the salts that are formed in the reaction. This is a case of neutralization, the ammonia neutralizing the acid to form a salt.

Experiment 17. How to Remove Alkali from Clothing. If caustic soda is accidentally spilled on the clothing pour some tartaric acid solution or vinegar on the spot and then wash the spot out with water. This is another case of neutralization.

Experiment 18. How to Remove Grass Stain. Grass stain may be removed by rubbing the spot with a little alcohol or carbon tetrachloride.

Experiment 19. How to Remove Mildew. Dissolve 3 measures of Calcium Hypochlorite in a test tube half full of water and rub the stain lightly with a little of this solution. Remove the calcium hypochlorite by washing with water.

Experiment 20. How to Remove Iodine Stain. Dissolve 3 or 4 measures of Sodium Thiosulphate in a test tube 1/3 full of water and rub some of this solution on the fabric stained with iodine. Notice that the blue or brown stain is quickly removed. Then wash the spot with water to remove the sodium thiosulphate.

Experiment 21. How to Clean Silverware Electrolytically. If you have any silverware which is stained dark by exposure to the air you can easily remove this stain, which is silver sulphide, by treating the silverware as follows.

Obtain an old aluminum pan and place the silver to be cleaned in the pan. Now cover the silver with a solution of common salt or baking soda made by dissolving 2 spoonfuls of the salt in each quart of water used. Now place the pan on the stove and allow the solution to boil for two minutes. Remove the silverware and wash it with fresh water. Notice that the black stains are removed and the silver is bright and clean.

The black stain or silver sulphide was reduced by the chemical action taking place in the solution. A feeble electric current was formed in which the aluminum pan acted as the negative pole and the silverware as the positive pole. The electrolyte in this case was the solution of common salt or baking soda.

The metal silver cleaners which you probably have seen advertised on the market are simply metals of aluminum or zinc. The process of cleaning silverware with these cleaners is the same as that used in this experiment.

Experiment 22. The Lemon Electric Cell. Procure a fresh, juicy lemon and cut two small slits, one on each side, as shown in the illustration.

Now clean the copper and zinc plates by scrubbing them. Insert the zinc and copper strips in the lemon, as shown in the illustration. (Figure 49.) To prove the passage of an electric current, touch your tongue to the ends of the zinc and copper strips. Notice the slightly tingling sensation produced on the tongue. This proves that

a current is passing from one metal to the other. When the external circuit is closed, the citric acid (lemon juice) attacks the zinc, forming citrate of zinc. By the separation of positive zinc from the zinc strip, the zinc strip is made negative.

The positively charged hydrogen ions of the citric acid, which is in the lemon, being displaced by the zinc, deliver their positive charge to the copper. Thus the copper is positively, and the zinc negatively, charged when the cop-

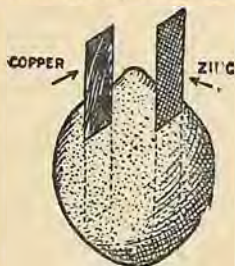


FIG. 49

per is joined to the zinc or when the circuit is closed. The flow of electricity externally is from the copper to the zinc.

The lemon cell polarizes quickly, so lift out the plates frequently to remove the hydrogen bubbles.

Experiment 23. How to Galvanize Iron with Zinc. Mix together on a sheet of paper 4 measures of Powdered Zinc, 1 measure of Aluminum Sulphate, $\frac{1}{2}$ measure of Powdered Magnesium and 3 measures of Calcium Carbonate.

Now take a wet cloth and after touching it to the mixture rub the clean iron to be galvanized with some of the mixture. After thoroughly rubbing, wash the iron free of the paste with water and notice that it is coated with zinc.

Galvanized ironware is iron which has been treated with zinc compounds in a similar manner.

Experiment 24 How to Galvanize Iron with Nickel. Mix together on a piece of paper 3 measures of Calcium Carbonate, $\frac{1}{2}$ measure of Powdered Magnesium and 5 measures of Nickel Ammonium Sulphate.

Now rub thoroughly by means of a wet cloth some of this mixture on the clean iron to be galvanized. Then wash off the paste with a little water and notice that the iron is now plated with nickel.

Experiment 25. How to Remove Grease from Clothing. A grease stain which has been in clothing for some time can be removed by treating the stain with alcohol, gasoline or carbon tetrachloride. Carbon tetrachloride is the best solvent to use, as it is non-inflammable, cheap and vaporizes quickly. In removing a grease stain in this way, always begin at the edge and work into the center, rubbing the stain thoroughly with a cloth containing some of the solvent. This is a case of solution.

A fresh grease spot when removed in this way often leaves a ring on the clothing. To remove a grease spot place a little talc or starch over and under the spot and warm the spot with an iron. The talc will absorb the grease and can be easily brushed off afterwards. Repeat the process until the spot is removed. This is a case of absorption.

A grease spot may also be removed by rubbing neutral soap on the spot until a lather is obtained and then rinsing off with water. This is a case of detergency.

Great Fun Giving Shadow Entertainments

Try These, You'll Like Them



Fig. 36. A sheet over a doorway

Boys, you can have the greatest kind of fun by giving shadow shows to your friends, and the

preparation you need is very slight. Hang a sheet over a folding doorway as shown in Fig. 36.

Now opposite the door put a strong lamp on a stool, chair, or table, according to the show (Fig. 37). The audience is in darkness on the other side of the screen.

Show 1. The Dentist. Dentist



Fig. 37. Showing lamp on a chair

seated, bell rings, boy comes in with bandaged head, dentist seats him and examines tooth, boy howls, dentist takes very, very large pliers, and pulls out a very large cardboard tooth (Fig. 38). The tooth, of course, was stuck in boy's coat collar



Fig. 38. The dentist

heart, all with much pantomime, takes large coal tongs, shoves them down boy's throat (apparently, of course), and



Fig. 40. How it is done

at one side. Use much pantomime all through the show.

Show 2. The Doctor. Doctor seated with very large plug hat and very long beard, bell rings, boy enters rubbing stomach and groaning. Doctor seats him, takes pulse, examines tongue, listens to



Fig. 39. The doctor

pulls up a long snake (Fig. 39). More pantomime. Boy not yet well, doctor again shoves tongs down his throat and pulls up an alligator, and so on. Much pantomime of boy feeling fine.

The snake and alligator are cut out of stiff paper or cardboard and are handed up by a third boy as shown in Fig. 40.

Show 3. A Surgical Case.

Scene 1. A boy is seated at a table with large plate of potatoes. He swallows them whole, then swallows knife, fork, spoon, saltcellar, and so on. Much pantomime of enjoying a good meal.

Scene 2. Doctor seated at table, boy rushes in rubbing stomach, doctor lays him on table, takes large knife, jabs it



Fig. 41. A surgical case

into boy's stomach (Fig. 41), boy raises head to object, doctor hits him on head with hatchet (Fig. 42) and proceeds to cut him open, throws back coat to imitate opening stomach, and takes out all the potatoes, knife, fork, spoon, and so on. Doctor sews boy up, hits him on head with hatchet, boy comes to, pantomime of feel-



Fig. 42. Quieting the patient

ing fine, shakes hands with doctor and thanks him.

The knife and axe are cut out of cardboard, the plug hat is a tube of stiff paper on an ordinary hat, the whiskers are another tube of paper. The boy swallowing potatoes really hands them to another boy hidden beside the chair.

Show 4. A Boxing Match.



Fig. 43. A boxing match

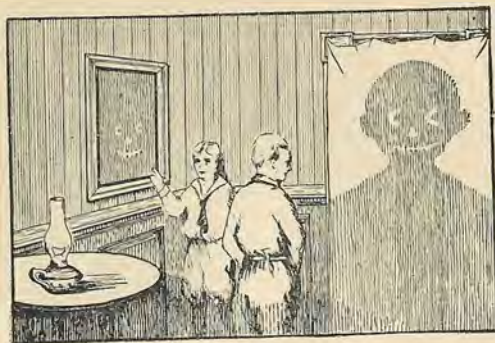


Fig. 44. Living shadows

and if the big fellow finally runs away and steps over the lamp to the chair it looks as though he had jumped into the ceiling. Little fellow then struts around as winner.

Show 5. Living Shadows. Cover a mirror with two pieces of paper, out of each of which you have cut identical eyes, nose, and mouth with teeth, as shown in Fig. 44. Paste the under paper against the mirror, but paste the outer paper only at the top. Arrange the light and boy as shown and sway the outer paper back and forth. Do you see goggling eyes and snapping mouth?

Now have the boy, whose shadow is shown, make a speech with proper gestures, while you sway the paper. The effect will be extremely amusing to the spectators.

Show 6. Living Shadow Dialogue. Arrange two mirrors as above and place one on each side of the screen. Have the two shadows carry on a dialogue while two other boys sway the papers.

You will have plenty of fun inventing shows of your own, and with a few beards, mustaches, and false noses made of paper or of other material you can have very, very funny times.

Put one boy near the screen and another nearer the light. The first is natural size, the second is enormous (Fig. 43). If they now pretend to fight it is very, very funny from the audience. In one of the fights, have the lamp on the stool, let the little fellow beat the big fellow,

ABOUT VACUUM TUBES AND CIRCUITS

IT might be said that most of the recent radio developments have been based upon the vacuum tube. It is certain that this piece of radio apparatus has a most important bearing on improvements in general. Quite a number of years ago, Edison discovered that if a cold plate is put inside of an electric-light bulb, and if the plate is connected to a battery in such a way that is slightly positive, an electric current will flow from the heated filament to the cold plate. This was known as the "Edison effect."

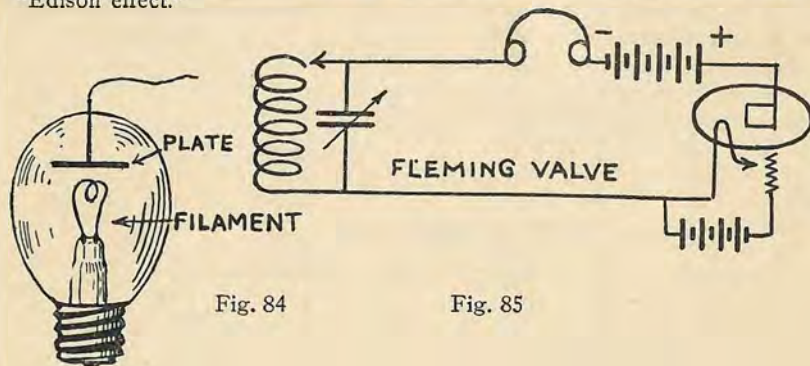


Fig. 84

Fig. 85

Several years later, Fleming, a British scientist, made use of the so-called "Edison effect" and constructed what is known as the Fleming oscillation valve. In reality this valve was nothing more than Edison's electric-light bulb and plate, but Fleming found that this device was a reliable detector of radio waves. Its advent in the radio field filled a long-felt want. Up to that time numerous detectors were made, but none of them equaled the reliability and sensitiveness, as well as the uniformity, of the Fleming oscillation valve, or vacuum tube, as it is now called.

The method of connecting the valve (Fig. 84) to a tuned circuit is pictured in Fig. 85. This is shown partly for its historical value and also to demonstrate to the reader the connection between the old-style Fleming valve and the modern vacuum tube.

HOW A SIMPLE VACUUM TUBE WORKS. Lee DeForest, an American radio experimenter, found that the vacuum tube comprising two elements might be greatly improved by the introduction of a third member between the filament and the plate. This third member is a zig-zag wire called "the grid." Fig. 86 shows an elementary vacuum tube or "audion," as he named it.

It is the purpose of the writer to describe the theory of the audion in an elementary manner. There are slight modifications of this theory, but for ordinary purposes the explanation which follows covers its operation.

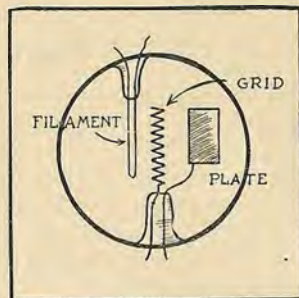


Fig. 86

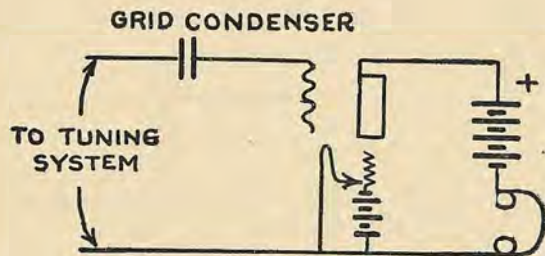


Fig. 87

If a filament is heated in a vacuum and the plate near the filament is made positive, "electrons," that is, negative charges of electricity, will be liberated from the filament. Unlike charges of electricity attract each other. The negative electrons and the positive plate carry unlike charges. Therefore, the electrons are drawn over to the plate. (See Fig. 87.) The more positive the plate is made, and the higher the filament temperature, the more electrons will flow from the filament to the plate. For any given

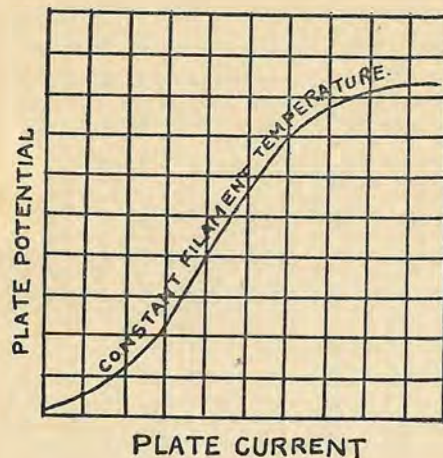


Fig. 88

rent in a two-element vacuum tube.

HOW THE GRID AFFECTS THE PLATE CURRENT. The introduction of a third element in the tube affects the characteristic curves of plate current. To state, in simple terms, the effect of the grid, we shall ask the reader to consider a vacuum tube as a resistance. We shall speak of the space between the heated filament and the plate in terms of resistance. This space offers a certain resistance to the flow of current and the grid simply varies this flow.

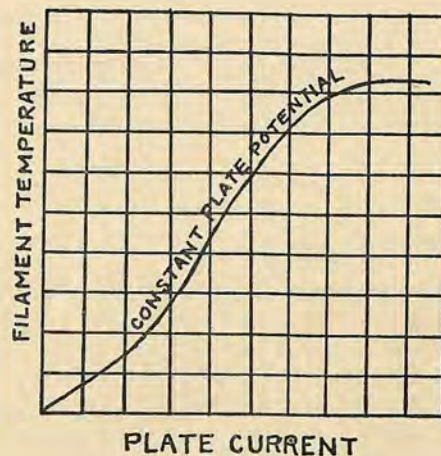


Fig. 89

filament temperature the electrons will flow in increasing numbers for increasing plate potentials. There is, however, a limiting value to the increased flow, that is, there is a point when increased positive potential on the plate does not increase the flow of the electrons. In a similar manner for any fixed positive value on the plate, the electron flow becomes more dense with increasing filament temperatures. These two actions are shown in a graphic manner in Figs. 88 and 89, which are two curves that indicate the flow of cur-

If the grid is charged positively, it will decrease the resistance and more current will flow. If the grid is made negative the resistance is increased and less current flows. The connection is made as shown in Fig. 90. A certain value of plate potential is chosen, for instance, let us say, 45 volts.

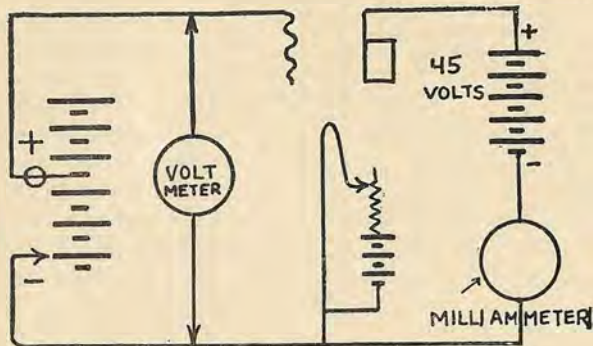


Fig. 90

The filament is heated by means of a battery. This can be made a constant value, and a steady current will flow from the filament to the plate. A sensitive ammeter may be inserted in the plate circuit, as shown in the illustration, and this will record the plate values. The battery can be varied over a certain range of voltage. Let us say that the grid is varied from four volts negative to four volts positive. We find that four volts of negative potential on the grid will almost shut off the current flowing in the plate circuit, but the four volts positive charge has very little effect upon the plate current, though it does increase it slightly.

PLOTTING GRID PLATE CURVES. This variation from four volts negative to four volts positive on the grid may be carried out for all the ranges of voltage between the two values. The results may be graphically shown, a curve showing them can be plotted. This has been done and is shown in Fig. 91. This type of curve is known as the "characteristic grid-plate curve." The characteristic curve is, of course, taken for a given filament temperature, or filament current, and the plate is given a certain constant positive potential.

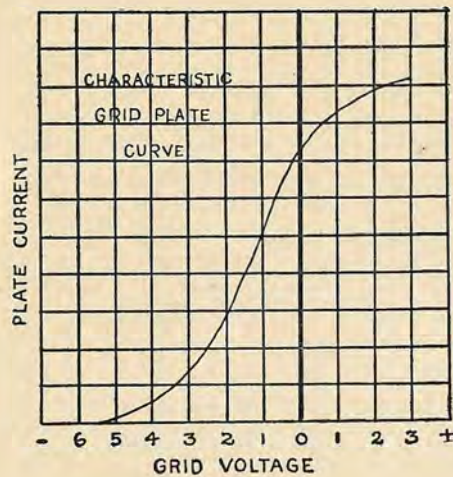


Fig. 91

Another curve may be taken with a different positive value on the plate. The filament is generally left a constant and is kept at the value of current which is usually indicated by the maker of the tube. The majority of receiving tubes operate with a filament current between .5 and 1.1 amperes. When a whole series of curves are taken with different plate potentials, this series of curves are often called a family of curves.

The reason for emphasizing the characteristic curves of a vacuum tube is because of their extreme importance,

as well as the help which they give in understanding the subject, especially the more complicated forms of vacuum tube action which will be described later.

HOW THE VACUUM TUBE ACTS AS A DETECTOR. The action of a vacuum tube in receiving radio signals may be easily explained by reference to the characteristic curve. First consider the diagram

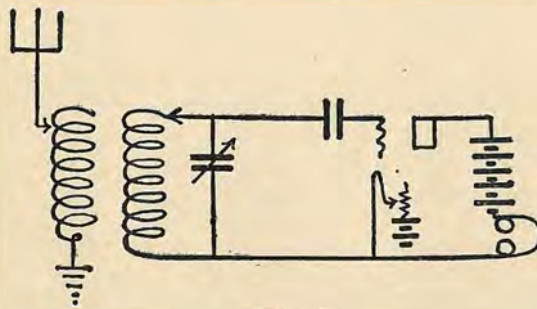


Fig. 92

shown in Fig. 92. An oscillating current is induced in the antenna which flows up and down and through the primary inductance. A similar oscillating current is set up in the secondary coil. This oscillating current, of course, varies from negative values to positive values.

tive as detectors. However, when the tube is used, either as an amplifier or an oscillator, the hard tube is the more practical. One reason for this is the ease with which a hard tube can be adjusted. It takes a certain definite plate voltage and a fixed value of filament current. When these two values are reached, the tube is ready for operating. On the other hand, the gas tube requires careful adjustment of the filament current and correspondingly critical plate voltages.

So far we have considered the vacuum tube only as a detector. There are other uses to which these tubes may be put, since they not only detect, but amplify and also generate oscillations of their own. We shall next consider the vacuum tube as an amplifier.

THE VACUUM TUBE AS AN AMPLIFIER. It again is desirable to refer to the characteristic curve. A certain portion of the characteristic is almost a straight line, and if a point is chosen in the center of this line, it will be seen that equal changes in grid voltage will produce correspondingly equal changes in the plate current. Not only are these changes equal, but they are of much greater amplitude than the current required to make the change.

When a small effect can be made to produce a greater effect, we have "amplification," and this is what can be made to take place in a vacuum tube. Small changes on the grid can be made to produce large changes in the plate current. This can be illustrated graphically, and Fig. 95 shows a small oscillating current on the grid and the resultant current in the plate circuit.

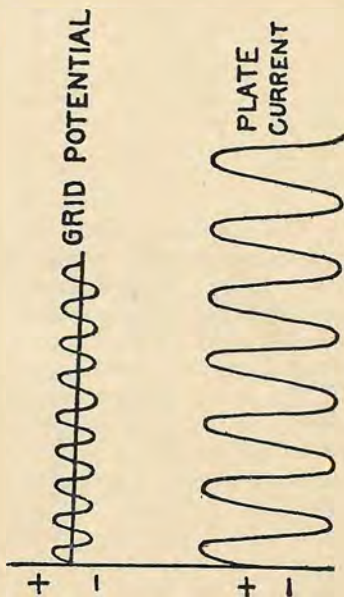


Fig. 95

The amplifying possibilities in a vacuum tube can readily be made use of. Each circuit is shown in Fig. 96. In this circuit the impedance X is used to equal the impedance which ordinarily would be

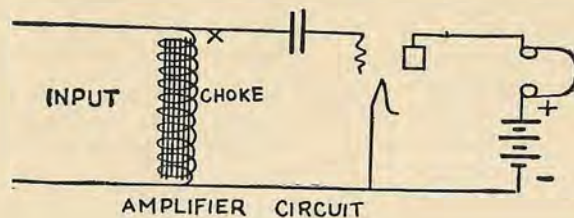


Fig. 96

represented by the telephone receivers in the detector circuit. The amplifier is connected to the detector in place of the telephone receivers. The incoming signals are detected in the usual manner by the first vacuum tube.

In this tube the signals receive their first amplification, due to the battery in the plate circuit, and the particular trigger action of the vacuum tube. These amplified signals are put into the impedance instead of the telephone receivers in the amplifier circuit. Now the signals are again amplified so that the final strength is many times that of the original signal.

CONNECTING UP VACUUM TUBES FOR AMPLIFICATION.

It is possible to use another amplifier and again amplify the signals which are coming from the first amplifier. It is not considered practical to amplify more than two or three steps by this particular method which is called "audio frequency amplification." This name is given to it since the amplification takes place at audible rates.

There are several different methods of coupling amplifiers together as well as amplifiers to the detectors. We have already described the impedance method. Instead of connecting an impedance in the circuit to take the place of the resistance of the telephone receivers, we may connect a straight ohmic resistance as shown in Fig. 97. This resistance should be in the neighborhood of $\frac{1}{2}$ to 3 megohms. It is connected in place of the telephone receivers and for the best results equals the

resistance, or impedance, which exists from the filament to the plate of the tube used.

In place of impedances or resistances, we may use a small transformer. This method of connection is shown in Fig. 98. The transformer method offers certain advantages. For example, the transformer

can be made to step up the voltage, thus causing greater amplification. It may also be used so that the input side equals the impedance of the filament to the plate path of the first tube, while the secondary has an

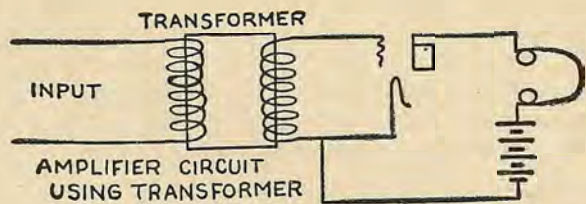


Fig. 98

impedance which is equal to the impedance from the filament to the grid of the amplifying tube. Under these circumstances, we receive the maximum amplification with a given tube without distortion.

A steady direct current in a circuit is opposed only by the resistance of that circuit. However, if the current is oscillatory and the circuit has inductance and capacity, or both, the opposition to the current is no longer its resistance alone, but it must also overcome the effects of the capacity and inductance. The opposition is termed "impedance," and it corresponds in every way to oscillating currents as resistance does to direct currents.

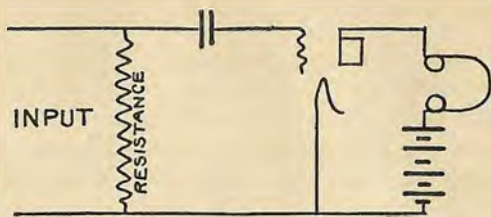


Fig. 97

THE ARMSTRONG AMPLIFIER AND HOW IT WORKS. In describing the use of a vacuum tube as a detector and an amplifier in the preceding paragraphs, we referred to its use as a separate tube. Major Armstrong developed a circuit which requires only a single tube not only to detect, but also to amplify. The method is obvious enough after some

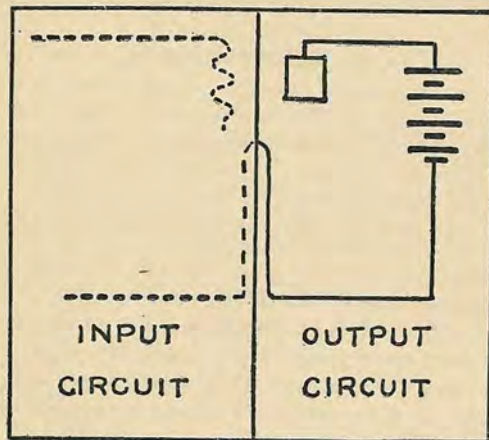


Fig. 99

one else has pointed out the way. Armstrong's method was to take the amplified signals which we would ordinarily put into the telephone receivers and to feed these signals back to the input of the vacuum, when they will reappear at the outlet and will be amplified. These amplified signals can again be returned to the input and again they will appear at the output considerably more amplified. Fig. 99 shows the input and output circuits of a vacuum

tube. The method which was used by Armstrong will be understood from Fig. 100. The telephone circuit is connected back to the input circuit by means of coil T. The current flowing through the telephone receivers also flows through the coil T which is placed near the secondary inductance.

Variations in current in coil T cause variations of current to be induced in the secondary and these variations reappear in the telephone receiver greatly amplified. A sin-

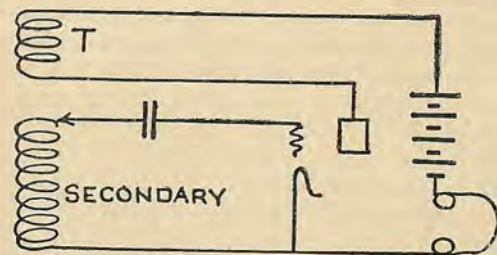


Fig. 100

gle tube may be made to produce amplifications as great as 100 times the original signal strength.

After amplification has been had by the Armstrong method, these signals may be put into audio frequency amplifiers and the intensity of the signals increased many more times. Radio signals, by means of vacuum tubes, can be amplified again and again. Instead of telephone receivers, loud speaking horns may be put into operation so that the sound of the signals can be heard over a large room.

The vacuum tube amplifiers may be used for all kinds of amplification. As an illustration, we might point out the amplification which is done over the long-distance trans-continental lines. Vacuum tube amplifiers are used on the long-distance telephone lines and they make telephony between New York and San Francisco possible. The wonderful advantage of the vacuum tube over all other methods of amplifying is due to the fact that it is a perfect amplifier and can be made to amplify without the slightest distortion.

THE VACUUM TUBE AS AN OSCILLATOR. So far, we have shown how the vacuum tube detects, amplifies within itself, and amplifies as an amplifying tube. These same tubes can be made to generate electric oscillations. These oscillations may be used for radio telegraphy or telephony. To understand the action of a vacuum tube as a generator need not be any more difficult than understanding its action as a detector. We shall not consider yet the detailed circuits which are required, but just the elementary facts.

A steady current is flowing in the plate circuit of a vacuum tube. Variations of potential on the grid will cause variations in the plate current. If we can vary the grid circuit a million times per second, the plate current will likewise vary a million times per second. These million variations per second correspond to a wave length of 300 meters, and if the plate circuit of the tube is connected to an antenna, a wave length of 300 meters will be emitted.

MICROPHONE ANALOGY OF CURRENT VARIATIONS. It need not be a difficult matter to cause a million variations of potential to take place on the grid of a vacuum tube provided we are not forced to use mechanical means. An automatic method is extremely easy and here again we make use of Armstrong's "regenerative" or "feed-back" principle. To understand this principle as it applies to transmitting tubes, let us consider an analogue.

If a telephone receiver is connected in series with a microphone and battery as shown in Fig. 101, a disturbance in the microphone causes a

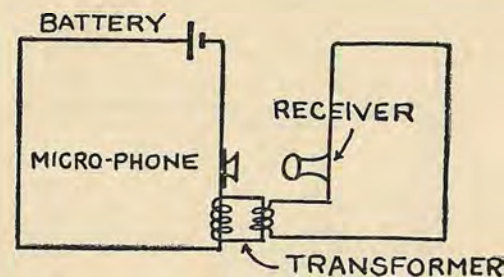


Fig. 101

sound to be emitted by the telephone receiver. Supposing, now that a sound is started, we take the telephone receiver and bring it near the microphone; the sound in the telephone receiver will act on the microphone. The microphone, in turn, will set up a noise in the telephone receiver. This action will be repeated again and again and faster and faster, once it is started. The only thing which limits the frequency is the type of the circuit and its inertia of the diaphragms of the microphone and telephone receiver.

The microphone and telephone receiver may be likened to the inlet and output circuits of a vacuum tube. If the two circuits are coupled together and a disturbance is created which will cause a slight change in the grid potential, the tube will start to oscillate and it will continue to oscillate for some time, the only limit to the rate of oscillation is the value of inductance and capacitance in the circuits. We can choose the inductance and capacitance so that the rates can be anything from one or two oscillations per second up to several hundred millions of oscillations per second.

Not only does the tube set up oscillations and furnish the necessary current to transmit radio signals, but it also furnishes undamped oscillations, that is, oscillations of constant amplitude. There is no dying-out action, and the waves travel a much greater distance without losing their energy. An additional advantage is present; that is, the undamped waves traveling from the transmitting to the receiving station are good carriers of the voice. Thus we have a radiotelephone made practical by the use of the vacuum tube at the transmitting end.

KINDS OF OSCILLATION CIRCUITS. An elementary circuit for setting up oscillations by means of the vacuum tube is shown in Fig. 102.

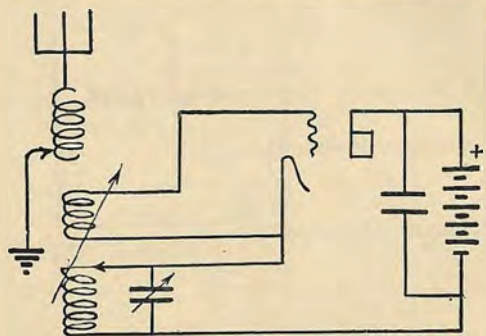


Fig. 102

There are many modifications possible, but all of these modifications are based either upon an inductive feed-back or capacity method. The elementary circuit for a capacity feed-back is shown in Fig. 103.

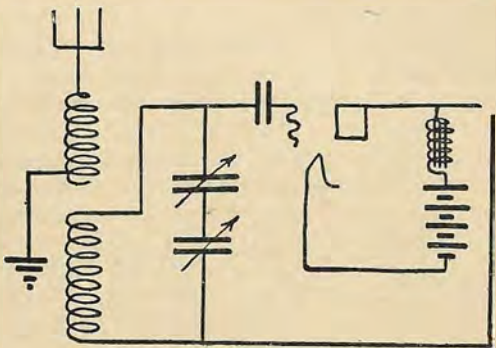


Fig. 103

A complete hook-up of an oscillating tube for either transmitting telegraph signals or speech is shown in Fig. 104. This is the capacity

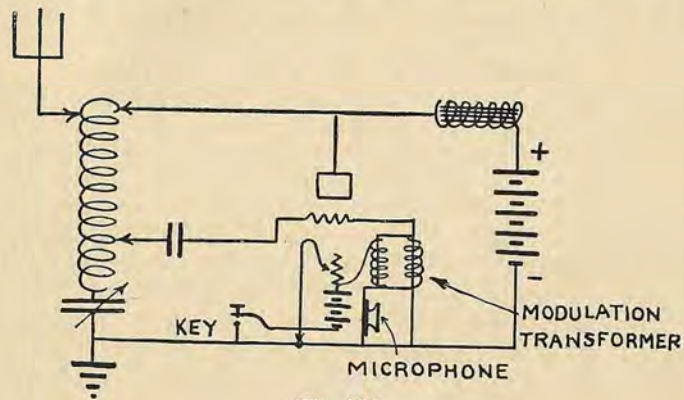


Fig. 104

method. The inductive type of circuit for telegraph or telephone is shown in Fig. 105. The latter part of this chapter will be devoted to various circuits for receiving and transmitting which require the use of vacuum tubes.

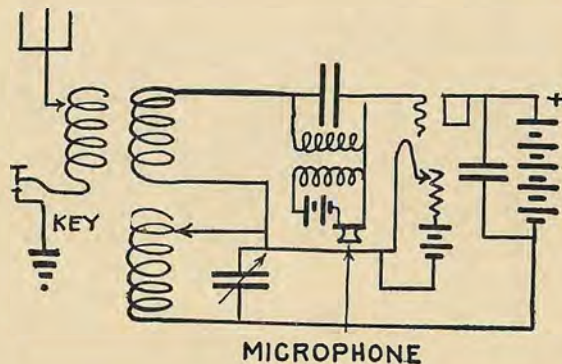


Fig. 105

THE VACUUM TUBE AS A RECEIVING OSCILLATOR. There is still another use for the vacuum tube and that is as an oscillator for receiving. If the transmitting station is sending out undamped waves at the rate of 1,000,000 oscillations per second, this cannot be heard at the receiving station since the rate is not only beyond that of the human ear, but is also too fast for the diaphragm of the telephone receivers.

If, however, the receiving vacuum tube is made to oscillate at the rate of 1,001,000, the two rates will interfere with each other and 1000 times per second the oscillations will add to each other, instead of interfering. This 1000 times per second becomes an audible note to which the telephone receiver responds and which is within the range of the human ear.

To receive continuous waves, we make use of the Armstrong feed-back circuit, and instead of feeding back the oscillations at an audible rate, we feed them back at a rate which is slightly greater or slightly less than the transmitting rate, thereby making it possible to hear the continuous wave signals. One form of continuous wave receiving circuit is shown in Fig. 106.

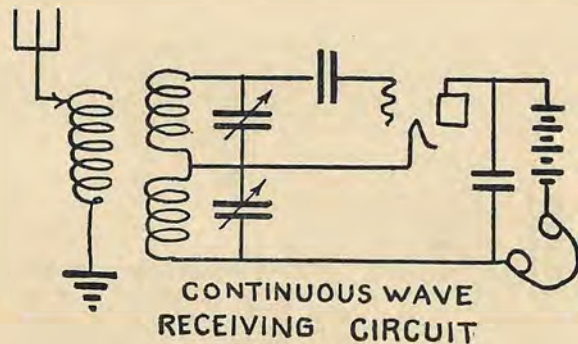


Fig. 106

HOW TO BROAD JUMP

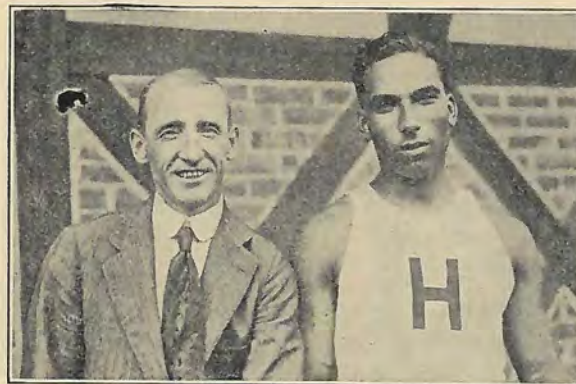
BY EDWARD J. FARRELL, HARVARD FIELD COACH

Photos of Edward O. Gourdin

World's Record Holder, Running Broad Jump

25 feet 3 inches

The good broad jumper must be first of all a fairly good sprinter. Alva Kraentzlein, the old University of Pennsylvania marvel who created the present Intercollegiate record of 24 feet 4½ inches, still holds the world's record for the 220 yard low hurdles. This is a race in which speed is combined with skill. Carl Johnson of the University of Michigan, who made a Conference record of 24 ft. 2 in. was very fast in the flat races, having covered the 100 yards in 9 4/5 seconds, besides being one of the best hurdlers and high jumpers in the country. Al Gutterson, University of Vermont, who at the 1912 Olympiad leaped 24 ft. 11½ inches, only a quarter of an inch behind Peter O'Conner's record, was well known for his ability over the low hurdles. Sol. Butler of Dubuque, who still holds the record of 24 ft. 8 in. for the National championships, shares the world's record for 60 yards. He covered this distance in 6 2/5 seconds when a school-boy.



This shows Edward O. Gourdin, the Holder of the World's Record in the Running Broad Jump and Edward L. Farrell, the man who taught him how to jump. Mr. Farrell won great fame as an all-around athlete, and was the Broad Jumper and Running Hop-Step-Jumper on the American Olympic Team in 1912.

Harry Worthington the Dartmouth star, who ruled in this event for over five years, holds the 300 yard record for the indoor track in Boston. Edward Gourdin, of Harvard College, the present intercollegiate, New England, and National champion, as well as world's record holder, has run 100 yards in 9 4/5 seconds and shown proficiency in the other sprints and the jumps.

The other requisites for the good broad jumper is the ability to make an actual leap high into the air; and not the elongated step on which so many would-be jumpers rely. This quality is one not generally acquired by training—no matter how assiduous. But constant practice is essential for bringing out whatever skill one may have. The best broad jumpers go as high in the air as the ordinary high-jumper. Johnson has leaped 6 ft. 2 in. in



FIGURE 1. THE RUN.

The run is easy up to the first mark which can be seen on the runway. This mark must be hit exactly right, for from this point the speed is increased and an error here cannot be corrected later. In the illustration the muscles of the legs are still relaxed, although the doubled right fist shows that every muscle will be tightened as soon as the foot has touched the check mark. Note that the eyes are fixed on the distant take-off, and the mind, as shown by the facial expression, is centered on but one thing—an earnest whole-hearted jump.

FIGURE 2. THE TAKE OFF.

This is the critical moment of the process. At this point the speed acquired by the sharp run is converted into lift. Note the determination of the athlete. The body is well ahead of the foot from which the athlete takes off; the right leg is stiffened as the right arm is swung up, thus helping to raise the left knee as high as possible. This is a perfect take off. Every available inch of the board has been used. If the right foot extended a fraction of an inch more, the jump would be a foul, for no part of the foot must show over the take off board.



the running high jump and he goes almost this height in his long jumps. Gourdin has several times jumped 5 ft. 9 in. in the high; and in the broad jump he leaps well over 5 ft. at the highest point of the jump.

But the mere being a good sprinter and a good leaper will not make one a broad jumper. These two qualities must be so coordinated as to obtain the best results. And herein lies the hardest part of jumping. The jumper comes down the runway at gradually increasing speed until he reaches the take-off, where all his effort is concentrated on reaching the highest possible elevation. The difficulty lies in making this change. At no time must the jumper think of the pit and the consequent landing. The sole purpose in the early stages of the jump is to get height. Probably the commonest fault of beginners is the tendency to reach for the ground as soon as, or before, they have attained proper elevation.

The most important part of the jump is the landing. Most jumpers are content with the distance covered in the first motion and land in a standing position. But a study of the men who have leaped over 24 ft. will show



Figure 3.

In this picture the jumper has reached his full height, and the knees, aided by the arms, have been drawn up. The legs will now begin that convulsive motion that resembles running in the air.



Figure 4.

The legs have been thrust out full length thus adding many inches to the distance. The great difficulty here is to avoid sitting down and thus spoiling the effort. The jump is measured from the front edge of the take off to the first break in the soil of the pit. Note that in a soft pit, the athlete makes quite a large break, and actually lands many inches beyond what the tape will give him.

that remarkable results can be obtained in the last few moments of the operation. Gourdin always has contended that the difference between his jumping and that of others lies in the angle of the legs on landing. The

legs meet the soft dirt at an angle of less than thirty degrees.

The event, while apparently one of the easiest on an athletic program, is really one of the most exacting—both on the nerves and physique of the jumper. The powerful thrust at the take-off, the kick in mid air, and the hard shock at the landing, all call for great muscular development of the front part of the thigh. But while the average jumper is a big, muscular athlete, the smaller man has won no small measure of success. The larger man has the momentum; the smaller man has the spring. Gutterson, Kraentzlein, Butler and Gourdin are all men of about six feet, weighing over 160 lbs. But against this array we have a Worthington, and a Johnson, who were tall and slight.

The broad jump is made from a "Take-off" board, eight inches wide set flush with the ground. The jumper lands in a "Pit" of soft earth, alone or mixed with equal portions of sawdust, extending from a point about twelve feet from the Take-off to a point about twenty six feet. Of course no athlete will clear this distance; but the additional room is needed for the pitch forward after landing. And as the jump is measured from the front edge of the take-off to the nearest break in the pit, the athlete

really jumps farther than the tape indicates. Five feet in front of the Take-off there is drawn a white balk line. Whenever the athlete finds that his step is not coming just right, he must stop before he crosses the balk line or the effort will



Figure 6.

The jumper has succeeded in lifting his weight over his knees and is now assured a safe landing. The strain is over; the muscles are relaxing; and the athlete once more becomes conscious that there is an enormous crowd witnessing his efforts.



Figure 5.

This illustration shows the strenuous effort to avoid falling back and losing any distance. The tendency is to settle down, but the head and shoulders are straining to reach forward. This shows that broad jumping is an event that taxes one throughout.



A

Sol Butler, Famous Dubuque Athlete, breaking the American Record for Broad Jump at Harvard Stadium at Cambridge with distance of 24 ft. 8 in. Note legs drawn up to the body and height of jumper.

feet from the Take-off and a check mark about 50 feet from the Take-off. In taking these measurements you must be careful to run at the same rate of speed that is to be used in an actual jump. These preliminaries over the athlete is ready for the jump.

THE RUN

Stand on the mark. Do not start the run until you have fully made up your mind that this effort will be your best. Now having run smoothly up to the 50 foot mark, increase the speed until you reach top speed at just two steps before the take-off. Then without hesitation or wavering concentrate on the lift. The run must be smooth; you should not

B

Bob Gendre of Georgetown University, winning Broad Jump in Pentathlon at Franklin Field April 29th, 1921. Note Gendre has the height in the air but he has extended his feet too far out in front of him too early in the jump.



count against him. The jump must be made from the board. It is declared a foul when any portion of the jumping foot shows over the front edge of the take-off.

By a few simple tests the beginner can find just where he should start his run to enable him to reach the take-off with the jumping foot each time. The best method is to start at the take-off and reverse the run. Stand with both feet on the take-off. If you use the right foot as the jumping foot, step off with the right foot and take three or four easy strides. Place a mark where the right foot strikes the ground. Repeat and continue the run for about 60 feet, increasing the pace as you strike the mark first made. Again make a check mark where the right foot falls at the end of the 60 feet. Now with a steel tape you can transfer these marks to the runway so that you have a starting mark 60

lengthen or shorten the strides except that the very last step with the jumping foot is somewhat shorter. This gives two advantages. In the first place it permits you to crouch as low as possible. The leap is a leap, and not, as I have said above, a long step. In the second place, this maneuver keeps the weight of the body well ahead of the jumping foot, thus saving that energy that would otherwise be expended in raising the body over the knee-joint. The arms are to be carried exactly as in running. Then the left arm and right knee follow as the other arm and knee are held up as long as possible.

The best way to get height is to draw both knees up to the chest, and ever straining upwards, to hold them there until the moment of landing when they are thrust vigorously forward. While in mid air some jumpers try a series of twitches or kicks that give the impression of walking in the air. These motions while they do not give any additional impetus to the forward motion do nevertheless help immensely in keeping the feet from dragging. The motion is attained by taking a second jump in the air. That is, the left leg, after having been drawn up to its full height, is thrust quickly downwards and backwards as the right leg is drawn up and in turn thrust down. This flexing of the muscles brings good results.



After you have expended all the original speed and height in reaching a position over the pit, there remains only one thing. Swing forward the feet from the hips. This will cause the body to approach the soft dirt of the pit in an almost sitting position. Indeed you probably will sit down a few times until you have mastered the knack of driving forward

D
Ned Gourdin winning the Intercollegiate at Cambridge, Mass., May 29th, 1921. Note great height in the air. Just after the take-off, in the act of bringing his legs up.



C
Ned Gourdin of Harvard University. An excellent picture of Ned Gourdin reaching his legs out at the end of the jump for every inch.



E
Ned Gourdin smashing the World's record on Broad Jump. Gourdin made the miraculous jump of 25 feet 3 inches. Note great height in the air, knees well up.

event that may readily be combined with several other forms of running and jumping. For purposes of practice a short run and jump to get height is ideal. Five such trials a day topped off with three real leaps for distance and form three times a week would be a good schedule.

In broad jumping as in all branches of sport the necessity of clean living is imperative. In the heat of battle one is often called upon to do better than he knows how; and in such a situation there is nothing more bitter or discouraging than the thought that he has squandered his and the team's chances of success.

F
L. St. Cyr Ingram of Oxford University, England. Legs are well drawn up. Body is too much crouched. Ingram could have jumped much farther had he greater speed and been surer of his take-off.

with the arms, and letting the knees give way suddenly, as soon as the heels have touched the pit. If the landing has been made properly there will be no sprawling over the pit nor will there be a second jump or bound out of the pit; but you will literally stick in the dirt, and find great difficulty in preventing a fall back. A casual examination will prove to your satisfaction that this swing of the legs on landing will easily add two feet to any jump.

In this event as in all others one cannot overemphasize the need of being thoroughly warmed up before attempting any jumping. And the knack of hitting the take-off and getting a good lift once acquired, the athlete should not take many actual jumps. As said before the event is hard on the leg and back muscles. The best training is diligent practice with the sprinters or hurdlers. This is an



PROMINENT FIGURES IN THE WORLD OF SPORTS IN 1921

The most spectacular fistic battle of this or any other century, a world's series in which all past marks for attendance and receipts were shattered, a drama of the tennis courts which drew the attention and comment of two continents—these were but part of the notable performances in the world of sports during the year 1921. Closely following these three events, which were international in the point of attention and interest, might be mentioned the new home run record of Babe Ruth; the international polo match between the United States and England; Tilden's



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**Dempsey and Carpentier
Just before their record making
fistic battle**

tennis; Schaefer's rise in billiards; Paddock's phenomenal sprinting and the remarkable aquatic feats of Miss Ethelda Bleibtrey.

Everything in sport pales in a comparison with the fistic struggle on July 2, at Jersey City between Jack Dempsey, world's champion heavyweight boxer, and Georges Carpentier, the French light heavyweight who challenged for the title.

The bout itself was short but not lacking in thrills. In the second round Carpentier, second choice in the betting which was 3 to 1 against him, landed on Dempsey's jaw and for a few seconds the champion was tottering. Before and after this one flash by the challenger Dempsey held sway and he finally delivered the knockout punch in the fourth round.

The failure of Mlle. Suzanne Lenglen, the temperamental French miss who was regarded as the queen of the tennis world, provided the real drama of the year. With a nation rendering her homage and much of it pulling for her success against the American champion, Mlle. Lenglen proved a dismal failure. She withdrew from the court during a match with Mrs. Molla Bjurstedt Mallory when the latter was literally playing the French woman off her feet.

The default, or resignation, created a sensation throughout this country; also in the sport realms of Europe. There was much sympathy showered on the visiting player and arguments



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**Mrs. Molla Bjurstedt Mallory
Who now holds the International
Women's Tennis Title**

for or against her action were numerous.

A world's series that was a city series as well—the first affair of its kind ever played entirely within one ball park—marked the close of a big year in baseball where interest always is greatest among sport followers of the United States. It was the first world's series in which a Yankee team had figured, likewise the first for Babe Ruth since he had established himself as the greatest home-run hitter in the history of the game. The combination added to the interest in the series which was reflected in the presence of far more newspaper men from other cities than had attended any previous series.

A total of 270,000 fans paid more than \$900,000 to see the

eight games, both figures being record makers for a world's series. The series resulted in a victory for the National League champions, 5 games to 3. An operation on Ruth's arm early in the series and his inability to play in the last three games, except as a pinch hitter in the final contest, served to take some of the interest out of the struggle. The games were featured mainly by the brilliant pitching of Hoyt, Douglas, Mays, Nehf and Barnes.

Ruth, during the regular season had eclipsed his remarkable home-run record of the previous



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Babe Ruth, "King of Swat"

year. It was regarded as phenomenal when he hit fifty-four homers in 1920 and many wagers were made that this mark would not be broken. Ruth went out and broke it, bettering it by five. At the close of the world's series Ruth again figured in the

public prints as a result of his refusal to observe the rule against world series players engaging in exhibition games. As a result he has been fined his world series money—close to \$3,300—as have Bob Meusel and Bill Piercy. Ruth established several other records besides beating his previous homerun mark. It was early in the year that the sport was placed in the hands of Judge Kenesaw M. Landis as Commissioner with supreme authority.

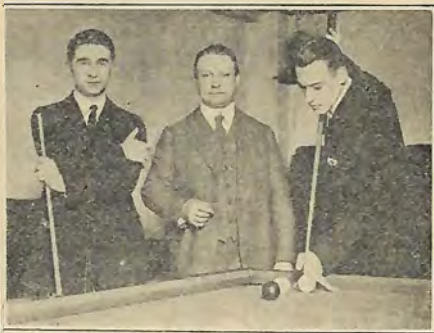


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Miss Ethelda Bleibtrey
World's Champion Woman Swimmer; winner 100 metre swim, Olympic Games, 1920

The great speed marks of the year were those of Paddock on the cinder path, Miss Bleibtrey in the water and Jimmy Murphy over the automobile speedway.

Many speed records were bettered, but the work of those mentioned here was of the phenomenal order.

International competition featured many sports. The big event involving two nations was the Dempsey-Carpentier fight and the same nations were mainly concerned in the ill-fated expedition of Mlle. Lenglen to win tennis honors in this country. Then there was the international polo match, invasions of golfers both here and abroad, with the winning of the British open by Jock Hutchison, an American. Tennis also had its share of international competition. A British soccer team toured this country, as did for-



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Roger Conti, Billiard Champion of France; Ora Morningstar, and Jake Schaefer, World's Champion

eign golfers and billiardists. British track and field stars visited these shores, also a fencing team from England. From the standpoint of international events the year was one of the greatest in sport history.

1921 SPORTS CHAMPIONS

PROFESSIONAL BASEBALL
World's Champions—New York Giants.
National League Champions—New York Giants.
American League Champions—New York Yankees.

FOOTBALL

Leading Eastern Team—Penn State.
Leading Conference Team—Iowa.
Leading Southern Team—Centre.
Leading Pacific Coast Team—California.

PROFESSIONAL BOXING

Flyweight Champion—Jimmy Wilde, England.
Bantamweight Champion—Johnny Buff, Jersey City.
Featherweight Champion—Johnny Kilbane, Cleveland, Ohio.
Lightweight Champion—Benny Leonard, New York.
Welterweight Champion—Jack Britton, New York.
Middleweight Champion—Johnny Wilson, Boston.
Light Heavyweight Champion—Georges Carpentier, France.
Heavyweight Champion—Jack Dempsey, Salt Lake City, Utah.

WRESTLING

World's Heavyweight Champion—Stanislaus Zbyszko, New York.

GOLF

National Amateur Champion—Jesse Guilford, Boston, Mass.
National Open Champion—Jim Barnes, Pelham, N. Y.

National Women's Champion—Miss Marion Hollins, Westbrook, L. I.
Professional Golfers' Association Champion—Walter Hagen, New York.

TRACK AND FIELD

(National Senior Champions)
100-Yard Dash—Charles W. Paddock, Los Angeles A. C.
220-Yard Dash—Charles W. Paddock, Los Angeles A. C.
440-Yard Run—W. E. Stevenson, New York A. C.
880-Yard Run—A. Helffrich, New York A. C.
One-Mile Run—Joie W. Ray, Illinois A. C., Chicago.



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Charles Paddock
Winner 100 Metre Race, Olympic Games, Antwerp, 1920

Five-Mile Run—R. E. Johnston, Edgar Thomson Steel A. A., Pittsburgh.
Ten-Mile Run—R. E. Johnston, Edgar Thomson Steel A. A., Pittsburgh.
120-Yard Hurdles—Earl J. Thomson, Boston A. A.
220-Yard Hurdles—Earl J. Thomson, Boston A. A.
440-Yard Hurdles—A. Desch, Notre Dame University, South Bend, Ind.



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Earl Thomson shattering 110 Metre Hurdle Record at Antwerp Olympic Games, 1920

Three-Mile Walk—William Plant, Morningside A. C., N. Y.
Seven-Mile Walk—William Plant, Morningside A. C., New York.
Pole Vault—Ed Knourek, Illinois A. C.
Shot Put—Clarence Hauser, Los Angeles A. C.
Hammer Throw—Pat Ryan, Loughlin Lyceum, New York.

56-Pound Weight Throw—Pat McDonald, New York A. C.
Running Broad Jump—E. O. Gourdin, Harvard University.
Running High Jump—D. Y. Albert, Chicago A. A.
Discus Throw—Gus Pope, Multnomah A. C., Portland, Ore.
Running Hop, Step and Jump—Kaufman Geist, Ninety-second Street Y. M. H. A., New York.
Javelin Throw—Milton Angier, unattached.
All-Around Championship—S. Harrison Thomson, Los Angeles A. C.



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Earl Thomson of Dartmouth, winning 120 Yard Hurdle at Cambridge

Team Championship—Los Angeles A. C.
CROSS COUNTRY RUNNING
National Senior Champion—R. E. Johnston, Edgar Thomson Steel A. A., Pittsburgh.
National Senior Champion Team—New York A. C.
Intercollegiate Champion—R. E. Brown, Cornell.
Intercollegiate Champion Team—Cornell.

SWIMMING

100 Yards, Free Style, Outdoors—Pau Kealoha, Honolulu.
440 Yards, Free Style, Outdoors—Ludy Langer, Honolulu.
880 Yards, Free Style, Outdoors—Ludy Langer, Honolulu.
Long Distance—J. W. Hall, Brooklyn Y. M. C. A.
Fancy Diving—A. W. Hartung, Illinois A. C.
High Diving—Clarence Pinkston, San Francisco.
440 Yards, Free Style, Outdoors, Women—Ethelda Bleibtrey, W. S. A., N. Y.
880 Yards, Free Style, Outdoors, Women—Ethelda Bleibtrey, W. S. A., N. Y.
Long Distance, Women—Ethelda Bleibtrey, New York.
High and Fancy Diving—Helen Meany, W. S. A., New York.
Water Polo Champions—Illinois A. C.

POLO

International Champions—U. S. team (Capt. Milburn, Hitchcock, Webb, Stoddard).

BASKETBALL

National A. A. U. Champions—Kansas City A. C.
Intercollegiate League Champions—Pennsylvania.
Conference Champions—Triple tie among Wisconsin, Michigan and Illinois.

GYMNASTICS

National All-Around Champion—Curtis Rottman, New York Turn Verein.

TENNIS

National Singles Champion—William T. Tilden 2d, Philadelphia.
National Doubles Champions—W. T. Tilden 2d, Philadelphia and Vincent Richards, New York.



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Devereaux Milburn
Captain of American Polo Team
International Champions



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William Tilden 2d,
National Tennis Champion

National Mixed Doubles Champions—W. M. Johnston and Miss Mary Browne, Cal.
 National Women's Singles—Mrs. Molla Bjurstedt Mallory, New York.
 National Women's Doubles—Miss Mary K. Browne and Mrs. Louise R. Williams, Cal.
 National Junior Champion—Vincent Richards, New York.
 Junior Doubles Champions—Arnold W. Jones and W. W. Ingraham, Providence, R. I.
 National Boys' Champion—Julius Saglowsky, Indianapolis.
 National Boys' Doubles Champions—Thomas McGlinn and Miles Valentine.

AUTOMOBILING

Champion Race Driver—Tommy Milton.

CHESS

World's Champion—Jose R. Capablanca, Havana, Cuba.

MOTOR BOATING AND YACHTING

One-Mile Championship—Miss America II.

Harmsworth Trophy Race—Miss

America II.

International Fishermen's Race—Won by Bluenose of Canada.
 International Six-Metre Class Team Race—Won by England.

TRAPSHOOTING

Grand American Handicap Winner—E. F. Haak, Canton, Ohio.
 National Amateur Singles Champion—Nick Arie, Kingman, Ariz.
 National Amateur Doubles Champion—R. A. King, Delta, Col.

CYCLING

National Amateur Champion—Bobby Walthour, Jr., Newark, N. J.
 National Professional Champion—Frank Kramer, East Orange, N. J.

PROFESSIONAL BILLIARDS
 World's Balkline Champion, 18.2—Jake Schaefer, Chicago.

World's Balkline Champion, 18.1—Willie Hoppe, New York.
 Three-Cushion Champion—John Layton, Sedalia, Mo.

Pocket Billiards Champion—Ralph Greenleaf, Wilmington, Del.

Three Famous Golfers One of Them a President

The President; the British Open Champion, and the American Open Champion, just after Jim Barnes had won the National Championship and President Harding had presented him with the double-handled silver cup. Jack Hutchison, Chicago professional, is holding British open championship trophy which he won recently at the historic St. Andrews Links of Scotland.



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MECHANICAL TRICK CARDS

MECHANICAL TRICK CARDS. We now come to a class of card tricks that depend on (1) the mechanical construction of the cards themselves or (2) on separate devices, which are often mechanical for their illusive effects.

THE SIMPLEST MOVING PIP CARD. The Effect. The card is shown as say, the Eight of Hearts. You breathe upon it, when it changes to the Seven of Hearts. By breathing upon it again, it will change back to the Eight of Hearts.



Fig. 60

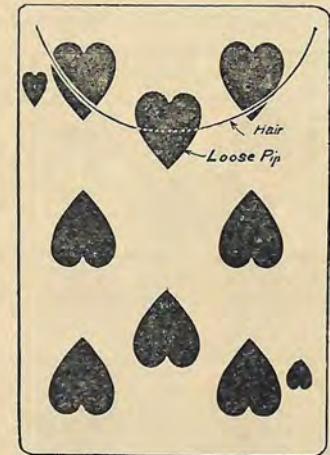


Fig. 61

Construction. Cut a heart pip out of a card and split it in two. Now take a fine hair and lay it between the split heart pip and glue the pieces together as shown in Fig. 60. Next, make two needle holes in a Seven of Hearts near the corners of the card, pass the ends of the hair through them and fasten them to the backs with a little glue; the loop of hair should be just long enough so that the heart pip hangs down in the center of the four center heart pips that are printed on the card as shown in Fig. 61.

Presentation. You show the card as the Eight of Hearts and just as you breathe on it you give it a slight upward jerk. This causes the loose heart pip to swing up and over the card and on to the back of it which thus changes into a Seven of Hearts. By reversing the operation the card is changed from a Seven of Hearts into an Eight of Hearts.

THE WALKING PIP CARD. The Effect. A strictly mechanical changing card is called by magicians the walking pip card in virtue of the way in which the pip moves. It consists of changing a Seven of Spades to an Eight of Spades, or the other way about, visibly or invisibly, before the eyes of the audience.



Fig. 62

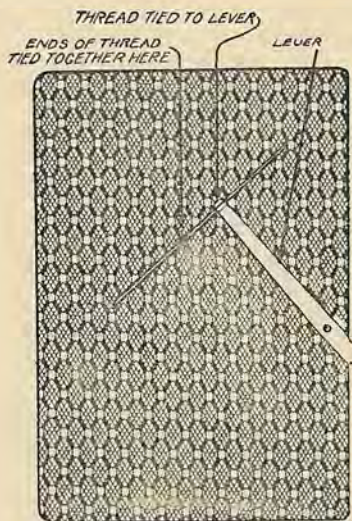


Fig. 63

Construction. First cut a pip out of a Spade card and thread this on or tie it to a fine white silk thread. The ends of the thread are then passed through the two diagonal pips as shown in Fig. 62, and are tied to each other back of the card as shown in Fig. 63. A small cardboard or brass lever is pivoted to the back of the card, as is also shown in Fig. 63, and the upper end is fixed to the thread while the lower and free end is at the bottom of the card.

Presentation. To make the pip move over a pip on the card or to the middle of the latter, all you have to do is to press on the lever with your forefinger a little to one side or the other. Moving pip cards with two walking pips worked by the same lever can be easily made and it is possible to make them with four moving pips so that a Five of Diamonds will change into a Nine of Diamonds and reverse.

THE CHANGING PIP SLIP CARD. The Effect. You show the Ace of Diamonds, when it visibly changes into the Trey of Diamonds or the other way about as you wish.

Construction. A Trey of Diamonds is used in one corner of which is printed the index which shows it to be the Trey of Diamonds and on the other and diagonal corner the index shows it to be the Ace of Diamonds. The two end pips are cut out of the card, with the point of a sharp knife, as shown in Fig. 64.

Now on the back of this card and in the middle of it a strip of card, $\frac{3}{4}$ of an inch wide and $1\frac{1}{4}$ inches long, is glued by its edges as shown in Fig. 65. Next take another card and cut it out in the shape of an (E) as shown in Fig. 66, and paint the ends of it a bright red to correspond with the color of the pip on the first card. This done, slip the

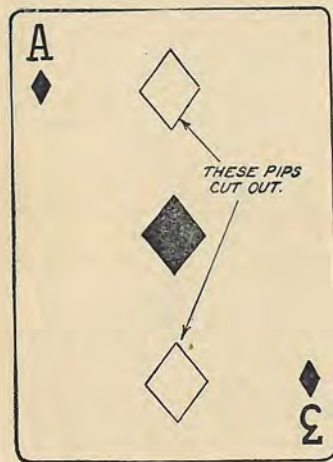


Fig. 64

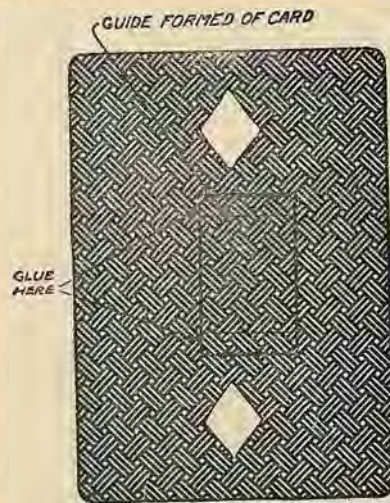


Fig. 65

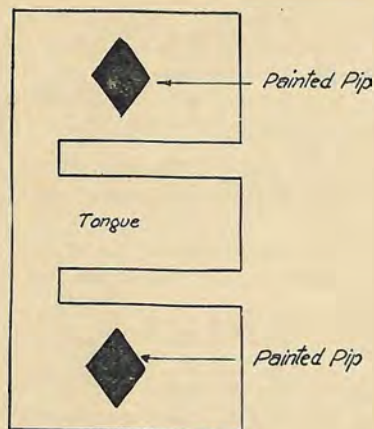


Fig. 66

tongue of the (E) piece through the strip of the card which is on the back of the cut-out card as in Fig. 67. The card can be used in this condition but it is better to glue a card cut out as shown in Fig. 68, over the sliding (E) piece to protect it. The piece cut out of the protective card gives ample room for your finger to slip the (E) piece forth and back.

Presentation. To change the Ace of Diamonds into the Trey of Diamonds, or vice versa, you hold the card with your forefinger on the (E) piece and then gently slide it in or out according to the change you want to make.



Fig. 67



Fig. 68

The History of Gilbert Toys



Today when I look over our plant covering many acres of floor space, and catch sight of a thousand or more employees, it seems a long time since I first started making Gilbert Toys, but, reckoned in years, it is hardly any time at all. But "much water passes over the dam in a few years." Little did I think those last few years I was in college that no sooner would I graduate when I would be striking out for myself.

Three things always interested me—Athletics, Sleight-of-Hand, and Scientific Experiments. Outside of my school work athletics claimed the major part of my time, but a good share was left to learn the secrets of magic and scientific things, the two hobbies I had ever since I was a boy. Both have been of great service to me: first, to help me earn my way through college and second, to bring science down to a boy's understanding through the scientific toys of our manufacture. The first money I ever made was by giving magic entertainments to private audi-

ences, and while entertaining one of these audiences in this way, the thought occurred to me that if these same magic tricks I was doing could be put up so that boys would understand them easily, they would have a splendid sale. I determined to try it out. So even before I left college I had rented a small wooden building out in Westville, Connecticut, a suburb of New Haven, and started to manufacture magical apparatus on a small scale. I was my own manufacturer, shipper, and salesman, and during the holiday season I spent a great deal of time demonstrating in some of the larger cities. It was not long before *Mysto Magic Sets*, as they were called, were known pretty familiarly all over the country.

Manufacturing and selling just magic toys of this kind and type did not satisfy me. I had always felt that toys, besides giving a great amount of fun and enjoyment, also had a big influence on the character of a boy and that they should be considered of greater importance by parents. I realized that as a boy I always had a longing to know more about the secrets of nature and to experiment along scientific lines. So I conceived the idea of manufacturing toys of a character and kind that had been such a hobby with me as a boy—real engineering toys.

I then constructed the first models of what was to become one of the world's greatest toys—ERECTOR. These first models were crude, hand-made things that I spent many an hour working over myself. Finally the dies were completed and we started to produce the first Erector Sets. From that





day to this, Erector has been steadily growing in popularity, until it is now sold in almost every country in the world. From the very beginning boys liked it because it was something entirely different from any toy that had ever been given them—its girders were like actual, structural steel, and at that time it was the only toy operated by an electric motor.

Parents were quick to see its educational value and how their boys would benefit by playing with such a toy. While educational, at the same time it was not "school booky," and the hit it made with boys proved its value as a scientific toy.

Its phenomenal success made necessary our moving into a larger plant on Foote Street, New Haven, in 1913, and its continued growth forced us to build our new plant on Fox Street, New Haven, in the early part of 1915.

My experience with Erector showed me I was on the right track. Toys could be made more than mere playthings—they could be made to mean something to the boy and his parents, and so I have continued to bring out many engineering toys of the kind and character that will hold the boy's interest because they are full of intensely interesting things and provide a great amount of fun and amusement.

As you go through this book of mine you will see illustrated the big family of Gilbert Toys that have grown up with this great, big business of ours, until it became necessary to build what they tell me is the largest toy factory in the world, covering many acres. It can be seen standing out conspicuously, with its big Wireless Tower on the main New York, New Haven and Hartford Railway going through New Haven. Its front door is always open to any of my boy friends who visit New Haven, to see the wonders of automatic machinery of every description—the kind that are turning out this great family of Gilbert Toys.

A.C. Gilbert
President.



ERECTOR

"The Toy Like Structural Steel"

Join the big family of American boys—hundreds of thousands of them—who play with Erector, the wonderful Engineering toy. The big reason why Erector is the choice



No. 4

Get These Big Exclusive Advantages In Erector.

- The only actual structural steel toy.
- The lapped, interlocking edges of Erector Girder, (an exclusive patented feature) enable you to build four-sided and square columns.
- Each piece is stamped accurately out of steel.
- Each part is scientifically made; correct in design and proportion.
- More parts for building strongest and largest model.
- Every essential engineering part.
- Anything mechanical can be duplicated with the Erector.
- Big, reinforced steel wheels, grooved and hubbed for every engineering purpose.
- BIG NEW MANUAL, showing exceptional mechanical models. In addition to those illustrated, thousands of other models can be built.

No. 4 Erector.

Here's the famous No. 4 Erector. I call it the famous No. 4 for it has always been the choice among boys.



THE
STURDY
SQUARE
GIRDER
BUILT
ONLY
WITH
ERECTOR

This set contains the powerful Erector Electric motor with which you can make your models actually run. It also has a big assortment of parts to build models with and the big Erector Manual showing many models you can build. Motor comes knocked down. Full directions are given in the manual for assembling it. This is the kind of set you'll be proud of. Packed in great big wooden box with paste-board cover, four color label, size 22 x 8½ x 2¼ inches. Approximate weight: 6 lbs. Price \$5.00 (Canada, 7.50).

NO. 1 ERECTOR.

Here's an Erector Set that you'll enjoy. This one includes an assortment of girders, shaftings, angle irons, base plate, bolts, nuts, screws, etc. With this outfit you can build any number of unique and modern models. The book of instruction included gives complete directions and shows pictures of many fine models. Packed in a Gilbert Toy carton with four color label, size $12\frac{1}{4} \times 8\frac{3}{4} \times 1\frac{1}{4}$ inches. Approximate weight, 1 lb. 10 ounces. Price \$1.00. (Canada \$1.50)



No. 1

NO. 3 ERECTOR.

Here's a dandy set. Contains just the right number of parts for building some great models. There's standard Erector girders, angle irons, shaftings, wheels, pulleys, nuts and many other parts that come only in Erector Sets. There's no end to the pleasure you can get from this set. Packed in a Gilbert Toy Carton with four color label. Size $19 \times 10 \times 1\frac{1}{4}$ inches. Approximate weight: 4 lbs. Price \$2.50. (Canada \$3.75.)



No. 3

ERECTOR NO. 7

Quite a complete set for the boy who is old enough to make difficult models. It contains many parts for building most of the models shown in the book of instructions which comes with the outfit. There is included a motor and a reverse base to operate the crane, derrick or elevator that you make. The fact that you use motive power in your work adds to the reality of it. All the parts of the standard Erector equipment packed in hardwood cabinet $12\frac{1}{4} \times 20\frac{1}{4} \times 3\frac{1}{2}$ inches. Weight approximately 18 lbs. Price \$10.00. (Canada, \$15.00).



No. 7

ERECTOR NO. 8.

An advanced set containing a sufficient number of parts to do most any kind of building. You can build some wonderful models with this outfit, such as locomotives and things requiring care and study. You will not be limited in your work; you can build some very big models requiring a whole lot of girders, angle irons, shaftings, nuts, bolts, etc. Of course, the powerful Erector motor is included, together with reverse base and control switch. Packed in hardwood cabinet size, $12\frac{1}{4} \times 20\frac{1}{4} \times 4\frac{3}{4}$ inches. Weight approximately 32 pounds. Price \$20.00. (Canada \$30.00.)



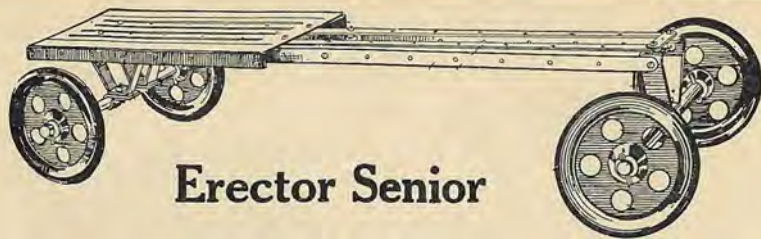
No. 8

ERECTOR NO. 10.

The largest and most complete Erector set made. You can be sure that with the assortment of parts in this outfit you will have no trouble in setting up models of the most difficult machines. There's the crackerjack Erector motor and a 110 volt universal motor for operating direct from house current, reverse base, control switch, girders, angle irons, shaftings, nuts, bolts and everything you could wish. Packed in hardwood cabinet with trays to hold the different pieces in the right place, size $12 \times 20 \times 3\frac{1}{2}$ inches. Price \$30.00. (In Canada \$45.00).



No. 10



Erector Senior

**POWERFUL—STURDY AND LIFE SIZED
WHEEL TOY AND MACHINERY MODELS**

Here's the greatest toy of all, boys—a regular humdinger. With this New Erector Senior in addition to the splendid toy which you see set up you can make many fine things easy as rolling off a log—a glider that is better than the regular ones, a wheel-barrow, a baggage truck that's the real thing—big machinery models like cranes, derricks, swings—something new every week.

These toys are not models or flimsy affairs. They are honest-to-goodness ones, exceptionally strong and sturdy—toys that you can get on and ride yourself. All you need is a screw-driver and wrench and the parts in the outfit. With them you can build real life-sized models in no time at all.

No. 15 Set \$5.00

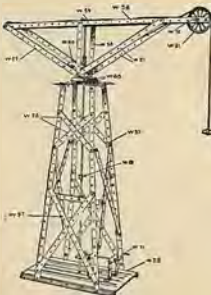
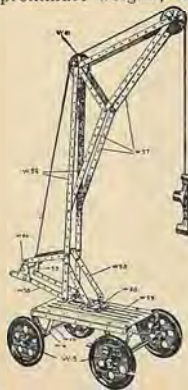
The set comes assembled as a four-wheel Coaster with extra parts enough in the box to build many other life-size models. Many of these are wheel toy models, such as wheel barrow, high truck, low truck, barrel truck, wagon, tip cart, high factory truck, barrel truck with supports, low factory truck, and big machinery models almost without limit. Manual of Instructions which comes with each set illustrates windmill, lawn seat, ladder, trolley repairer, stationary crane, wheel derrick, movable hoist and movable crane.

Built almost entirely of metal, it is a toy that will stand the hardest abuse. Braces, angle irons, supports, etc., are of heavy band iron. The wheels are disc type of heavy gauge steel, 5 inches in diameter, put together with special riveting and locking hub device.

Packed in strong corrugated container with three color descriptive label. Size of box 31¼ x 6¼ x 12¼ in. Approximate weight; 16 lbs. Price \$5.00. (Canada \$7.50.)

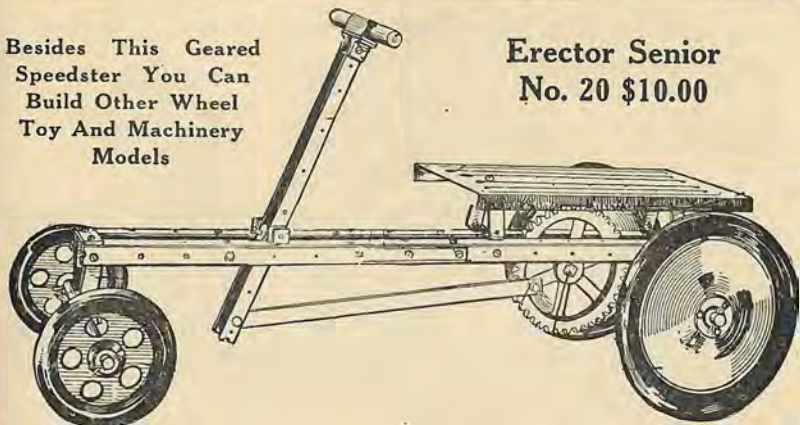


**Life Size Wheel
Toy and Machin-
ery Models**



Besides This Geared
Speedster You Can
Build Other Wheel
Toy And Machinery
Models

**Erector Senior
No. 20 \$10.00**



With this outfit you can build many more wheel toy and machinery models, the adding of the heavy sprocket gears enable you to make accurate and highly detailed machinery of all kinds.

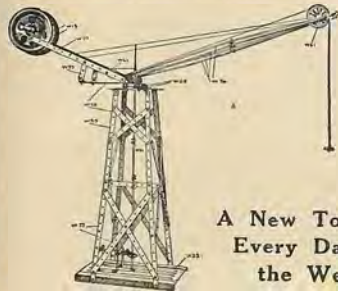
This set comes assembled as a geared speedster four feet long—a speedster that you can operate yourself—get on and ride to your heart's content. Then you can build the models which can be built with Erector Senior No. 15, using two of the 8 in. diameter wheels and two 5 in. diameter wheels in place of the four 5 inch wheels furnished with Erector Senior No. 15.

Remember the models that can be built with it are life size, big enough for you to use yourself. Set is packed in heavy corrugated carton with three color label. Size of box: 32¼ x 12¼ x 9¼ in. Approximate weight: 26 lbs. Price \$10.00. (Canada \$15.00.)

Think what fun you can have building yourself a different toy every day or every week or as often as you like. There's no end to the sport this New Erector Senior will give you. Read over carefully the description of each outfit.

You cannot imagine what real fun is until you have learned to build these wheel toys and machinery models.

An Erector Senior outfit means that you will have bully times—indoors and out—that you will get real enjoyment from your play. Get one of these sets and learn what fun it is to build your own toys.



**A New Toy For
Every Day in
the Week**



Gilbert Electrical Sets

66 Stunts With an Electric Motor No. 3005

Until you have this set you'll never know the amount of fun you can have with an electric motor, or the great number of things you can do with one.

The apparatus is included in the set and the big book with it tells you all about a motor and shows you, among a great many other things, how to make a water rheostat, the song of the siren, the spinning chain, how many colors make white, how a steam engine governor works, how to make



black lines appear to be white, three good optical illusions, etc. Packed in Gilbert Toy carton 18 x 10 x 1 1/4 inches. Approximate weight 2 lbs. Price \$2.50. (Canada, \$3.75).

75 Electrical Toys and Tricks No. 3005.

Here you are boys! The kind of an electrical set you've always wanted. Nothing complicated about this or hard to understand. A dandy set with which you can perform 75 crackerjack electrical tricks,



No. 3005

and make some fine electrical toys.

Find out how to generate electric current; how to "taste" electricity; how to make an electro-magnetic gun; how to make an electro-magnetic pile driver; what the earth has to say and many other intensely interesting things. In Gilbert Toy carton 18 x 10 x 1 1/4 inches. Approximate weight 2 lbs. Price \$2.50. (Canada \$3.75).

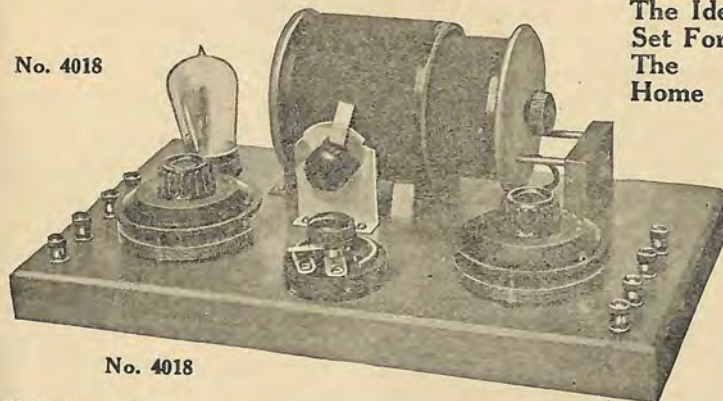


No. 3003

Gilbert Radio Outfits

The Ideal
Set For
The
Home

No. 4018



No. 4018

With this outfit telephone messages can be heard from approximately 100 miles and under ideal atmospheric conditions, from considerably greater distances. It is an extremely simple outfit to operate requiring as little mechanical knowledge as any set on the market. It is the one that we recommend at all times for the buyers of wireless apparatus who desire a wireless telephone equipment in the home as a matter of interest and amusement, and do not wish to be bothered with mechanical details.

This set is a very sensitive receiving set, a combination of a detector and a set of sensitive tuning coils augmented with two variable condensers. Waves varying in length from 200 to 800 meters may readily be received.

We have used the telescoping type of tuning coils in this set because we believe this method to be the simplest and most effective in tuning in for wireless telephone and wireless telegraph work. The coils are wound on strong forms, impregnated and baked. They slide with a free motion on two brass rods.

The set is mounted on a wood base 14 3/4 x 9 1/2 inches. All wood parts are finished with an attractive high polish. The knobs are made from specially prepared black composition, and the binding post, switch levers, screws and nuts are all of brass. We have carefully protected the wiring on the bottom of the set by setting in a board which entirely covers the wiring. This board however, may readily be removed. The set is carefully assembled and wired by expert workmen trained in assembling wireless apparatus. Exhaustive tests assure the customer that the instrument will be received in A-1 condition. Price \$25.00. (Canada \$37.50).

Set Needs To Complete, Ready for Operation.

- 1 Only U. V. 200 Tube, No. 4072.
- 1 Only B Battery, No. 4077.
- 1 Only 6 volt storage battery—any battery of this voltage will work satisfactorily. We do not stock this item.
- 1 pair Head Phones, No. 4055.
- Sufficient wire and insulators to erect aerial, approximately 100 ft. long.

Complete directions and diagrams for connecting and operating accompany the set. We do not hesitate to recommend this to give absolute satisfaction. Like all our wireless apparatus this is backed by the guarantee of The A. C. Gilbert Co.



COMPLETE RECEIVING SET No. 4016.



No. 4016

This set might well be termed "the little wonder." We recommend it highly to all beginners in Radio work. The outfit just as you see it in the picture, is complete in every detail. The only equipment necessary to operate it is sufficient wire and insulators to erect aerial.

Construct an aerial and away you go. The outfit consists of a tuning coil, crystal detector, and a pair of sensitive phones with head band. No batteries are required. It will receive waves varying in length from 200 to

600 meters. The receiving range is approximately 300 miles for wireless telegraph signals and 10 to 15 miles for wireless telephone and much greater distances can be heard under favorable atmospheric conditions.

The set is arranged very compactly in a stained hardwood cabinet $6\frac{3}{4} \times 7\frac{3}{4} \times 5\frac{1}{2}$ inches. The price of this set will enable most every boy to join the ever increasing ranks of the amateur radio experimenters. Get in the swim boys; it's a wonderful game. Price \$15.00. (Canada \$22.50).



Gilbert Tele-Set No. 3502

This outfit works just like the instruments in the telegraph stations where communications between distant points take place every day, and is just the outfit you want.

In the book of instructions included with the set everything is explained very simply so that it will be easy for you to understand how every part works. After you have used your set

and know the code, it will be very interesting for you when in a telegraph office to listen to the instruments they have there. It is well, too, that you become familiar with the code used in Wireless. Then you will be in a position to understand the transmission of messages by this system as well as by telegraphy. This is the game for you—the kind of play that gives you plenty of fun and at the same time teaches you things every boy is eager to know. Packed in Gilbert Toy carton, $12\frac{1}{8} \times 8\frac{3}{8} \times 1\frac{1}{4}$ in. Approximate weight: 12 ozs. Price \$1.00. (Canada, \$1.50).



No. 3502

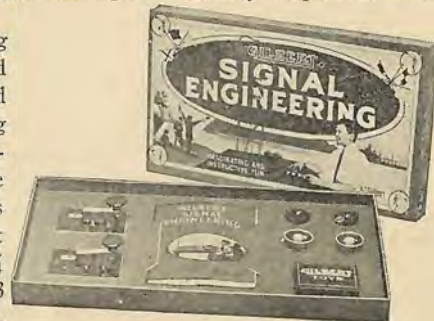
Signal Engineering

Learn How To Wig Wag—Semaphore Code, Etc.

What better sport could you have than that of sending messages by signals, using many different systems?

Gilbert Signal Engineering and the big book with it will teach you how to use the Heliograph, the Wig Wag, Ardois, the Semaphore, and other systems of signalling operated with such great success by the U. S. Army and Navy. Learn about the signals used by ships when out at sea.

Has also 128 page book giving directions for using the set and instructions for making flags and other signals as well as telling you how to Wig Wag, use a Semaphore and Blinker. Gives code and illustrations of many flags in four colors. Packed in Gilbert Toy carton, size $18 \times 10 \times 1\frac{1}{4}$ inches. Approximate weight: 3 lbs. Price \$1.00. (Canada, \$1.50).



No. 6541

Gilbert Weather Bureau Outfits

In the minds of most people a very silly idea prevails about the weather and the weather man. It is the general idea that the weather knows no laws—that it is lawless and reckless, fickle and changeable;



No. 6533

that the weather man is a sort of conjurer, and by some mysterious gift he is able to prophecy things that most people know nothing about. Nothing could be further from the truth. The study of the weather is a science, like electricity, chemistry, or medicine; there is nothing mysterious about it at all.

As a matter of fact, the weather man is a scientist, and by means of his instruments which indicate definite things to him, he comes to certain conclusions. He is not a prophet;

he does not prophecy, he forecasts. He has a weather bureau station which is maintained by the Government. There are over a hundred of these stations located in various cities throughout the United States, and they are very interesting places. They are usually located on the top floor of one of the tallest buildings in the city, with apparatus on the roof, some of it electrically connected in the room below with wonderful machines which make records all day long on special charts.

If you are interested in having a weather bureau station of your own, I can tell you now that it will be one of the most interesting things you ever had in your life. you will have a knowledge of a subject on which most people are quite ignorant, and if you are a boy you will stand for leadership among boys for knowing about things that to most people are mysterious and magical.

This outfit enables you to study the first principles of the weather. It contains an anemometer for determining the velocity of the wind; a wind vane for wind direction; a dandy boy's book on weather, explains all about how to set up the outfit and operate it.

Comes in Gilbert Toy Carton with four color label, size 18 x 10 x 1 1/4 inches. Approximate weight: 1 lb. Price \$1.00. (Canada \$1.50).



No. 6534 WEATHER BUREAU

A more advanced outfit than our No. 6533. In addition to the weather vane, anemometer, etc., it contains thermometers and a very high grade barometer so you can find out more about the science of weather and do a number of interesting experiments. There is also an electrical apparatus to be connected to the anemometer, simplifying the studying of the wind velocity considerably. The 150 page book on weather also included will be found intensely interesting.



No. 6534

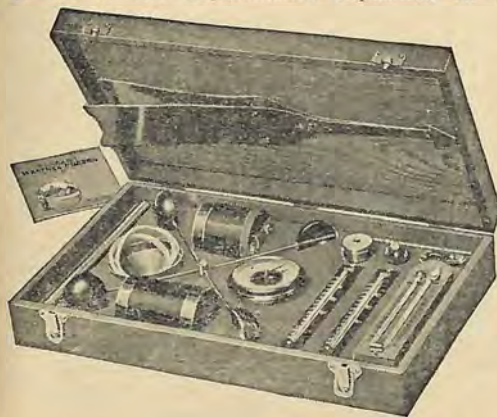
Packed in Gilbert Toy carton with four color label, size 18 x 10 x 2 1/4 inches. Approximate weight: 2 lbs., 4 oz., Price \$10.00. (Canada \$15.00)

No. 6536 WEATHER BUREAU

The most complete weather bureau outfit we make. It contains the apparatus in our No. 6534 set and in addition a maximum and minimum thermometer, and a special "Sunshine Recorder." With this outfit, you can do all of the experiments explained in our big book on weather.

This is a very attractive and interesting book, written particularly for boys and contains some 150 illustrations. With this book and the apparatus in the set you can have a very complete weather bureau of your own and make accurate forecasts of the weather.

Comes in stained hardwood cabinet fitted with strap hinges and suit case clasps, size 20 x 12 x 3 3/4 in. Approximate weight: 8 lbs., 8 ozs. Price \$15.00. (Canada \$22.50).



No. 6536



Gilbert Civil Engineering

With the Gilbert Civil Engineering No. 6525 you will be able to lay out your playing field accurately. You can measure distances, make a map of your backyard, putting in the trees, fences, sheds, etc. You can use your apparatus anywhere—at the camp, where it is necessary to get information about the land on which the camp will be located. Find out what the grade of your street is. Do many things that the civil engineer does when he is completing a great piece of construction work.

With the set comes a fully illustrated book on surveying from which you can obtain a knowledge of how to use your equipment, how to survey, and of the work great engineers have done. The outfit contains all parts necessary for building your own transit. Packed in corrugated cardboard container, size $15\frac{1}{4} \times 6\frac{3}{4} \times 6$ inches. Approximate weight: 6 lbs. Price \$5.00. (Canada \$7.50).



No. 6525

Hydraulic And Pneumatic Engineering

Think what it means to you to be able to construct models of water systems—to make trench guns with which you and your chum can have a real battle! Learn how

ships that have been sunk are raised—interesting facts about the submarine, the depth bomb, and torpedo.

A Gilbert Hydraulic and Pneumatic Outfit is an equipment you can use as often as you like and never grow tired of it. You can make models of big construction work, build a miniature water supply system of your own, etc. All the necessary apparatus with big book is included in this outfit. Price \$2.50. (Canada \$3.75).



No. 6502

Gilbert Light Experiments

No. 6516

FUN WITH LIGHT!

With an outfit of Gilbert Light Experiments you can have some wonderful fun. There's a big book on light with every outfit telling interesting facts about the sun and the sun's rays, and how to make use of them. Then, too, it tells you how to give shadow shows, give an exhibition of freakish images that will amuse your friends.

While you are playing with this outfit, you will learn about the telescope, opera glasses, microscope, moving picture machine, and many other important instruments. There's a pile of fun in every one of these outfits for a boy. It is complete with lens, mirrors and all necessary equipment. No. 6516 Light Experiments is packed in Gilbert Toy carton, with four color label, size $18 \times 10 \times 1\frac{1}{4}$ inches. Approximate weight: 2 lbs. Price, \$2.50. (Canada, \$3.75.)



No. 6516

Sound Experiments

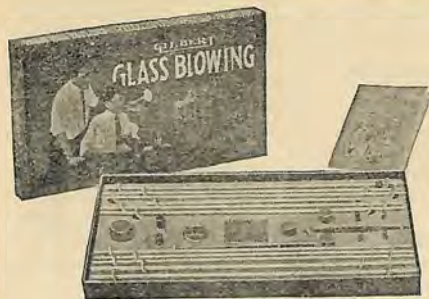
WHAT IS SOUND?

With one of these outfits you can have great fun finding just what sound is—how it is produced—why some pianos sound better than others,—why a violin produces a musical tone, and many other things, including a number of startling rapping tricks with which you can astonish your friends. The outfit contains tuning forks and sound box, receivers, mallet, etc., and big book on sound, telling how to perform many fascinating experiments, and also shows you how to do many startling tricks with apparatus you have in your own home. This is one of the most intensely interesting scientific toys of today and every boy should have one. No. 6521 Sound Experiments packed in New Gilbert Toy carton with four color label, size $18 \times 10 \times 1\frac{1}{4}$ inches. Approximate weight: 2 lbs., 12 ozs. Price, \$2.50. (Canada, \$3.75.)



No. 6521

Gilbert Glass Blowing



No. 6545

You can have all kinds of fun with this set making many attractive and useful articles for yourself—besides it will be a big help to you if you have the Gilbert Hydraulic and Pneumatic Engineering Outfit, Chemistry, etc.

It contains glass tubing in various lengths, blow pipe, Alcohol lamp and complete apparatus for performing a number of experiments illustrated and described in the big book

on glass blowing written by Prof. C. J. Linde of MacDonald University, Quebec.

Packed in Gilbert Toy carton with four color label size, 18 x 10 x 1¼ inches. Approximate weight: 2 lbs. Price, \$2.50. (Canada, \$3.75).

Mineralogy

DO YOU KNOW WHAT COAL IS?

Do you know how it is mined? Where they get diamonds? How to tell a good one? If you'd like to know these things and lots of others just as interesting, you surely want one of these new Gilbert Outfits on Mineralogy. It comprises a complete assortment of minerals and metals for you to practice with, as well as a boy's book on Mineralogy, prepared by Mr. William J. Horn, our Research Chemist. There are many fascinating experiments included that you will surely be pleased with. No. 6550 Mineralogy, is packed in Gilbert Toy carton with four color label, size 18 x 10 x 1¼ inches. Approximate weight, 1 lb., 9 ozs. Price \$2.50. (Canada, \$3.75.)



No. 6550

Gilbert Magnetic Fun And Facts

Did it ever seem strange to you that a compass always points to the North? Do you know why it does—what it is that attracts the fine needle point of the compass? Very few boys do. The boys who do not are the boys who have never heard of magnetism and do not realize what a tremendous effect it has on our everyday life.

Gilbert Magnetic Fun and Facts explain all about the compass and many other things besides. They show you how to build a magnetic tight rope walker, magnetic jack straws, a magnetic navy and any number of electrical tricks with which you can surprise your friends.



No. 6504

Contains two horse-shoe magnets, iron filings and other parts for performing many of the experiments illustrated in the big book on magnetism included with the set. Comes in Gilbert Toy carton, with four color label, size 8¾ x 12¼ x 1¼ inches. Price \$1.00. (Canada \$1.50).

No. 6506

Contains parts for building simple magnetic motor, iron filings, etc., for performing experiments in big book of instructions, also included.

Packed in Gilbert Toy carton with four color label, size 8¾ x 12¼ x 1¼ inches. Approximate weight: 2 lbs. Price \$2.50. (Canada \$3.75).



No. 6506

CHEMISTRY.



Of all the big sciences there are two which I think are the most interesting. One is Electricity, which I told you about, the other is Chemistry—and the two sciences are worked together in a great many cases. If you know Chemistry, you will know how a great many of the things which are so necessary to your every day life, are manufactured or grown. Chemistry tells you how dye is made for the clothes you wear. What the substance you call "lead" in the pencil you are writing with really is. How soap is made. How your

mother's silver-ware is plated—and any number of interesting things like that. Wouldn't you like to be able to make ammonia for your mother—or a bar of soap—do chemical magic tricks—or make a wet cell to operate your door bell? You can do these things with Gilbert Chemistry Outfits.

Remember these are all entirely new sets that are certainly great ones. They are chock full of wooden boxes with some of the salts and chemicals, and glass bottles sealed with wax, for the liquids.



No. 5009

The Leader of Them All.

Here's a Chemistry set you will be proud of. It is a complete chemical laboratory in itself, packed full of harmless chemicals of all kinds, as well as test tubes, funnel, glass tubes, alcohol lamp, filter paper and many other things to perform the hundreds of experiments told about in the big book that comes with the set. Just think there are 453 different experiments in the big book. It all comes in great big stained hardwood cabinet, size 22 x 8½ x 3¼ inches. Approximate weight: 5 lbs., 8 ozs. Price \$5.00. (Canada \$7.50).

Gilbert Chemistry
No. 5007

With the harmless solutions that come in this set you can prepare many substances used in every day life. Produce startling effects by placing one ingredient with another. Learn the method of making cloth fire-proof. How to pass an egg through the neck of a bottle and manufacture disappearing ink. Packed in the Gilbert Toy carton, with four color label, size 8¾ x 12¾ x 1¼ inches. Approximate weight: 1 lb. Price \$1.00 (Canada \$1.50).



No. 5008

With this set you can find out how dye is made for the clothes you wear; what the substance you call "lead" in the pencil you are writing with really is; how soap is made; how your mother's silver-ware is plated—and any number of interesting things like that. Here's a corking chemistry outfit. In addition to the many acids and alkalis included, this outfit has a test tube rack, filter paper, alcohol lamps, etc. Book of Instructions gives complete directions for the many experiments you can do with this set. Packed in Gilbert Toy carton with four color label, size 18 x 10 x 1¾ inches. Approximate weight: 1 lb., 10 ozs. Price, \$2.50. (Canada, \$3.75).



No. 5010

With a set of this size—the largest in the Chemistry Outfits—you can learn the elementary facts of this science and make your play both fascinating and beneficial. Do electrotyping—make tests of metals. It will be a very easy matter for you to plate old metals, etc., with a finish resembling gold. All this is explained in a book of instructions which covers every detail and is included in each set. There are a great many tricks that you can do with your solutions. With this larger set you can do many of them. Packed in hardwood cabinet, this set is very convenient to carry about. Size, 18¾ x 10¾ x 3 inches. Approximate weight; 6 lbs., 8 ozs. Price \$10.00, (Canada, \$15.00).



Gilbert Mysto Magic Series

As you boys probably know, I first started this big Gilbert Toy business by making Magic tricks, but long before that I was practicing Magic professionally, giving entertainments for lodges, clubs, churches and other organizations, and in this way earned practically my entire expenses for college. For this reason I am in a very good position to appreciate what it means to boys to have something of this kind that they can fall back upon. Something that will help them work their way through school, or

give them additional spending money. By no means is it the money alone that you derive from this that makes it enjoyable. It's one of the greatest ways to amuse yourself and your friends that I know of. Best of all, it trains your eyes, fingers and hands. You probably don't believe that, but after you have practiced Magic for a while you'll soon see that it is entirely true.



No. 2001

Packed in Gilbert Toy carton, $12\frac{1}{4} \times 8\frac{3}{4} \times 1\frac{1}{4}$ inches. Weight approximately 1 lb. Price, \$1.50. (Canada \$2.25).

No. 2005 Mysto Magic



No. 2005

Just think of the fun you can have making dollar bills appear in your coat sleeve or making cigarettes and handkerchiefs vanish. This outfit contains a very good assortment of famous tricks, like the Drumhead Tube, Linking Rings, Handkerchief Cassette and many others. The book of instructions tells you how to perform each trick and lists many you can do with apparatus you have in your own home. Packed in Gilbert Toy carton size $18 \times 10 \times 1\frac{1}{4}$ inches. Weight approximately 1 lb., 8 ozs. Price \$5.00. (Canada \$7.50).

No. 2006 MYSTO MAGIC

One of the best collections of amateur magic for giving complete entertainments; containing Magician's Nickel-Tipped Wand, Show Poster, and illustrated Manual giving complete instructions how to give a performance, including "patter," etc. Some of the tricks included are: Spirit Slate, Siberian Transport Chain, Drumhead Tube, Handkerchief Cassette, Passe-Passe Coin Trick, etc.

Comes in stained hardwood cabinet with tray, size $13 \times 9 \times 3$ inches. Approximate Weight: 6 lbs. Price \$7.50. (Canada \$11.25).



No. 2006

THE PROFESSIONAL SET.

This outfit is really a semi-professional set. It is one of the best collections of amateur magic and intended for the boy who, after practicing Magic for some time, desires to equip himself with an outfit he can use to give shows, not only to his friends, but for church, lodges, and Y. M. C. A.'s as well. It contains a splendid assortment of the leading tricks that are practiced by the foremost magicians today. Such as Large Wand, Show Poster, Phantom Card Trick, Vanishing Coin from Glass, Drumhead Tube, Magic Slates, Phantom Ring, Ching Ling Soo, Okeito Coin Box, Mysto Coin Shells, Disappearing Handkerchief, Princess Card Trick, Pick-it-Out, Sphinx, Papel Blanco, Rice to Water, Chinese Linking Rings, Cigarette Vanisher, etc.

Box: Stained hardwood compact chest with suit case clasps size $16\frac{3}{4} \times 10\frac{1}{4} \times 2\frac{3}{4}$ inches. Approximate Weight, 4 lbs., 12 ozs. Price \$10.00. (Canada \$15.00).



No. 2009



No. 2022

that will fascinate and mystify. Big book in every outfit telling how to do each trick. The outfit contains a complete assortment of chemicals, some in liquid form in glass bottles, sealed with wax, and others in powder form in wooden containers. There are enough chemicals included with which to give a whole evening's entertainment. Packed in Gilbert Toy carton, size 18 x 10 x 1¼ inches. Approximate weight: 1 lb., 5 ozs. Price \$2.50. (Canada \$3.75).

Handkerchief Tricks

No. 2025

Contains a collection of clever and novel feats, such as you have seen the magicians perform on the stage.

With it is included a book of instructions telling you in a very simple way the manner in which each trick is performed. The number of illustrations is large because every move that must be made is pictured so that you cannot misunderstand any direction given.

The outfit contains all the material you need to give a full evening's entertainment for your friends or your club.

Comes in Gilbert Toy carton, size 18 x 10 x 1¼ inches. Approximate weight: 1 lb., 6 ozs. Price \$2.50. (Canada \$3.75).



No. 2025

Chemical Magic

No. 2022

How do you suppose magicians on the stage pour red, then white and then blue liquids all from the same pitcher right before your eyes? Haven't you envied them and wished you could do wonderful tricks of that kind?

With one of these outfits you can give a complete entertainment of chemical magic

Card Tricks

No. 2000.

Boys, when you have watched magicians perform their mystifying card tricks, haven't you had the desire to perform those very same stunts yourself?

It is a great sport, and live-wire boys can easily become masters in this line of entertainment by closely following directions given in the Book of Instructions which comes with every Gilbert Magic Card Trick Outfit.



No. 2000.

The outfit contains eight mysterious card stunts that are used by the foremost magicians. Set packed in special Gilbert Toy sealed carton. Size 12¼ x 8¾ x 1¼ inches. Price \$1.00. (Canada \$1.50).

Mutt & Jeff Jokes

No. 2008

Every boy knows about Bud Fisher's famous comedians, Mutt and Jeff. You fellows have had many a good laugh and thoroughly enjoyed the pranks these laugh-producers are pictured doing in all the newspaper comic supplement pages. Best of all, the jokes and tricks they do are harmless and are stunts every regular fellow wants to get away with himself, and if an outfit chock full of jokes and tricks that are corkers, appeals to your fancy, No. 2008 Mutt and Jeff Joke Set is what you are after.

The Sore Finger, Rubber Tack, Raveling Joke, Window or Plate Smasher and Magic Ink Spot, come packed in Gilbert Toy sealed carton with Book of Instructions telling you just how to do and get best results out of a collection of the biggest laugh-producing tricks ever invented.

Price \$1.00. (Canada \$1.50).



No. 2008

Gilbert Coin Tricks

No. 2020

Just think! You can give shows and mystify your friends with the same fascinating coin tricks that are used on the stage today by many of the professional magicians. You can learn all sorts of palming and sleight-of-hand tricks—feats of magic that are very interesting and mystifying.

You can make a coin vanish from a newspaper—vanish a coin from your closed hand—make coins appear out of the air—pass a coin through a table—vanish a coin from a glass, and many other tricks that will make your friends' eyes open in wonder.

With a Gilbert Coin Trick Outfit all of these things are simple. There is a big book comes with each set explaining how each trick is performed, just how to hold your hands when giving shows on the stage, how to talk so that you will divert the attention of your audience, in fact all the information you need to give Magic Coin Trick entertainments.



No. 2020

The Outfit contains a complete assortment of magic coins for all the different tricks, together with other apparatus necessary. Packed in the distinctive Gilbert Toy sealed carton, size 18 x 10 x 1 1/4 inches. Price \$1.00. (Canada \$1.50).

Gilbert Knots and Splices

No. 2021

They thought the rope was tied tightly and in a way that would make it impossible for you to escape. From all appearances they were right, but they did not know that for you it was a very easy matter to escape. You had an outfit of Gilbert Knots and Splices from which you had learned how to make various kinds of rope ties, and how to get out of them. There was hardly a knot that any one could show you that you wouldn't know how to tie and untie.

If you haven't already one of these sets, you certainly want to get one, for with it you will learn how to splice rope; how to tie useful knots; and how to do many tricks that are now being performed on the stage by famous magicians. You can give shows for your church or club. Your boy friends will admire you for being clever and will want to join in the fun.

For real pleasure—for a crackerjack way of entertaining your friends, get a set of this kind. You will be pleased with it all right. Outfit contains a complete assortment of sample knots, with a quantity of rope to practice with, as well as a complete book on knots, telling how to tie them and how to perform many startling experiments. Packed in the Gilbert Toy sealed carton, 18 x 10 x 1 1/4 inches. Price \$1.00. (Canada \$1.50).



No. 2021

Gilbert Puzzle Party

No. 1029

A good puzzle to solve—one that is a corker and which will test your thinking power to the limit is about the most fun you could wish for, and the No. 1029 Gilbert Puzzle Party Set provides an entertainment for you and your friends which is hard to beat.

With the puzzles in this outfit, different games can be played and prizes given to the person solving the various puzzles first. Instructions



No. 1029.

for each trick telling just how to do them, come with each set which is packed in the Gilbert Toy sealed carton, 7 1/4 x 5 x 3/4 inches. Price 25 cents. (Canada 40 cents).

Gilbert Puzzle Party

No. 1030

No one really seems to know when, where, and how puzzles originated. In fact, the greatest puzzles in all Puzzledom is in regard to their origin. With the varied assortment in the No. 1030 Gilbert Puzzle Set, your puzzle-solving ability will be tested to the limit. There is always a spirit of keenest competition in one of these puzzle contests and interest is kept at highest pitch until the winner is declared.

Outfit complete with Book of Instructions giving all necessary information and directions regarding all puzzles in set. Comes packed in the individual Gilbert Toy sealed carton, 8 3/4 x 12 1/4 x 1 1/4 inches. Price 50 cents. (Canada 75 cents).



No. 1030

Gilbert Puzzle Party

No. 1031

Just imagine a dozen of your friends all seated around a big table, each with a different puzzle to solve and each one trying their best to win the prize that has been put up for the one who masters the puzzle first! There is nothing more fascinating than a good puzzle, and the fun there is in doing these tricks will keep you right on your toes every minute.

With the assortment of puzzles in the No. 1031 Set, a most enjoyable party can be had, and a special Book of



No. 1031

of Instructions which comes with this outfit gives complete information about each individual puzzle.

Set packed in the Gilbert Toy sealed package, $8\frac{3}{4} \times 12\frac{1}{4} \times 1\frac{1}{4}$ inches. Price \$1.00. (Canada \$1.50).

Gilbert Puzzle Party

No. 1032

A complete assortment of all Gilbert puzzles is what is included in this No. 1032 Puzzle Party Outfit, the largest and most popular set we have ever made up. A wonderful variety of tricks, each one being entirely different from the other. Not only is there that fascinating fun connected with the solving of all puzzles, but a good training in quick thinking as well, for to solve a puzzle it is necessary to think and think quickly and logically.

The set is complete in every detail, and a great variety of tricks makes possible one grand big Puzzle Party.

Outfit packed in the Gilbert Toy sealed carton. Size $18 \times 10 \times 1\frac{1}{4}$ inches. With complete Book of Instructions and supplementary folder covering additional miscellaneous tricks. Price \$2.50. (Canada \$3.75).



No. 1032

Gilbert Anchor Blocks

Real Stone Building Blocks

Here you are boys, real stone building blocks with which you can build miniature models of houses, bridges, churches, city halls and many other things. Best of all, the stones and bricks are designed just like the big stones that are used to make real buildings. Your models will look true to life and dandy reproductions of all kinds of architecture. Each outfit contains an assortment of stones in many sizes, shapes and colors, for building churches, houses, garages, fire engine houses, city halls, libraries and any number of those kind of buildings.



No. 1 Stones and Erector Parts

With every outfit comes a finely illustrated design book printed in colors and showing many models that have already been built with Gilbert Anchor Blocks. You can, of course, build many models not shown in the book that you think of yourself.

No. 1 ANCHOR BLOCK.

Fun? Gee whiz, boys, you cannot realize what fun there is playing with an architectural construction set like this! It is hard to imagine the different models you can make with this corking outfit. The rattling good times you have with this outfit you will never forget.

Set comes packed in cardboard container, size $4\frac{1}{2} \times 7 \times 1$ inches and is a dandy for the young architect to own. Price \$1.00. Canada, \$1.50.

No. 2 ANCHOR BLOCK

With the equipment in this set, boys, you can build a little city in itself. Then again, your chum can build with you and you can let Dad be the judge and decide who has made the best model. There is the greatest fun you ever saw playing with these blocks. Attractive buildings such as small churches, court houses, schools, etc., can all be built in miniature from the contents of this set which comes packed in hardwood cabinet. Size $12\frac{1}{2} \times 8\frac{3}{4} \times 1\frac{1}{4}$ inches with design book illustrated in colors. Price \$2.50. (Canada \$3.75). Corking, fine!



No. 2 All Stones

No. 6 ANCHOR BLOCK

This set, boys, is the first in the series of the larger outfits. Fully equipped with all the necessary parts for expert building. There is no limit to the number of models you can make from the large and varied assortment of blocks. The greatest fun ever playing with this set.

With the yellow, red and blue construction blocks covering a big range in size and consisting of upright columns, squares, oblongs, triangles, arches, etc., wonderful designs can be made in miniature of public buildings, bridges, etc.

Set comes packed in hardwood cabinet, size $12\frac{3}{4} \times 8\frac{3}{4} \times 3$ inches and has ground plan sheet as well as two beautifully illustrated books in colors. Price \$5.00. (Canada, \$7.50.)

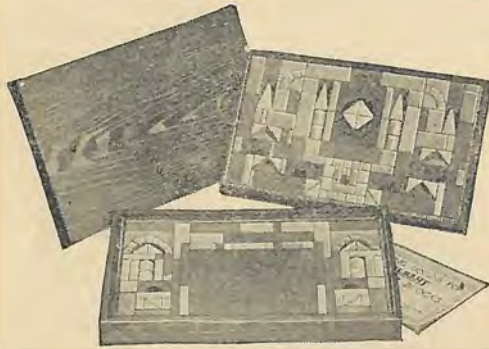


No. 6

No. 8 ANCHOR BLOCK

There is approximately 250 different blocks in this set ranging in all shapes and sizes, and the yellow, red and blue stone pieces make possible the duplication of any building you want to design. Curved arches with inlaid brick effect, cylinder upright columns, large and small angle pieces, squares oblongs and flats for inlaying and color effect, make a combination that will allow your building any thing and give you the best fun you ever had.

Packed in hardwood cabinet, size $16\frac{1}{2} \times 10 \times 3$ with book of sectional plans and building designs in colors. Price \$10.00. (Canada \$15.00.)



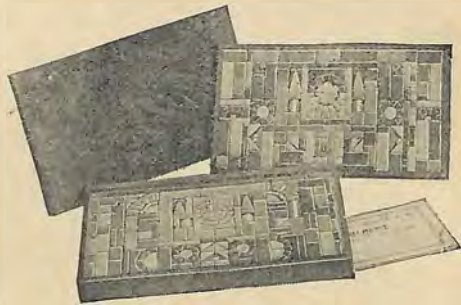
No. 8

No. 10 Anchor Block

Boys, here is the biggest and best of all Gilbert Anchor Block Sets made up of all stones.

This assortment of different colored stone blocks molded into buildings by the proper placing of arches, columns, flat pieces, squares, oblongs, triangles, etc., gives the young architect every opportunity to show his or her originality to the very best advantage.

Packed in hardwood cabinet. Size $18\frac{3}{4} \times 10\frac{3}{4} \times 3$ inches, with sectional and building plans illustrated in color, this outfit is truly the acme of perfection in Gilbert Anchor Block Sets. Price \$15.00. (Canada, \$22.50.)



No. 10

**Gilbert Designer and Toy Maker
No. 8002**

Learn how to enlarge or reduce different designs with this set. You will be interested in this set. After you know how to use the set you can use any design you want—transfer it to wood and then saw it out with the scroll saw included in this set. You can build easily bird cages, small book racks and a number of useful articles. Make exact copies of designs found in magazines and books. You can either reduce or increase the size of the article you build from the original sketch as you prefer. There is included also a board on which you can try out your designs.

Comes in Gilbert Toy carton, size $18 \times 10 \times 1\frac{1}{4}$ inches. Approximate weight, 1 lb., 8 oz. Price \$1.00. (Canada \$1.50.)



No. 8002

Picture Framing Outfit**No. 703**

In times past, the framing of pictures was always considered a job for the art stores to handle. It certainly is true that picture framing properly done is an art; but it is an art which need not be left to the stores—that is, to professionals. With the simple, well-chosen tools in this set, a small bench or table upon which to work, and a little careful study, you will be able to design and build your picture frames and build them right—frames which will add beauty and dignity to your favorite enlargements, color prints, etc.

There's a whole heap of fun in this set. Every set contains mitre box and saw, etc., together with strips of moulding to practice with. There's also a book of instructions telling you just how to frame pictures. Packed in Gilbert Toy Carton, size $18 \times 10 \times 1\frac{1}{4}$ inches. Approximate Weight 2 lbs., 6 ozs. Price \$1.00. (Canada \$1.50.)



No. 703

Gilbert Carpentry Outfits

Every boy interested in Carpentry knows well enough the value of a good set of tools. There isn't a workman in any trade who doesn't regard his tools with great pride. He keeps them intact and ready for use always. When you decide to make a workshop of your own at your home, be sure in acquiring a set of tools that you get those of good quality.

No. 700 CHEST.

Have your folks ever said about you, "He's a handy boy about the house?" If not you surely want to show them that you are just as handy with tools as any other boy. Show them that you can put up new pantry shelves or build a chicken coop or anything else they want built. Get this dandy set with Brace, Gimlet Bit, Scroll Saw, Hammer, etc. Packed in stained hardwood cabinet, 12 $\frac{3}{4}$ x 8 $\frac{3}{4}$ x 1 $\frac{7}{8}$ inches. Approximate Weight: 2 $\frac{1}{4}$ lbs. Price \$1.00. (Canada \$1.50).



No. 700



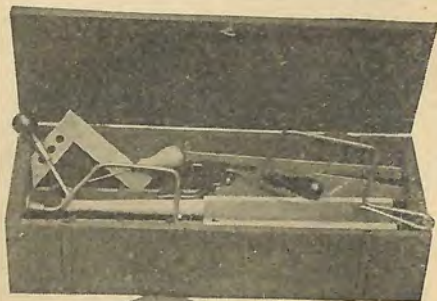
No. 706

No. 711

- | | |
|--------------|-------------------|
| 1 Mitre Box | 1 Scroll Saw |
| 1 12" rule | 1 Chisel |
| 1 Saw | 1 Screw Driver |
| 1 Hammer | 1 Awl |
| 1 Brace | 1 Bit |
| 1 Try Square | 1 Carpentry Book. |

Cabinet:—Stained wood, size 22 x 8 $\frac{1}{2}$ x 5 $\frac{1}{2}$ inches, with compartments for nails, tacks, bolts, nuts, screws, etc.

Approximate Weight:—9 $\frac{1}{4}$ lbs. Price \$5.00. (Canada \$7.50).



No. 711

No. 706

- | | |
|--------------|-------------------|
| 1 Mitre Box | 1 Hammer |
| 1 Try Square | 1 Brace |
| 1 Awl | 1 Bit |
| 1 Saw | 1 Carpentry Book. |

Cabinet:—Natural wood finish, size 22 x 8 $\frac{1}{2}$ x 3 inches, with compartments for nails, screws, nuts, etc.

Approximate Weight:—7 lbs. Price \$2.50. (Canada \$3.75).

No. 726

- | | |
|--------------|------------------|
| 1 Gimlet Bit | 1 Pliers |
| 2 Bits | 1 Screw Driver |
| 3 Chisels | 1 Carpentry Book |
| 1 Nail Set | 1 Scroll Saw |
| 1 Try Square | 1 Saw |
| 1 Awl | 1 Plane |
| 1 Draw Shave | 1 Hammer |

1 Brace

Cabinet:—Special compact chest, stained wood, fitted with strap hinges and suit case catches, size 16 $\frac{3}{4}$ x 10 $\frac{1}{2}$ x 3 $\frac{1}{8}$ inches.

Approximate Weight:—7 lbs. Price \$10.00. (Canada \$15.00).



No. 726



No. 736

No. 736

- | | |
|----------------|------------------|
| 1 Screw Driver | 1 Brace |
| 1 Hammer | 1 Saw |
| 1 2' Rule | 1 Plane |
| 2 Bits | 1 Scroll Saw |
| 1 Gimlet Bit | 1 Pliers |
| 1 Nail Set | 1 Draw Shave |
| 1 Awl | 3 Chisels |
| 1 Try Square | 1 Carpentry Book |

Cabinet:—Special compact chest, stained wood, fitted with strap hinges and suit case catches, size 18 $\frac{3}{4}$ x 10 $\frac{3}{4}$ x 3 $\frac{1}{8}$ inches.

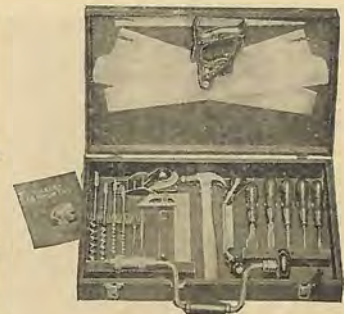
Approximate Weight:—9 lbs. Price \$15.00. (Canada \$22.50).

No. 741

- | | |
|--------------|-----------------------|
| 1 Brace | 1 Hammer |
| 1 Plane | 1 Draw Shave |
| 1 Nai. Set | 3 Chisels |
| 4 Bits | 1 Screw Driver |
| 1 Rule | 1 Awl |
| 1 Gimlet Bit | 1 Saw Set With handle |
| 1 Try Square | * and 3 saws |
| | 1 Carpentry Book |

Cabinet:—Stained hardwood, fitted with suit case clasps and strap hinges, size 20 x 12 x 3 $\frac{1}{4}$ inches.

Approximate Weight:—11 lbs., 8 ozs. Price \$25.00. (Canada \$37.50).



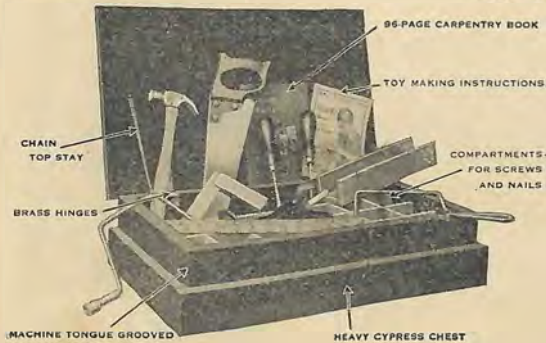
No. 741



No. 750

These big chests are made of the best grade cypress, free from knots, hand tongued, grooved, adjustable lift, heavy steel hinges. Could not be duplicated today for the price we are charging for the complete chests with tools in this special bargain offer. Tools are extremely high grade, extra fine steel saws, brace, hammer, bits and chisels, etc.

Chest No. 765 contains ten high grade tools commonly used about the home, together with book on Toy



No. 765

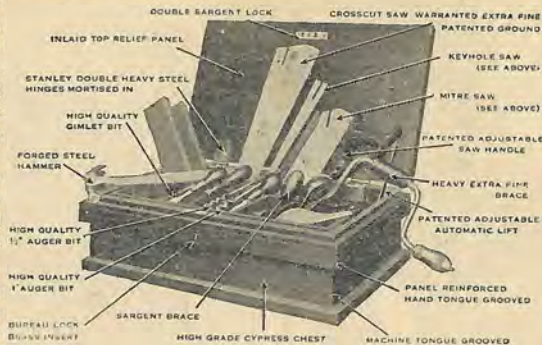
No. 750

- | | |
|----------------------|-------------------------------------|
| 1 Screw Driver Bit | 1 Nail Set |
| 1 Brace | 1 Rule |
| 1 Small Screw Driver | 1 Plane |
| 1 Large Screw Driver | 1 Combination Set of 7 Bits |
| 1 Gimlet Bit | 1 Try Square |
| 1 Glass Cutter | 2 Hammers |
| 1 Draw Shave | 1 Saw Set with handle and 3 Chisels |
| 1 Countersink | 1 Carpentry Book |

Cabinet:—Stained hardwood, fitted with suit case clasps and brass corners, size 21 x 14 x 4 inches.

Approximate Weight:—18 lbs., 8 ozs. Price \$35.00. (Canada, \$52.50).

SPECIAL TOOL CHESTS



No. 770

Making, Picture Framing and a 96 page Carpentry Book, giving drawings and instructions how to build useful things for the home. Price \$5.00. (Canada \$7.50).

Chest No. 770 contains twelve extra high grade tools, cross-cut saw, mitre saw, key-hole saw with patent adjustable handle, extra fine brace, etc., all the best quality possible. Price \$10.00. (Canada \$15.00).

These chests subject to prior sale. Will not be carried after present supply is exhausted.

Gilbert Toy Motors and Electrical Accessories

You know that unless a motor works when you want it to, it is more trouble than it's worth. And I can tell you, boys, these Gilbert Toy Motors work. They are strong and powerful and will surprise you with the way they stand up. Of course, besides motors, I make lots of electrical toys to be used with them, such as control switches, reverse bases, transformers and electrical shockers. But you can be sure you can depend on all of them to do the things you want to have them do. They are great to use with your Erector Models. Your regular toy dealer sells them.



No. P-53

P-53 Motor. This motor has two terminals, pressed steel base, latest type tubular holders with copper gauze brushes. Works great. Height 3¾ inches. Weight 14 ozs. Price \$1.50. (Canada \$2.25).

P-54 Motor. This is the same as P-53 Motor mounted on a reverse base, so that you can run it either backwards or forwards. Fine for running elevator models. Height 3¾ inches. Weight 14 ozs. Price \$2.00. (Canada \$3.00).



P-54



P-56-G

P-56-G Motor. This is one of the strongest universal toy motors made. Attaches direct to electric light socket operating on alternating or direct current 110 volts. Made of drawn steel with bronze bearings. Height, 3⅞ inches. Weight 3 lbs. Price \$5.00. (Canada \$7.50).

P-58 Four Terminal Motor. I made this motor especially for operating Erector and other Mechanical Toy models. Can be used with P-59 Reverse Base or P-61 Control Switch. You won't find a better motor for the price anywhere. Height, $2\frac{3}{4}$ inches. Weight, 12 ozs. Price \$1.50. (Canada \$2.25).



No. P-58



No. P59

P-59 Reverse Base. This is used to operate four terminal toy motors either backward or forward. Can be directly attached to motor P-58 or at a distance with longer wire. Size, 4 x 4 inches. Weight 7 ozs. Price 50c. (Canada 75c).

P-60-C Transformer. This transformer saves the use of batteries. Attach it to your electric light socket (alternating current only) and run your motor direct from it. Comes with 5 ft. cord and plug. Size, $3\frac{1}{2}$ x $3\frac{3}{4}$ x $2\frac{1}{2}$ inches. Weight: 2 lbs., 12 ozs. Price \$5.00. (Canada \$7.50).



No. P-60-C



No. P-61-C

P-61-C Control Switch. With this control switch you can regulate the speed of your motor. It is controlled by lever, just like all big rheostats. Porcelain base, size 4 x 4 inches. Weight, 7 ozs. Price .75c. (Canada \$1.15).

275 Electrical Shocker. Here's an electrical toy you can have loads of fun with. Get your friends to hold the handles and give them a real electric shock. Size 4 x $2\frac{3}{4}$ inches. Weight, 2 lbs., 8 ozs. Price \$2.00. (Canada \$3.00).



No. 275



The Real
Story of a Real Boy



A Story For
Wide-Awake Fathers

Keeping Up With Father

In Which Jim Craig Tells How He Got
New Power of Leadership

We have a new game at our house, my two brothers and I. We call it "Keeping Up With Father." We just hit on the name all of a sudden on last Christmas Day while we were going through the pictures and titles of ten corking books that father had smuggled in on the quiet and put with my presents. It sounds funny, but we couldn't "see" our other presents for a while.

You want to know about that game and why we named it.

Well, father is a very busy man, but he knows a tremendous lot of interesting things about science, and engineering, and chemistry, and magic, and wireless, and electricity, and athletics. He had always been keen about magic and tricks of all kinds. So he got us to like these things, too.

Then he discovered that set of books which let us right into a lot of wonderful secrets.

Here are some of the things we learned: How to understand the wonders of the Radio Telephone and Broadcasting and how to build your own Wireless Outfit. How to train to become a champion athlete, to be a champion pole vaulter, high jumper or broad jumper.

How to do the strange rope tricks of the Davenport Brothers, who, as you know, made everybody think they had spiritualistic powers until their secrets were exposed.

How to master the secrets of Hydraulic and Pneumatic Engineering, Coin Tricks and Chemistry, how to do some of the amazing tricks that made such magicians as Herrmann and Kellar famous.

How to build all kinds of wonderful and useful things at home with a few tools and a carpenter's bench.

How to be able to talk about big inventions intelligently and explain them to others.

The set contains these ten wonderful volumes:

Radio Telephone and Broadcasting, Boy Athletics, 66 Stunts with an Electric Motor, 75 Electrical Toys and Tricks, Chemistry, Hydraulic and Pneumatic Engineering, Signal Engineering, Carpentry, Knots and Splices, Coin Tricks.

I think I have told you enough about these books to make you long to possess a set yourself. But, to give you any real idea of all the splendid information there is in these books, is quite beyond me. Just think of having a quick answer to all the questions that come up in the wonderful fields covered by these volumes.

I only hope for your sake that someone will give you this great set of books. And I'll bet you right now, that if your father gets this marvelous Boy's Library for you, he will have just about as much fun with it as you do.

But here! I haven't told you the name of this set, or who wrote it.

It is called the Master Hand Library (ten books in all), and it was got up by Mr. A. C. Gilbert. You know, the man who invented the building sets (Erector) and all those other sensible toys we get for Christmas and Birthday and Vacation presents—I mean the mechanical ones that teach us engineering and carpenter work, and wireless and magic and chemistry.

Believe me, he knows how to write for boys! He ought to, for he was "some boy" himself.

That game I told you about—"Keeping Up With Father"—is more fun than anything we ever played. That's pretty strong when you think of football, hockey and all that.

But this is another kind of fun. It is planning and building and doing experiments in wireless and chemistry and everything else that men do.

It beats school learning all to pieces, and you haven't any idea what a lot of interesting things, which you never dreamed of before, you can get from Mr. Gilbert's books in almost no time.

JIM CRAIG.

You have read Jim's own story. He knows what he is talking about because he has read these fascinating books from cover to cover and in his spare moments has gathered a perfectly surprising fund of information and inspiration on the things of popular science which every man must know to be well-rounded.

Jim didn't tell you, but they have wrought a wonderful change in him. His father tells us he has gone ahead with leaps and bounds—so far as popularity is concerned—since he began reading and using the Master Hand Library. Jim wasn't naturally a leader, but somehow he seems to be chosen now for the job whenever the boys get together. He seems to be always a few steps ahead of the procession. You can be too, with these Master Hand Books.

Gilbert Master Hand Library of Boys' Books

Science--Engineering--Manual Training--Athletics

Books in Cloth Covers, 50c (Canada, 75c)

No. 2140 GILBERT CARPENTRY	No. 2146 GILBERT COIN TRICKS
No. 2141 GILBERT CHEMICAL MAGIC	No. 2147 GILBERT HANDKERCHIEF TRICKS
No. 2142 GILBERT CIVIL ENGINEERING	No. 2148 GILBERT MAGNETIC FUN AND FACTS
No. 2143 GILBERT HYDRAULIC and PNEUMATIC ENGINEERING	No. 2149 GILBERT SIGNALLING
No. 2144 GILBERT KNOTS AND SPLICES	No. 2150 GILBERT SOUND EXPERIMENTS
No. 2145 GILBERT LIGHT EXPERIMENTS	No. 2151 GILBERT WEATHER BUREAU

Books in Paper Covers, 25c (Canada, 40c)

No. 2153 GILBERT GLASS BLOWING	No. 2157 GILBERT BOY ATHLETICS
No. 2154 GILBERT MINERALOGY	No. 2158 FUN WITH YOUR ELECTRIC MOTOR
No. 2155 GILBERT CHEMISTRY	No. 2159 ELECTRICAL TOYS AND TRICKS
No. 2156 GILBERT RADIO TELEPHONE AND BROADCASTING	No. 2160 GILBERT DESIGNER AND TOYMAKER



Hello Boys!
REG. U.S. PAT. OFF.

You can get a year's subscription to Toy Tips for 25c.

Think of it! 25 cents for this great little paper with all the big features like the Correspondent Corner, Gilbert Institute Clubs, Gilbert Engineering Institute for Boys, stories that I write for the paper myself, stories that boys write of their different experiences with Gilbert Toys, etc. I don't want to make any money on this paper. All I ask you to do is to send 25c to cover the postage and mailing.

Mail this coupon TODAY. Toy Tips has 32 pages chock full of interesting and important information. Send your coupon today. Don't wait another minute to be a subscriber to this wonderful paper.

Cordially yours,

A.C. Gilbert

President.

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Mr. A. C. Gilbert, Pres.,
The A. C. Gilbert Company,
27 Blatchley Avenue, New Haven, Conn.

Enclosed is 25c. Please put me on the subscription list for "Toy Tips" for one year of eight issues.

(Print your name and address)

Name

Street

City State

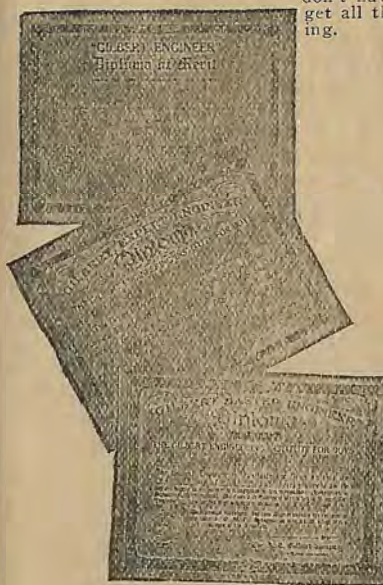
GILBERT ENGINEERING INSTITUTE FOR BOYS



Every Boy Who Has A Gilbert Toy Is Entitled To Free Membership In Engineering Institute Win Diplomas—Fraternity Pins.

It is because I realize that boys who are interested in real play—who are working hard to make themselves the right kind of men should have the same opportunities that their older brothers have in schools and colleges that I have founded this Gilbert Engineering Institute for Boys.

DIPLOMAS READY FOR FRAMING FREE TO DEGREE WINNERS



While we haven't any college buildings or classrooms, we have everything else that goes with a regular Institute, except, of course, in real colleges it is necessary for you to study lessons which are sometimes hard and uninteresting. In this Institute you don't have to do a lot of tiresome studying. You can get all the advantages of it right while you are playing.

Every boy who owns a Gilbert Toy is entitled without further charge to a membership in the Gilbert Engineering Institute for boys, and to all the privileges which the Institute bestows upon its members. It is only necessary to send examination papers to the Institute showing that you have built models with Gilbert Toys and that you understand thoroughly some of the very interesting sciences which they represent. These examination papers are gone over very carefully by the judges of the Institute. They look to see that you have built good models and performed some very interesting experiments and then award you the different degrees with Diplomas and Fraternity Pins.

Fraternity Pins Free To Degree Winners.



2nd Degree Expert Engineer



3rd Degree Master Engineer