Science and Invention

With which is combined

THE EXPERIMENTER

THE DREAM RECORDER
See Page 398
From $780 year store to $8200 year building in one year

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WHAT these two Hartford men have done, you too can do. Early in 1925, they secured a license to operate the patented Nestler Rubber Fusing Process in Hartford, Conn., and opened for business in a small $65 a month store. In twelve months they built up the largest tire servicing business in the state with no previous tire experience. An $8200 a year building has just been taken to give room to take care of a steadily increasing demand.

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HOW TO INVENT—WHAT TO INVENT

and What to Do About Protecting
and Selling An Invention

ALTHOUGH the fact has been universally recognized that Invention is governed by a few simple, easily acquired, fundamental principles, no one ever thought of putting these principles in black and white so that everybody interested in invention could read them. In spite of the fact that Thomas A. Edison made his famous statement that invention should be taught as a science, thousands of people continued to work blindly, doggedly, haphazardly to perfect their ideas.

But now anyone can learn how to invent. Fifteen famous inventors have at last given to the world the laws and principles of Inventive Science. They have shown every ambitious man and woman how to invent. They are teaching Invention exactly as other people are teaching law, medicine, bookkeeping. Instead of spending years groaning blindly, instead of wasting your time in useless, fruitless, heart-breaking drudgery, you learn how to complete your ideas quickly and what to do about them when they are completed. You learn how to think so you are sure to succeed.

Everybody Invents

For a long time it was commonly believed that every invention was a matter of pure luck—the result of some happy inspiration on that suddenly flashed through a man’s brain, and which made him fabulously rich without the slightest effort or thought. But you can prove for yourself that this is not so. You can prove for yourself that invention is the result of thinking and action along definitely exact, scientific lines.

Suppose when you went home tonight you found a window rattling. Through your mind would flash, almost instinctively, a regular order of thoughts which characterize the conception and completion of every invention the world has ever known. First, you would recognize a problem to be solved—the rattling of the window. Then you would think of several principles of science or mechanics which would solve your problem. You might think of the scientific fact that if you poured water on the frame the wood would swell and tighten the window. You might think of using a nail. But what you most probably would do would be to use the oldest mechanical principal known to man, the wedge.

What Invention is

Brought down to its simplest terms, that is exactly the way every invention has been made—combining two ideas; a problem which must be solved and a fact of mechanics or science which solves the problem. So, although you may never have thought of it just this way, every time you solve a problem in your daily life—at home, traveling, or in business—you are an inventor; you use the principles of thought and action which govern the Science of Invention!

You can see, therefore, how easy it is for you to develop your natural instinct to “fix things.” The same processes of thought that almost instinctively told you to fix a rattling window with a wedge can be so well developed that you can learn to invent other things almost as easily and quickly. You know, too, that every invention is possible only by thinking inventively. And every inventor is agreed that the principles of Inventive Science are so simple, so easy to learn that anyone, regardless of training or education, can develop himself to become a successful inventor!

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Afraid of My Own Voice

But I Learned to Dominate - Others Almost Overnight

Suddenly the boss turned to me and queried, "Well, Conroy, what's your opinion?" They all listened politely for me to speak and in the silence I heard my thin, wavering voice stammering and stuttering a few vague phrases. Like a flash Stoddard interrupted me and launched on a brilliant description of his plan. All sat spell-bound as he talked—my views were forgotten—and yet I have been studying the problem for months and I was prepared to suggest a sound, practical plan which I knew would solve all our difficulties.

And that was the way it always was—I was always being given opportunities to show my ability and always failing miserably. I was bashful, timid, and nervous—I never knew how to express myself, how to put my ideas across. In fact, I was actually afraid of my own voice! Constantly I saw others with less ability, less experience than I being promoted over my head—simply because they had the knack of forceful speech, self-confidence, and personality—the very qualities I lacked.

In social life, too, I was a total loss—I was always the "left-over"—the one who sat back and watched the others have a good time. I seemed doomed to be an all around failure unless I could conquer my timidity, my bashfulness, my lack of poise and inability to express myself.

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SCIENTIFIC WEATHER FORECASTING

By HUGO GERNBACK

If any one had predicted, 500 years ago, the exact occurrence, to the second, of a solar or lunar eclipse for the coming year, or for ten years in advance, he would probably have been executed or burned at the stake, without much ado, for witchcraft. Astronomy, as we know today, is an exact science, and it is possible now to predict eclipses with certainty within a few seconds of their actual occurrence, not only for one year ahead but for centuries and thousands of years in the future, if necessary.

Weather predicting, particularly long-range weather predicting, has not been much of a success heretofore. The reason was that it was not founded upon an exact science. We do know, however, that the sun must of necessity be responsible for our weather in general. We know that it is the sun that, through its electromagnetic rays, transformed into heat in the outer layers of the air, has an important relation to the weather.

It is known to science that in the upper regions of our atmosphere the air currents are always about the same, while on certain parts of the earth, due to rotation of our planet and to solar activity combined, we have certain trade winds at almost exact times of the year. From such data it is possible to make exact weather predictions because other variable data, up to this time, has been missing. This variable data has now been studied for a number of years by Dr. Charles G. Abbot of the Smithsonian Institute, who has recently discovered new proofs that the amount of heat given off by the sun from day to day, and from year to year varies. It is believed by Dr. Abbot that from such data that can be ascertained accurately, it will be possible in time to make long range weather predictions.

For some thirty years Dr. Abbot has been investigating sun phenomena and has measured the heat which it sends indirectly to the earth. In true scientific fashion, Dr. Abbot made measurements with exceedingly accurate instruments at various points of the earth, such as Mt. Wilson and Mt. Whitney, in California, Bassour, Algeria, at Mt. Harqua Hala, in Arizona, and at Mt. Montezuma, in Chile, South America. He constructed wonderfully sensitive instruments, capable of measuring the milliionth part of a degree change in temperature, with which to effect the intricate heat measurements.

Dr. Abbot plotted the measurements of the total quantity of heat received on the earth's surface. On the same paper he then plotted the solar constant-values over a number of years. These solar constant-values are the result of the measurements of the total quantity of heat received on the earth's surface, and then corrected measurements of the loss of heat through the earth's atmosphere so as to indicate the values as found, for instance, on the moon. The two results were closely parallel.

Not content with this Dr. Abbot also plotted the average number of sun spots for July of the same years on the same paper, and the harmony was again apparent. With this accomplished, the next step was to make the daily measurements of solar radiation as accurately as was humanly possible. The National Geographic Society has already donated $53,000 to establish a solar observatory at Mt. Broukharos, in southwest Africa, in order to co-operate with Dr. Abbot's two existing stations in California and Chile. The outcome of all this will be that during the next few years it is hoped that by these methods it will be possible to accurately forecast weather conditions for any part of the world for weeks, and in some cases, months, ahead.

The problem is one of great complexity, because there are so many variable factors that enter into the calculation of such problems. For instance, the percentage of moisture in the air is most important and must be accurately known. This is easily ascertained by instruments which are already in use. Another and vital variable is contained in volcanic dust thrown out by volcanoes of the earth from time to time. Such volcanic dust is thrown up to great heights and the impalpable dust stays in the upper regions of the atmosphere for many months. The dust in this case acts as a sort of screen, and cuts off solar radiation, hence, during a volcanic outbreak, experience has shown that cooler weather may be expected, because less solar radiation reaches the earth.

Dr. Abbot in his selected measurements, made for the month of July for the years 1910 to 1920, was careful to omit the years 1912 and 1913, because the volcano of Mt. Katmai, in Alaska, filled the atmosphere of the whole northern hemisphere with volcanic dust during those years.

Then there is the matter of meteoric dust, which is thrown a number of times during the year, into the atmosphere. Every time a meteor strikes the upper regions of the atmosphere, the meteor becomes volatilized, acting in an analogous manner to volcanic dust. Swarms of meteors hit our atmosphere almost constantly, there being hardly an hour during the day when such bodies do not strike us, while at other times during the year, whole swarms pass through the upper air. It is very likely, however, that a mean value can be found for this meteoric dust, which will greatly facilitate long range weather forecast.

The far-reaching import of these researches can not be appraised too highly. From an economic standpoint alone their value is truly tremendous.

Mr. Hugo Gernback speaks every Monday at 9 P.M. from Station WRNY on various scientific and radio subjects.

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Above we behold one of the eight seadromes or airplane landing stations spaced 460 miles apart across the Atlantic Ocean, as proposed by a well-known American engineer, Mr. Edward R. Armstrong, of Wilmington, Delaware. These huge landing stages would be about eleven acres in extent, measuring 200 ft. by 840 ft. They would have deep draught, as great as 150 ft., so as to have their buoyancy chambers and legs below the wave depth.

Ocean Stations for Airplanes

STARTLING as it may seem, a prominent American engineer, has actually worked out the technical details for an ocean landing platform or seadrome, on which Trans-Atlantic airplanes can land. One of the most interesting questions that arise in connection with such a project is that of anchoring the seadromes along the route across the ocean. Mr. Edward R. Armstrong of Wilmington, Del., chief research engineer for the famous Du Pont Powder Company, is the man responsible for this latest development in trans-oceanic air travel, and as the accompanying drawings show the platforms are to be anchored by three steel cables, extending down through three miles of water in some cases to 12,500 pound anchors. The platform can shift back and forth as waves and storms may dictate, and plenty of latitude is permitted due to the long cables. If the platform should move half a mile or more, it would make no difference to the airplane pilots.

As the picture on the opposite page shows, the seadromes would be marked at night by powerful colored searchlight beams, each station having its own particular color. Located fifty miles apart along the airplane route would be marker buoys, each buoy being illuminated automatically as darkness approached. The eight large seadromes, each measuring 200 ft. by 840 ft. and covering 11 acres, would be veritable floating hotels. Repair shops and storage space are provided for in the present designs of Mr. Armstrong, and radio as well as other signaling means are arranged for. Each station has its own name which is illuminated at night. The inventor has prepared tabulated data proving that this is the only feasible method for transporting passengers across the ocean for the principal technical reason that if no such sea stations are utilized, then the planes can only carry about four passengers, the balance of their carrying capacity being occupied by fuel; the same airplane using Mr. Armstrong's scheme can carry forty passengers. Based on 100,000 passengers per year, the annual difference in cost in favor of the sea station route is $14,080,000. Mr. Armstrong's scheme calls for 24 planes total, while without sea stations 240 planes are required.

Photograph at left shows scale model of the Armstrong ocean landing stage under test in tank with waves 70 ft. high. Note that this remarkable design of platform preserves a practically level surface, while the waves break through it rather than against it.

Photo at right shows model of seadrome and also model of steamship "Majestic" under test in tank with 50 to 60 ft. waves; note that platform is practically level, while steamship "Majestic" is diving downward, practically overcome by the huge waves. The average height of ocean waves is 50 ft.

The photograph at left shows scale model of the Armstrong ocean landing stage under test in tank with waves 70 ft. high. Note that this remarkable design of platform preserves a practically level surface, while the waves break through it rather than against it.

End view of seadrome. The buoyancy chambers can be placed below the wave action depth.
How Airplanes May Skip Across Ocean

The realistic night scene above shows two of the Armstrong seadromes or landing stations for airplanes, as they wing their way across the Atlantic from America to England. Each station would have its own colored searchlights, enabling the pilots to distinguish each station if necessary. Located 50 miles apart along the aerial route are illuminated buoys anchored in position by cables and anchors. The large plane shown above has a capacity of 40 passengers and luggage and carries signal as well as landing lights. Hotel accommodations are provided on each platform for those desiring to stay over night. Owing to the clever design of these landing platforms, the waves break through them rather than against them. The buoyancy chambers supporting the platform are placed deep enough to escape the wave action, extending about fifty feet maximum.
The Dream Recorder
By HUGO GERNSBACK

"Well, how did you sleep last night?" says your host, as he pats you on the back.

"Fairly well," you retort, "but that Welsh Rarebit gave me such a beastly nightmare I couldn't go to sleep again for a few hours."

This is the sort of conversation we hear very frequently, but we laugh it off, and the world moves on.

Few people, if any, ever give a thought to the reason for our dreaming. From ancient times on, dreams have been looked upon with great superstition, and even today dream books are consulted for an interpretation of this or that dream. The mechanics of the dream itself, from the psychical viewpoint, have been studied by many philosophers and scientists, but few, if any, ever gave any thought to the primary cause of dreaming.

PRIMARY CAUSE OF DREAMS

It may be said that 90 per cent. of our dreams lead right back to our stomachs. That this has not been recognized more widely has always been a mystery to me. It is, therefore, not the brain that is primarily responsible for dreams, but, rather, the stomach. If you go to sleep with a comparatively empty stomach, that is to say, after your food has been digested, and has left the stomach, the chances are that you will have a good night's sleep and that you will not dream at all. Of course there are exceptions to this, as to anything else, but in the great majority of cases you will find that this is the truth.

When you have slept "like a top," it simply means that you have not dreamt. The person who sleeps best, and is most refreshed by sleep, is that person who does not dream. The term "pleasant dreams" should be abolished, as soon as possible. There is no such thing, in my opinion, as a "pleasant" dream. All dreams, whether pleasant or unpleasant, interfere with your rest, and if you do need the rest and do wish to wake up refreshed in the morning, then it is best to stop dreaming.

This seems a rash statement, but the point is that it is possible to prevent dreams, if dreams are harmful, as I shall show. Most foods take anywhere from two to six hours to digest. Some foods take even longer than this. The table reproduced herewith shows this clearly. Due to means not exactly understood today, there is an unusual nervous reaction between the stomach and the brain, while we are asleep, so that a full stomach with slow-digesting food causes constant dreaming, often of the nightmare kind.

My own theory is that the process is somewhat as follows: The minute you lie down and sleep, and the stomach is still working while digesting its food, the gases usually developed, press against the heart, causing an oppressed feeling, which is then, by nervous reaction, reflected to the brain, thereby inducing harmful dreaming.

FATAL DREAMS

This kind of dream is distinctly dangerous, often even fatal. A great many people die in their sleep. For instance, Mr. William Jennings Bryan died in such a sleep. It is quite probable that sleepers of this kind meet their death directly due to nightmares, or other fear-inducing dreams. For example, if, during a nightmare, as happens to all of us, we fly through space, or fall down a precipice, we usually wake up all covered with perspiration, and the heart beating violently. If the heart is sound, no

DIGESTION OF DIFFERENT FOODS IN STOMACH

These foods leave the stomach in two to three hours:
Boiled Milk, Eggs, raw, poached, or omelet; Beef Sausage, Sweetbreads, Oysters, Whitefish, Shellfish, Asparagus, White Bread, Rusks, and Biscuit.

These foods leave the stomach in three to four hours:
Chicken, Lean Beef, Boiled Ham, Roast Veal, Beefsteak, Salted Caviar, Coarse Bread, Boiled Rice, Boiled Cabbage.

These foods leave the stomach in four to five hours:
Smoked Tongue, Smoked Beef, Roast Goose, Salt Herring, Lentil Porridge, Pease Porridge.

An ordinary dinner leaves the stomach in four to five hours. Foods are divided into four groups, according to the ease with which they are digested. The first group contains the most easily digested foods:
(1) Beef Tea, Milk, Soft or Raw Eggs, Biscuit.
(2) Boiled Calves' Brains, Sweetbread, Boiled Fowl, Pigeon, Calves' Feet.
(3) Scraped, underdone Steak, Potato Puree, Stale Bread.
(4) Roast Chicken or Pigeon, Roast Veal, Cold Roast Beef, underdone, Whitefish, Macaroni, Rice, Chopped Spinach.

NOTE: There are exceptions to all of these, because food is digested more quickly by working men who consume energy than by those who sit still or lie down.
damage results, but if the heart is defective, often a heart stroke or the bursting of blood vessels occurs, with the immediate death of the victim. Any one with a weak heart, therefore, should never indulge in heavy food before going to sleep, whether it be an afternoon nap, or the night sleep. If he does, a fatality may result, directly due to a dream.

Even in most pleasant dreams, which have nothing to do with the digestive organs, affect the heart action. You may sleep with a totally empty stomach and still have a dream. In that case it probably never is a fear-inspiring or nightmare type. It is of the variety termed a "pleasant dream." A dream may be induced in a sleeper by scent, or perfume, by a slight noise in the room, by touching the sleeper's body at any point, by a change of temperature, by a change of barometric pressure, or by a nervous shock during the day, and a thousand and one other means. Such dreams are of a very short duration, as a rule, and do not greatly interfere with the sleep itself, although I maintain that it is best not to dream at all.

**IF YOU DREAM—SEE YOUR DOCTOR**

For that reason, if you are inclined to dream much, you should consult a physician and re-arrange your diet in such a manner that through the experience which you will shortly gain you will dream less and less. You will have to experiment on yourself, as my two individuals are the same. Some people find that they sleep much better by drinking a glass of hot water or milk before retiring, others find it altogether harmless and will have to be experimented with until you find the correct formula.

The sleeper's position in bed is also most important. Some people dream excessively when sleeping on their left side. This is but natural, because the heart, under compression, gives rise, very often, to fear complexes, especially in nervous and excitable people. It becomes then a matter of training to sleep on the right side or in such a position that no dreaming is induced. This is a matter of experience also, and here a little self-hypnosis often does wonders. If you are inclined to sleep on your left side, and if you know this induces bad dreams, all you have to do, before retiring, is to keep on repeating, with as much will and concentration as you can muster, that you will positively not sleep on your left side that night, and keep on repeating this in the well-known Coué form, nightly for several weeks. You will find that by willing strongly enough, you can cure yourself from sleeping in any position that you do not wish to assume.

**ACTUAL DREAM RECORDS**

In order to test what has been said before, I decided to make actual tests upon sleepers, and the illustrations here show the results of these tests. Recourse was had to a heart and pulse testing machine, known as the "Polygraph." The Polygraph is a very sensitive instrument, which, when strapped over the heart or on the wrist, will give an exact record of the heart beat. The instrument is exceedingly sensitive and records not only the breathing, but the heart action as well.

In order not to go into any great technicalities, it may be said here that a great number of records were made in our laboratories, and my theory that dreams could actually be recorded is now a fact. While the technique of dream recording has not been carried to a logical conclusion, I wish to state here that whatever results we had in the laboratories were very encouraging, and I hope that much good will come from the future recording of such dream actions. I believe that in due time physicians will find it necessary to record the dream actions of their patients if they dream too much, which consequently interferes with their health.

At this point I also wish to explode an old theory that dreams are of a very short duration. We actually found the reverse true, at least the polygraph recording the heart action, showed that a dream lasts at least a number of seconds, and not fractions. It is obvious, from the records obtained in our laboratories, that during the process of dreaming, the heart action is materially stimulated, and respiration is also accordingly increased. All of the cases which came under our observation produced the same effect, when a dream actually occurred.

The tests not having been carried on over an extended period, we had no chance to observe a nightmare or startling dream, but it is quite apparent from our records that if there had been such the resulting action would have been greatly increased. In our illustration, Fig. 2, we show actual records taken by the polygraph.

In case "A" it will be observed that the apex beat increases almost instantly to four times the normal sleeping rate. In "B" and "C" on our graph it becomes difficult to actually note the apex beat because of the influence which breathing has upon the heart record.

The gradual undulations of the curves in the normal record are produced by the process of inhaling and exhaling. The inspiration in all of the cases is much greater under the excited reaction of a dream than in the normal sleeping state. Notice also that the respiration is changed, when the subject changes his or her position during sleep and you will also see that when dreaming, in case "C" the heart rate was stimulated immediately after the change of position.

In "C" an electric bell was used to awaken the subject, being rung softly at first and then permitting the bell to remain quiet until the subject again assumed normal respiration and heart curves, and then the tone was increased until the subject eventually awoke. Although a slight disturbance took place every time, it was not as marked as just before awakening, at which time this patient recalled a dream of an alarm clock awakening her and summoning her to work.

It is obvious from records which have been obtained that dreams do affect not only respiration but also the heart beat, and that the dreams of some subjects stimulate the heart to a greater extent than those of others. It is believed that this is the first attempt made to record heart action during sleep, laying particular stress on the heart action of subjects who dream a lot. The experiments have not yet developed to a point where a record was taken during a nightmare or one taken of an individual who frequently walks in his sleep.
The most gigantic and terrifying cataclysm ever witnessed by man was probably that which took place when the Aegean Continent subsided so that water completely covered everything except the highest mountains. As the picture above shows, the onrushing tidal wave swept everything before it. Earthquakes caused giant cracks to open in the face of the earth, while volcanoes belched forth smoke, rocks and boiling lava. Imagine such a catastrophe occurring today, especially in the vicinity of our larger seaports like New York City or San Francisco.

The World's Greatest Cataclysm

By PROF. DONALD H. MENZEL, PH. D.
(Department of Astronomy, Ohio State University)

The most gigantic cataclysm ever witnessed by man doubtless occurred when the Aegean Continent subsided, as the picture above shows, and as the map drawing below and on the opposite page also illustrates. The time of this cataclysm is comparatively recent, contrasted to the millions of years that constitute every geological period. This subsidence occurred since the last glacial epoch. A flint knife discovered in deposits laid down before the catastrophe proves that man was present. Cross in map below shows where flint knife was found. The contour in depth-map below shows what the general shape of the continent was.

While the original subsidence was probably quite rapid, accompanied by floods, earthquakes, and volcanic eruptions which would destroy all life in the basin, it is interesting that it is still slowly continuing in spots. The two pictures above show the effect of the subsidence in the caves of Capri, Italy. The formations known as stalactites and stalagmites take place only in air. The fact that we find them submerged in caves proves that the water level has risen considerably since they were made. The unsettled condition of this region is further evidenced by the number of active and extinct volcanoes which surround the Aegean. It is not a coincidence that the three great prehistoric civilizations surround the vanished continent. From the similarity of their arts the parent race apparently was scattered in all directions.
The physical map above shows the positions of the centers of ancient civilization at the time of the great flood, caused by the subsidence of the Aegean Continent. It is thought, due to the similarity of their arts and legends, that the parent race was scattered as arrows show.

**Grass-Growing By Electricity**

**Experiments** in the use of electric light at night for promoting the rapid growth of grass have been tried under outdoor conditions on the Jumping Brook Golf Club's course in New Jersey. A clay gravel site was dug, and the top soil from another portion of the land used to provide about fifteen inches of soil for the green, which was sown early in June, and over a portion of it were erected 24 special reflectors, each containing a 1,000-watt tungsten bulb. The reflectors were hung four feet from the ground and gave a continuous even light. The light was switched on on June 6th, and for the next 21 nights. The weather was unfavorable to the rapid germination of grass seed, but the first seed came through under the electric light five days after planting.

Nothing came through on the unlighted portion of the green until two days later. At the end of three weeks the grass under the electric light had attained a general growth of nearly four inches, while on the portion of the green outside the lamps there was a growth of about one inch. This system saves at least 40 per cent. in the time between planting and cutting the average green, and after cutting it thickens the growth.

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**Air Bombers Beware**

In recent aerial target practice sleeve targets were shot down from a height of 12,000 feet by five inch guns on the U.S.S. “West Virginia.”
Hunting Whales with Airplanes

By H. WINFIELD SECOR

The tail ("flukes") is horizontal, and not vertical as in fishes; it is probably used as the sole means of propelling the animal. The dorsal fin is totally absent in some Cetaceans, but in others, the dreaded killer for example, grows to a great height. Unlike fishes there are no bones in the back fin or tail. Between the smooth skin and the flesh the entire body is covered by a thick layer of fat or "blubber," which prevents the loss of animal heat (it is from the blubber that the oil is "tried out." The nostrils, or "blowholes," which may be either single or double, open from the top of the head, save in the sperm whale. When a whale comes to the surface to breathe, it at once expels the air from its lungs. This warm air is saturated with water vapor, and when it is discharged, condenses; thus a column of steam or spray is formed, which is forced to a considerable height (20 feet or more). It is this spray which gives rise to the common belief that the whale actually sprays water. Cetaceans are found in all the oceans from near the Antarctic regions to within the Arctic Circle. Many of the smaller forms (porpoises and dolphins) ascend rivers for a considerable distance, and all the members of one family are exclusively inhabitants of fresh water.

The whales of the world may be divided into two great classes, viz: 1. Whales without teeth. 2. Whales with teeth.

Those of the first group (the toothless whales) are all characterized by plates of so-called "whalebone" or baleen, hanging from the roof of the mouth. The plates are of use in straining from the water the often almost microscopic animals upon which these whales feed. Whalebone varies greatly in length in different species. Whalebone was of considerable commercial value, the better grades at one time being worth from six to eight dollars per pound. The blue or sulphur bottom whale, a life size model of which hangs from the ceiling of the museum, the Finback and the Right whale are representatives of the toothless or whalebone whales.

(Continued on page 476)
S-51 Finally Raised
Grounds on Way to Navy Yard

The ill-fated submarine S-51, sunk after a collision with the S. S. "City of Rome," off Block Island, has at last returned to her home port after having appeared to be hopelessly jinxed. The first attempt to raise her from her resting-place 150 feet below the surface resulted in failure when the chains connecting the rear pontoons parted. Their breaking-away threw an additional load of 150 tons on the other pontoons, and it was found necessary to permit the S-51 to sink again so that a new "bite" might be taken. The specially-equipped "Falcon," under the command of Commander E. Ellsberg, recompressed air from the air-banks of the submarine S-50, which stood-by near at hand, and pumped it to the lifting pontoons which finally succeeded in raising the sub to the surface. In towing the S-51 to the Navy Yard she was grounded for a time on Man O' War Reef in the East River, but the next day she was placed in dry-dock.
Microscopic Engraving

Lord's Prayer Engraved on Pin Head

By R. P. TOLMAN

The micro-engraving shown at right was done in 1/100 inch circle.

When we are confronted with statements like this we are all likely to use a little word of four letters. Before this article is finished you will probably want to use this little word several times, but every statement is fact. Just one more illustration, before I tell you how these infinitesimal engravings are made. The Lord's Prayer is commonly used in things of this kind, for example, it has been engraved on the head of a large pin, and it has been cast on a typewriter body, one-sixth of an inch square and in micro-engraving it has been used extensively. Mr. McEwen sent one of his smallest engravings of the Lord's Prayer to the Bureau of Standards, Washington, D. C., to be measured. Their report gave the dimensions as 0.0016 of an inch by 0.0008 of an inch high. Now if you will multiply these figures you will find that one Lord's Prayer of this size will cover only 1/781,250th of a square inch, in other words the 277 letters in this prayer would have to be engraved 781,250 times to completely cover one square inch.

I don't blame you for shaking your head. Fig. 2 is a reproduction of this micro-engraving, it is not as clear as the larger ones, but it can be read. The distance between the top of the top line and the bottom of the last or seventh line is 1,200th of an inch. The paper on which this article is printed is about 1,400th of an inch thick, therefore the seven lines of this engraving could be repeated three times in a space equal to the thickness of one page of this magazine. It does not seem possible to carry this comparison along a little farther. The fifty-six words of the Lord's Prayer contain 227 letters and on this scale 177,343,750 letters could be printed on one page.
Odd and Unusual Patents

By STUART WALKER

Our civilization rests heavily upon the shoulders of the inventor. But for the man of new ideas we should now be living in huts and caves, wearing skins for clothing, and stalking about with a club in search of food. Fortunately for the world inventors are very numerous. The records at the United States Patent Office at Washington bear out this fact. Since the issuance of the first patent to Samuel Hopkins on July 31, 1790, for a process of manufacturing potash and pearl-ash, the Patent Office has granted more than a million and a half Letters Patents. Among them are the inventions which have changed the course of history, which have brought about our civilization of today—the internal combustion engine, the cotton gin, the locomotive, the telegraph, the telephone, the airplane, the radio, and thousands of others.

However, the Patent Office records also reveal many utterly useless patents, all undoubtedly intended to be of great service to mankind, but some are actually worthless, some grotesque, some ridiculous, and many are merely huge jokes. The scope of these "freak" patents extends far beyond the bounds of practical imagination.

No one who has been awakened from a sound sleep by the exasperating growls of a cat can fail to recognize the true intentions of the man who patented a "mechanical sheet-iron cat with cylindrical attachment and steel claws and teeth, worked by clockwork, having a bellows inside which inflated the tail at will to an astonishing size and, by a tremolo attachment, causes at the same time the sheet-iron cat to emit the noises of a living one." When you are bothered by felines, just put the sheet-iron pussy out on the back fence. Every cat that bears him will come out to fight. No sooner is the sheet-iron cat touched than his claws and teeth begin to work with startling rapidity. The other cats are tossed and put to flight, but the mechanical cat remains uninjured. In this case the inventor had, at least, a commendable intention, and it is strange that his efficient kitty did not become popular.

Those who spend time in worrying over the terrible congestion in all our large cities because of the great increase in motor vehicles may find suggestion of relief in the patent of a man from Wickes, Montana, which covers "a means for fast trains passing slow trains on the same track." This may sound highly imaginative, but the inventor proceeds to show what a simple and safe proposition it is. The patent provides for trains having rails along the tops of the cars and carriages, and inclined structures bearing rails at each end of the train. The fast train, upon overtaking the slow train, is merely supposed to run up the rear incline, along the top of the train, down the front incline, and on its way. It is a very simple matter indeed.

(Continued on page 469)

The horse walking on a tread-mill operated the wheels of an early train.

IT'S SO QUIET
I CAN'T SLEEP!

It took years of snoring to perfect the "Notta Bitta Comfort Anti-Snoring Pad."

The Pepper-box—bicycle to cure, scrap the mutts.

The 21st Century Unlimited to have clear track all the way.

Three alarm beds guaranteed to get you out on time, refreshed and limbered up.

Sock

IT'S SO QUIET
I CAN'T SLEEP!

It took years of snoring to perfect the "Notta Bitta Comfort Anti-Snoring Pad."

IT'S SO QUIET
I CAN'T SLEEP!

Etiquette demands that you salute your acquaintances, you cannot claim to be well bred unless you wear one of these automatic self-tipping hats etc., etc., etc.

That superb feeling of being dressed for the occasion, and as dry as the 18th Amendment.

The most chicken-hearted person can now perform a major operation on the old red rooster.

The iron pussy

The 21st century unlimited to have clear track all the way.

Three alarm beds guaranteed to get you out on time, refreshed and limbered up.

Sock

IT'S SO QUIET
I CAN'T SLEEP!

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www.americanradiohistory.com
SEVERAL weeks ago during conversation with a very dear friend of mine, who by the way had been a fellow student of spiritualism and kindred subjects, he informed me that he had on two occasions witnessed a séance by an unknown medium whose offering was little short of miraculous.

"Yes, Dunninger, this woman is an enigma. Often I have witnessed similar things but never in my numerous experiences has anything impressed me as so unusual. Miss Thelma Mason is unusual in a way that would ordinarily be accepted as a standard of unusual intelligence."

"In what way unusual?" I asked.

"Why this woman is no faker, I tell you Dunninger," said my friend Lustig. "She is uncanny; not alone does she bring apparent messages of those about her, but she actually described the likeness of my dead uncle Maxwell. Told me how long since he had departed and presented details of the illness that carried him off. Of course, I don't believe this stuff any more than you do, but I am frank to admit that she has me guessing. Would that you could hear those who were present with me speak of her seemingly marvelous readings, . . . they are fully convinced that she is supernatural.

"She actually calls the departed by names and tells the sitters things that actually makes the color leave their faces . . . they sit astounded . . . amazed!!"

"How does she do it? What is her method?" I scoffed at what was told me of this woman. Finally I attended one of her séances and I too was amazed. Now, Dunninger, you must pay this woman a visit and see for yourself just what really transpires.

"Good," said I. "There is no time like the present," as I looked at my time-piece. "It is just five minutes past seven. Let us hail a cab and be on our way."

"Yes," said my friend, "that is all very well, but these séances are not entirely public and arrangements must be made beforehand."

"Phone in hand my friend was soon informed that the next meeting would be held on the following evening. An appointment was made.

Arriving at the house, located in a side street east of Broadway, we were ushered into a reception room. The room was plainly furnished. The only pieces of furniture were several plain chairs and a small table. A quick examination proved that these articles were of the most ordinary type. No trickery there.

A number of pictures adorned the walls each of a religious character. These pictures were of the cheap lithographed type set in frames of the cheapest sort.

Here we were ready to witness the seemingly marvelous séances. Several "customers" were present. Several were of the aged type familiar at such séances. One old lady was there for the second time that week, she having attended the séances at least twice every week.

This old lady was in deep conversation with several others . . . unfolding the wonders accomplished by this medium. Listening to that sort of talk tired us, but suddenly into the room walked a maid. She was partly Chinese and partly French. A clever talker and with ideas that seemed to end when we switched from the borderland to more prosaic chatter.

Unfolding a tale of a noted Chinese medium this little lady had me thinking what wonderful ideas she would have for unworkable illusions for stage work. The maid next greeted several of the parties present; calling them by name and talking intimate bits of business.

"What is the charge for attending these séances?" I asked one of the bystanders.

(Continued on page 463)
Spirit Tricks

By WALTER B. GIBSON

The Following Tricks are Duplicates of the Stunts Used by Fraudulent Mediums, and can be Performed Perfectly With Very Little Practice.

A handkerchief is held in front of a bell in the manner indicated in the diagram below. The bell rings almost immediately after the handkerchief is raised to the position shown. When the cloth is withdrawn the bell may be examined. The method is made clear in illustration 2, below.

A sheet of carbon paper is inserted under the top leaf of a pad. A question is written and the message is signed.

The medium holds a napkin in the manner illustrated in the drawing immediately above. He turns body to the right, holding cloth in front of articles on table.

With one hand free, medium makes articles jump. Note attachment of napkin. Audience is on far side.

Three slates stacked together are examined and marked 1, 2 and 3 in upper corners. On being stacked again and taken apart a message is found on one of them.

The bottom slate has a message on the under side. On top is figure 1.

An improved version of the telephone trick is illustrated here. A person names a card in the pack and is told to call up Mr. Johnson, who tells him the name of the selected card over the telephone. No long list of names is required. Simply use the table shown, thus if the three of hearts is chosen tell the person to call Mr. Custer or Callahan. For the black cards use the title doctor or professor. For jack of clubs use Mr. X, the man of mystery and for King of Clubs or King of Diamonds use a name like Zeno.
The Month's Scientific News Illustrated
By GEORGE WALL

The Oregon State Department of Agriculture used flame thrower, a relic of the Great War, to destroy grasshoppers near Tule Lake. Casualties were estimated at 532,174,400.

The Army Chemical Warfare Service announces the perfection of a new gas pistol which will be used to combat crime. Unless they resort to gas masks in their raids, gunmen will be delivered gas-sick but uninjured into the hands of the law.

A special demonstration train carrying high-grade cattle, swine and poultry for demonstration to farmers and ranch owners, has been arranged for by the Department of Natural Resources of Nova Scotia. It will cover the territory of the Dominion Atlantic Railway.

Three cameras of a new type have been assigned to the Alaskan Mapping Expedition for an extended aerial survey. From a height of 15,000 feet an area of 9 miles of territory may be mapped at one exposure.

The biggest explosion of dynamite ever set off within the Golden Gate wiped out a danger to navigation, the sunken hull of the oil tanker "Alden Anderson," on May 6. The explosion caused a water spout estimated at 800 feet high and 125 feet in diameter. The Anderson burned in 1924, causing the death of 7 members of her crew.

Two students of the University of Maine have succeeded in dyeing trees from their outer surfaces to the hearts of their trunks, using the process invented by a German scientist. The indelible dye is contained in garbage cans suspended at a height, and is introduced through holes bored at the base of the trees. The sap distributes the coloring matter in from two to four days.

During the raising of the S-51, one of the divers who was tunnelling under the wreck to pass a lifting chain around it, found himself trapped by a cave-in of the sand at the entrance of his tunnel. He succeeded in extricating himself by reversing the nozzle of the high-pressure hose used to wash away the sand.

A diver salvaging the S-51 found himself trapped by a cave-in.

Above is shown the latest luxury for English infants. An automobile baby-carriage, run by a small storage battery electric motor, is geared to the wheels of the carriage platform. The nurse stands at the rear of the platform and governs the motor in the direction of travel by control levers.
A NEW advertising device called the projectograph, developed by Samuel E. W. Haines of Oakland, Calif., projects the image of a letter on a cloud bank by the use of a highly concentrated ray from a carbon arc projector. The positive or horizontal carbon is shaped in the cross section of the desired letter, and the reflector projects the image on it in a concentrated beam of light. The arc light is adjusted to focus on a distant cloud and is very efficient in cutting through fog as shown above. A battery of these lights may be used to write a sentence or slogan across the sky, or a series of letters may be projected from one projectograph by replacing the horizontal carbon by one cut to the outline of the letter to be projected.

Photo above shows construction of projectograph arc light. The horizontal carbon made in the shape of the letter to be cast, may be seen at the end of the two focusing rods. A mechanism is provided which permits the horizontal carbon to be adjusted and removed for replacement. The reflector is tilted so that the light may be concentrated at a distance, and the distance of the arc from it is easily adjustable.

Here is the latest apparatus developed by the Bureau of Standards for counting electrons. The process utilizes high frequency apparatus similar to that familiar to radio fans. L. F. Cutiss, expert or gamma rays at the Bureau of Standards, is standing in front of the control board. Scientists have been experimenting for years with various theoretical methods of counting electrons, but until now the apparatus has been very complicated and the results all too uncertain.

Students of Pomona College, Claremont, Calif., used apparatus at right for demonstrating the action of sound waves. A musical note from a pitch pipe causes standing waves to appear in a row of closely spaced gas jet flames. By means of this process, called the Tyndall experiment, the wavelength and amplitude of sound waves may be demonstrated. Prof. Rowland H. Tilton is shown explaining the method to his pupils.

A new English device for the measurement of the speed of revolving shafts utilizes the principle of an aperture synchronized to the speed of the shaft. A disk bearing a pattern of strips as shown in the illustration above is fastened to the end of the shaft and the pattern is viewed through either of two slits in the mechanism. When the shaft speed is a little greater than synchronization, the pattern will appear to move in the direction of rotation; if less, it will seem to reverse. Aperture frequencies of 6,000 and 12,000 per minute are used, because these numbers have a large number of factors and are multiples of the standard A.C. frequencies. — Allen F. Child.

The vibrating apertures of the speed-counter may be easily seen in the above photo. The thumb screw at right is used to adjust vibrator armature.
The new principles embodied in this valve cap which gives it a tremendous advantage, are ball-bearing action and compression contact. This construction renders the cap absolutely air-tight, and the inventor claims that any tire equipped with this valve cap need never be touched again until punctured or worn out. This cap is made in three parts: An outer metal section, heavily nickel-plated; a special non-leaking packing disk, and a third or inner section which supports this disk, allowing it to come into solid contact with the valve stem. Held thus firmly the packing disk cannot turn when the cap is screwed on.
Home Mechanics
How to Make a Maplewood Desk
By W. M. BUTTERFIELD

MAPLE desk in Early American Period is a beautiful piece of furniture. It can be made at home by following the illustrations on this page. Maple lumber is to be had at any first class lumber yard and the yard has the machinery to shape and cut it. Molding circular parts, mortises and tenons can all be better cut by machinery than at home or by hand.

If the home mechanic will cut accurate cardboard templates for his pieces, lumber can be shaped in the rough, ready to smooth and assemble. The mill work is done at slight cost in addition to that of the lumber.

The lower section of the desk should be assembled first. First there are two end or side pieces, each consisting of a single board 42\frac{1}{2} inches long, 14 inches wide and \frac{3}{4} inch thick. To prevent these from warping, tenons are engaged in mortises, cut one at each end of the top piece (see illustration for upper section). Each tenon is 7\frac{1}{2} inches long, \frac{1}{2} inch high and \frac{3}{4} inch wide.

The sides are again secured by a shelf-like cross-piece forming the bottom of the desk inclosure. This piece is mortised and tenoned at each end and is 31 inches long, 13\frac{1}{2} inches wide and \frac{3}{4} inch thick. They are further strengthened with a frame made of \frac{3}{8}-inch by 3-inch ply-board with mortise and tenon corner joints (as shown). This frame is glued and also screwed at each contact point.

A third support is given to the sides by a cross-piece with mortised and tenoned ends placed at the bottom of the drawer section. This piece is 31 inches long, 13\frac{1}{2} inches wide and \frac{3}{4} inch thick. It is of \frac{3}{8}-inch ply-wood. A frame made and attached as described above is also used. Ply-wood \frac{3}{8} inch thick is used for the back. It is 37\frac{1}{2} inches long and 30 inches wide.

The cross-pieces forming the openings for the drawers are mortised and tenoned. The bottom one is 31 inches long— including tenons, \frac{2}{16} inches wide and \frac{3}{4} inch thick. The upper three are \frac{3}{4} inch square and 31 inches long over tenons. The frame holding the four drawers and two piece holes placed in the desk inclosure is made in one piece. It has false joining marks (see drawing) and is 30 inches long, 14 inches wide, including brackets, and \frac{3}{8} inch thick. A butt in, back bracket, partitions and drawer slides are other parts used here. The wood used is ply-wood.

A single board 14\frac{3}{4} inches wide, 33 inches long and \frac{3}{4} inch thick forms the drop lid for the desk. To prevent it from warping, channel grooves 2 inches deep and \frac{3}{4} inch wide are cut through the center flatwise at each end, and pieces of the maple of the above size glued in the grooves with the two grains reversed or crossing each other. Molding (\frac{3}{4} inch quarter round) is used to form a false panel on the front of the lid. It is used as shown in gluing the sash door molding (see illustration).

The seven drawers all have \frac{3}{4}-inch maple fronts, with \frac{3}{8}-inch ply-wood backs and ends and \frac{1}{8}-inch ply-wood bottoms. They are made like any machine-made drawer, so by examining a drawer

(Continued on page 413)
Light for Universal Purposes

These photographs show a new type of light fitted with two suction cups and a clip permitting its attachment to any surface in any position. A ten-watt bulb is fitted in the highly nickel-plated reflector.—Dallmer Mfg. Co.

Marcel Waver

The can opener here, has a cutting knife, and a jointed right handle which grips the edge of the can and removes the top in one piece turning down the rim edges at the same time, thus preventing accidental injury from a sharp edge. It will cut square cans.—Truesdell Mfg. Co.

Wire Nuts

For joining two or more pieces of wire together without soldering the wires these nuts are very convenient. The ends of the wire are bared and pushed into the nut which cuts its own thread on the wire and makes a permanent connection. It is not necessary to tape the joint and four or more wires may be joined together with one nut.—Tork Company.

Ironing Machine

With this device the housewife can sit and do a day's ironing in part of one morning. It is attachable to any outlet. Because the roll opens, cuffs, neck bands, collars, dresses and skirts can be ironed.—Electric Household Utilities Corp.

Addresses of the manufacturers of any of the above may be had upon request.
To prevent the starter button being pressed down by children, garage attendants, thieves or unauthorized persons, thus discharging the car's battery, a simple stop collar of the type shown in the sketch can be attached to most makes.

This is a U-shaped piece which clips around the stem of the starter button, bearing against the collar and seats against the body of the starter switch or floor board above.

Make the U collar from 1/4-inch sheet steel, drill two small holes in the projecting ears for the bar of a small padlock. The length of the U collar is easily determined from the starter switch, taking the measurement when the button is not pressed down.

Of course this stop collar may not appeal to the closed country, where the majority of car drivers, using open cars will appreciate the advantage that this stop has in avoiding discharged batteries. The protection is appreciable in contrast to the small cost in time to make it up.

HOW TO LUBRICATE HIDDEN PARTS

Under the car for oiling, is not only hard on the clothes, but also hard on the eyes. Of course you might get out the goggled and line the garage floor with rugs, but this does not necessarily remove the undesirable features of getting under to lubricate.

A means which helps considerably to avoid the obstacles formed by disc wheels, low chassis, bumpers, and aprons, and simplifies the oiling work is that of drilling access holes for the spout of the oil can or for oil ducts.

To illustrate this, the sketch shows the main places which require frequent lubrication and the necessary access holes for oiling from a convenient place above the car.

Small holes are drilled through the running board aprons, through the dash, through the car flooring and under the rear seat compartment directly above the part to be oiled. The size of the hole required depends on the accessibility of the part under it. If only the oil can spout is to be accommodated, a half-inch hole is sufficient, but if a grease cup is to be reached, a four-inch or five-inch hole with tin cover should be cut. Many leads can be reached with a piece of copper gasoline pipe, pushed into a small hole drilled into the floor board and the oil fed to a bearing by dropping it into the tube.

SOME few years ago, not many car owners would concern themselves with the availability of the automobile in the winter. Conditions have changed, the car is an everyday necessity and the freedom with which it can be put in and removed from the garage is of especial interest.

To avoid being snow bound, with the garage doors stuck fast, the car owner will save trouble and much hard labor later on, by preparing the doors of his garage, to swing freely, when the ground is covered in deep layers of snow.

The appended sketch shows one of the simplest and best ways to arrange the opening to the garage, which consists mainly of hinged bottoms to turn up and inside the doors.

The doors to be altered are cut off a distance of twelve inches at the bottoms. Pine or preferably Cypress of a corresponding width is obtained, and by means of strap hinges, a piece is attached to the lower edge of each door. Battens are nailed on to re-enforce this extension, and a turn piece is arranged as shown to hold the extension down. One small hook to attach the extension when raised, completes the work of preparing the doors.

STOP COLLAR FOR THE STARTER BUTTON ON THE CAR

Repairs were being made to a building, and an automobile occupied a space where it was desired to load a truck in front of the building. The truck driver stepped into the parked and locked car, put it into gear, stepped on the starter and moved it up the block.

A simple scheme for locking the starter button.

Clever way to fit garage doors so as not to become snowbound.

On the honeycomb type of radiator leaks from a freeze or break caused by other reasons, can be neatly and serviceably repaired by means of a small metal disc on the outside and one inside.

To make this repair, cut out the two sections of metal, sheet brass for permanence, into a circular shape, or rectangular if this better meets the need. Tin one face of each piece of metal. Clean off the edges of the leaking area of the radiator and with a hot-tinned soldering iron, apply a circular area of solder. Then with a hot soldering iron, press the tin faced of the repair patch to the radiator and sweat it into place.

This repair is made without removal of the radiator and does not endanger the solder in the tubes as will a blow torch which is brought against the radiator, when attempting to fill interstices with solder.

If you desire you can attach your motor club emblem right over the brass patch, polish it bright or touch it up with black enamel.

MARKED GEAR SHIFT KNOB TO AVOID WALKING SHIFT

To add this to the car, only a file and machinist's stencils are required.

Cut an H into the convex surface of the knob with a file and stamp the letter and figures at the extremities of the H.

After cutting in the index, it is made clear and distinct by filling the cuts with white paint or white wax.

The correctly cut index indicates to the garage attendant or temporary driver, the proper location of the shift lever for each of the four conditions of operation, thus preventing the stripping of a gear.
AWARDS IN $5,000.00 MATCHCRAFT CONTEST

UKELELE AND CARRYING CASE OF UNUSUAL BEAUTY WINS FIRST PRIZE—$100.00, IN THIS MONTH’S CONTEST. MODEL BUILT BY STANLEY PERRON OF SALEM, MASS.

Undoubtedly the finest model which has been entered in the Matchcraft Contest up to the present time and which won for its builder, Stanley Perron, of Salem, Mass., the coveted First Prize, appears in the photographs on this page. It was really remarkable to see what Mr. Perron had created with the matches. The ukelele and its accompanying carrying case received this month’s $100.00 prize.

The above photograph shows the carrying case of the ukelele open and also clearly indicates the presence of a receptacle for spare strings. The carrying case is made of matches laid on in three layers, the corners of the case being very carefully joined and glued. The builder took great pains in polishing up this very excellent Matchcraft model, so much so that the matches took on a glass-like finish and exhibited a lustre which it would take a poet to describe. The ukelele itself has a very mellow tone and surprising volume for its match-construction. Thousands of matches were required.

The photo at the right shows the carrying case closed and the back of the ukelele. Every part of the instrument, with the exception of the keys and strings, is made of matches. Notice the back of the instrument and observe the concentric layers of matches located in different planes giving rise to the artistic effect. The back was built up several layers thick and then carved down and polished.

From the photograph of Miss Olsen, above, playing the ukelele, a fair idea of the size of the instrument may be obtained.

FOR the present year, SCIENCE AND INVENTION magazine will award a total of $5,000 in prizes in a new contest. You are asked to make models, fashioning the same entirely from safety matches. Please observe the following simple rules:

(1) Models submitted must contain at least 90 per cent. safety matches in their construction.

(2) Models made of toothpicks, paper matches, or non-safety matches, are not eligible in this contest.

(3) Models can be built around boxes or other supporting articles. Walls, roofs, etc., must all be self-supporting and made of matches.

(4) All liquid adhesives, such as glue, shellac, cements, etc., are permissible.

(5) Models may be painted, gilded or silvered.

(6) Models may be of any size.

(7) In order to win a prize, it is necessary that either models be submitted, or, if this is not practical, owing to their size, a 5" x 7" photograph of the model may be sent in lieu of the model itself. The best models submitted each month will be awarded the prizes scheduled herewith.

Caution—Soak or cut heads from matches before building your model so that the models may be expressed or mailed. The strike-everywhere square cut Liberty matches can be used if the heads are cut off.

REMEMBER—This is a monthly contest offering sixteen prizes every month. Don’t hesitate, send in your model now!

$5,000.00 Prize “Matchcraft” Contest

Watch for Prizes in October Issue

16 Monthly Prizes

<table>
<thead>
<tr>
<th>Prize</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>First Prize</td>
<td>$100.00</td>
</tr>
<tr>
<td>Second Prize</td>
<td>75.00</td>
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<tr>
<td>Third Prize</td>
<td>50.00</td>
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<td>Fourth Prize</td>
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<td>Fifth Prize</td>
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<td>Sixth Prize</td>
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<td>Seventh Prize</td>
<td>15.00</td>
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<tr>
<td>Eighth Prize</td>
<td>12.50</td>
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<tr>
<td>9th to 16th Prizes of $10.00 each</td>
<td>$80.00</td>
</tr>
</tbody>
</table>

IMPORTANT

Quite a few matchcraft models from contestants arrive broken every month, due to faulty packing, or weak construction. It should be remembered that boxes are often violently thrown around in transit before they reach us. Make sure first that your model is constructed strongly enough to withstand severe shocks. Then, before you send us the model, wrap it with bubble as well as you know how, throw it up almost to the ceiling and let it come down on the floor. Open up the box and see if the model is not damaged. Only after such a test can you know that the model will arrive safely.

All First Prize Awards will henceforth become the property of the Experimenters Publishing Company and will be used for exhibition purposes.

(8) All models submitted to SCIENCE AND INVENTION Magazine will be promptly returned to the builder, who will have all charges.

(9) Where SCIENCE AND INVENTION has any doubts as to the model (where photographs only are submitted) complying with all the regulations, the judges may, at their discretion, request that the actual model be sent in for inspection, paying transportation charges both ways.

(10) This is a monthly contest, lasting for twelve months, each monthly contest closing on the first of the month following date of issue. Thus the contest for the month of September will close October 1, 1926, and prize winning announcements will be made in the December, 1926, issue. The October issue will contain July prize winning entries.

(11) Models must be shipped in a strong wooden box, never in a cardboard box, as SCIENCE AND INVENTION can not be held responsible for breakage in transit due to models having been improperly packed.

(12) When models are sent, be sure to affix tag, giving your name and address, to the model itself. In addition, put name and address on outside wrapper of package.

(13) Address all letters, packages, etc., to Editor, “Matchcraft” Contest, care SCIENCE AND INVENTION Magazine, 33 Park Plaza, New York.

This contest started Dec. 1, 1925, and will terminate Dec. 1, 1926.
MATCHCRAFT

Model of Liner
Wins Second Prize $75.00
Made by James Quinn
of New York City

Eugene Jeffries' Fan
Wins Third Prize $50.00

SECOND PRIZE—$75.00 was won by James Quinn of New York City for the model ship shown in the photograph above and to the left. The ship has a hollow hull and the matches around the stern were bent so as to give this part of the vessel its shape. A comparative size may be obtained by examining the photo above. Miss Sadie Bernstein is holding the vessel.

THIRD PRIZE—$50.00 was awarded the fan, constructed by Eugene Jeffries, Anacortes, Washington. The fan is less than 1/16th of an inch in thickness at its edge, the matches being built up in blocks and then cut.

FOURTH PRIZE—$35.00. The remarkable model of a locomotive and tender illustrated at the right was built by Louis A. Smith of El Paso, Texas. The model may be pushed along the rails and every portion thereof works. Even the bell cord is of match conductors.

FIFTH PRIZE—$25.00 was awarded Oliver E. Kaupang of Minneapolis, Minnesota for the model of a dirigible illustrated here. The model is two feet, ten inches long and ten inches in height overall from the top of the bag to the bottom of the caboose. At the nose of the bag a door is located which may be opened to examine the inside construction. This consists of a series of spider-web-like cross bracings.

SIXTH PRIZE—$20.00. What should be more natural during the Philadelphia Sesquicentennial than that Karl Fichter of Philadelphia, Pa., should win a prize for his model of the Liberty Bell? Notice that the matches forming the bell are curved to shape. Also observe the crack in the bell and the bolts holding it together. The matches in the standard are also curved and the base artistically decorated by the manner in which the matches are laid.

EIGHTH PRIZE—$12.50. This statue of George Washington at Valley Forge is almost fourteen inches high. Pedestal, Horse and Rider are of solid construction, the latter too being carved to shape. The model is 100% matches, and was built by Irving Klein of Brooklyn, N. Y.

SEVENTH PRIZE—$15.00 was the award decided on for the ferryboat "Rockland" built by Warren C. Brown of Ossining, New York. The paddle wheels can be made to rotate, which motion is transmitted by means of levers to the beam on top of the ferry. There are two drive ways, one on either side of the engine-room.

FOURTEENTH PRIZE—$10.00 was awarded to Miss Beatrice M. Chasse of Central Falls, Rhode Island, for her construction of a Toonerville Trolley illustrated in the photograph at the right.
Further Matchcraft Awards

Continuing the List of Prize Winners for This Month.
Your Model May Also Win a Prize, so Send it in Now

NINTH PRIZE—$10.00 was the award decided upon by the judges for the perpetual calendar illustrated in the two photographs at the right. The setting of the case of the week is permanent, but the dates may be shifted at will and the month and year may also be changed. Sufficient additional wooden slides fitting into grooves accompany the calendar and extra letters to form all of the months of the year are also included. The back is of three-ply match construction. The model was built by C. E. Parker of Claymont, Del.

ELEVENTH PRIZE—$10.00. The model of farm buildings built by John E. Hackett of Hornell, N. Y., is illustrated in the photograph below. The farmer's home, graincrib, windmill, stable and silo may be seen in the photograph.

The pump and plunger and the pipes are made of matches. The piston of the pump is a solid block of matches. The table of the press is of four-ply match construction. The front has been removed to show interior of the device. More than 5,000 matches entered the construction of this model which is ten inches high and fourteen inches wide.

TENTH PRIZE—$10.00. All of the models which Oscar Solow, a High School student of New York City enters in the Matchcraft contest win prizes and this is another one of his models. The construction represents a working model of a hydraulic press. Water is admitted to the box in the lower right hand corner and by means of the pump operates the press.

A match construction which produces a very pretty scenic effect is here illustrated.

The model above is mounted on a base board. The judges, however, only consider those portions which are made of matches.

TWINTEENTH PRIZE—$10.00. Fred Sprandel of Abingdon, Illinois, whose name is familiar to all Matchcrafters because of his many previous prize winning ideas adds another to his long list by the construction illustrated here. Notice that the wheel is banded with matches which have been stepped and bent to shape. A nut on the plough share is also made of lucifers. The shear may be turned through 180 degrees to produce a narrow or a wide furrow. Observe how the handles have been bent.

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A single layer of matches forms the canteen here illustrated which is also banded with the same material. A chain of match construction serves as the handle. This chain is very unique.

In the above photograph, Miss Shirley Hecht is engaged in changing the monthly calendar. The numerals mounted on wooden tabs are made of raised red match heads.

FIFTEENTH PRIZE—$10.00. Henry Ludwig of Ridgewood, N. Y., who built the Matchcraft battleship shown above is only fourteen years old and although he submitted quite a few models in previous contests, this is the first one which won an award. The gun turrets are mounted on swivels and the guns may be raised or lowered and the turrets may be rotated. The construction of the hull is hollow and the matches were laid on ribs made of the same material.

THIRTEENTH PRIZE—$10.00. To the right we see a working model of a horizontal steam engine which was very cleverly constructed by Theodore Sterrett of Port Arthur, Ontario, Canada. This model is less than four inches long and two inches in width and approximately 2 inches high.

SIXTEENTH PRIZE—$10.00. The last of the group of prizes for this month, was awarded to Dr. A. A. Hansen of Virginia, Minnesota for his model of a canteen illustrated in the photograph below. The top is provided with a ring for its removal and a clasp for holding it in place.
Hindu's Sand Mystery

Red Sand  White Sand  Blue Sand
Mixing Bowl  Water  Red  White  Blue

The accompanying article explains how it is possible to mix red, white and blue sand with water and then remove a handful of the particular color asked for. The bowl is not faked.

Three sands of different colors are mixed into a container of water, the contents completely stirred with a rod. Any color is now called for and the magician placing his hand into the container, removes a handful of the sand, corresponding to the requested color, perfectly repeated, until a handful of each respective color has been removed from the water. Cakes of sand, previously made by mixing a small portion of paraffin with the sand, are concealed in the hollow mixing rod and are secretly dropped out of this rod, while stirring the contents of the container. As they are respectively removed, slight pressure will break the cake, permitting the sand to flow freely through the fingers. It is preferable to use a mixing bowl which is not transparent and yet which is not entirely opaque, as in the latter case there would always be a suspicion of a fake bowl.

The Enchanted Cigar

A magician offers a cigar to his friend who states his preference for a cigarette. Instantly, the cigar transforms itself into the desired smoke. This surprising trick is easily accomplished when one realizes that the cigar is drawn into the magician's sleeve by the usual pull arrangement. Most of the modern pulls operate from the waist. Consequently the one alert to this type of pull will never suspect that the old system is being used. The cigarette makes its appearance by dropping from the interior of a prepared cigar while the same passes up the sleeve. An ordinary cigar may be hollowed out to conceal the cigarette or a wooden plug covered with tobacco leaf may be used instead.

Chinese Plate Problem

A China plate which has been inspected is broken into many pieces with a hammer. A spectator selects one piece which he marks with his initial or some other insignia using a brush and India ink. The piece of plate is now ground into a powder and the powder emptied upon the spectator's hand. This is blown from the palm a moment later, whence the identical mark will be found to have been mysteriously imprinted in the center of his palm. The explanation is quite simple. The spectator smashes a plate with a hammer and marks one of the pieces. Thereupon the magician picks up this piece and hands it to the spectator to grind it up. While doing so an impression is carried off on the magician's thumb, which is again transferred to the spectator's palm as shown.

A Barrel of Plenty

A small barrel made entirely of glass is passed for rigid inspection. A committee is invited upon the stage and requested to suspend the barrel in mid-air assisted by four unprepared strings or chains. The Egyptian-clad wizard opens the faucet and fills glass after glass with wine, yet the transparency of the barrel shows the structure free from any liquid content. At any moment the action may be repeated after complete examination. This clever effect is merely an illusion, inasmuch as the liquid is contained in a rubber-bag arrangement concealed beneath the wizard's cloak. The liquid is forced by arm pressure through the tubing and faucet of the barrel as illustrated. It may be advisable to place the bag under the left arm while manipulating the faucet with the right hand. Controlling the pet-cock is quite a natural operation.
"A farmer's boy beside us had a handful of old horse-shoes. He began throwing them. One of them visibly went through the 'ghost.' Then a man with a star on the lapel of his overcoat fired a shot. It spat yellow flame. Where the bullet went no one could have told. The specter was unchanged."

CHAPTER I

The Ghosts of '46

There first of the "ghosts" made its appearance in February of 1946. It was seen just after dark in a small town known as Otter Creek, a few miles from Rutland, Vermont. There are willows along the creek-bank at this point. Heavy snow was on the ground. A farmer's wife saw the ghost standing beside the trunk of a tree. The evening was rather dark. Clouds obscured the stars and the moon. A shaft of yellow light from the farmhouse windows came out over the snow; but the ghost was in a patch of deep shadow. It seemed to be the figure of a man standing with folded arms, a shoulder against the tree-trunk. It was white and shimmering; it glowed; its outlines were wavy and blurred. The farmer's wife screamed, rushed back into the house.

Up to this point the incident was not unusual. It would have merited no more than the briefest and most local newspaper attention; reported perhaps to some organization interested in psychical research to be filed with countless others of its kind. But when the farmer's wife got back to the house and told her husband what she had seen, the farmer went out and saw it also; and with him, his two grown sons and his daughter. There was no doubt about it; they all saw the apparition still standing motionless exactly where the woman had said.

There was a telephone in the farmhouse. They telephoned their nearest neighbors. The telephone girl got the news. Soon it had spread to the village of Procter; and then to Rutland itself. The ghost did not move. By ten o'clock that evening the road before the farmer's house was crowded with cars; a hundred or more people were trampling the snow of his corn-field cautiously, from a safe distance regarding that white motionless figure.

It chanced that I was also an eye-witness to this, the first of the ghosts of '46. My name is Robert Mause. I was twenty-six years old that winter—correspondent in the New York office of a Latin-American Export House. With Wilson Grant and his sister Beatrice—whom I counted the closest of my few real friends—I was in Rutland that Saturday evening. Will was a chemist; some business which he had not detailed to me had called him to Vermont from his home near New York. In spite of the snowy roads he had wanted to drive up, and had invited me to go along. We were dining in the Rutland Hotel when people began talking of this ghost out toward Procter.

It was about ten-thirty when we arrived at the farm. Cars were lined along the road in both directions. Flashing head-lights; chugging motors. People trampling the road, the fields, cluttering about the farmhouse; talking, shouting to one another.

The field itself was jammed, but down by the willows along the creek there was a segment of snow as yet untrampled, for the crowd had dared approach so far but no further. Even at this distance we could see the vague white blot of the apparition. Will said, "Come on, let's get down nearer. You want to go, Bee?"

"Yes," she said.

We began elbowing and shoving our way through the crowd. It was snowing again now. Dark; but some of the people had flashlights which darted about; and occasionally a smoker's match would flare. The crowd was good-natured; with courage bolstered by its numbers, the awe of the supernatural was gone. But they all kept at a safe distance.

Somebody said, "Why don't they shoot at it? It won't move—can't they make it move?"

"It does move—I saw it move, it turned its head. They're going up to it pretty soon—see what it is."

I asked a man, "Has it made any sound?"

"No," he said. "They claim it moaned, but it didn't. The police are there now, I think—and they're going to shoot at it. I don't see what they're afraid of. If they wanted me I'd walk right up to it."

He began elbowing his way back toward the road.

FOREWORD

In this, my own conception of the phenomena see popularly called "ghosts," I have not intended to involve either spiritualism or religion. Rather have I determined to stand upon the middle ground of science. I am aware, of course, that many of you will declare that there is very little of our coldly precise science to support what I am so boldly setting forth. Call it then—

Scientification.

My basic conception is elusive; my characters freely admit it. Like a dream, not lending itself readily to word depiction. Purposefully I have made it so, far to reduce it to an over-realistic would paradoxically destroy the very essence of its reality. If at times my word pictures seem inadequate, I beg you to lower the printed page for a moment and let your own imagination roam.

If I can do that—stimulate your imagination, drive your thoughts from the humdrum affairs of our own little lives out into uncharted seas; and most of all, if I can thus entertain you—my purpose will have been accomplished. Ray Cummings.

www.americanradiohistory.com
We found ourselves presently at the front rank, where the people were struggling to keep themselves from being shoved forward by those behind them. Thirty feet across the empty snow was the ghost. It seemed, as they had said, the figure of a man, blurred and quivering as though moulded of a heavy white mist at every instant about to dissipate. I stared, intent upon remembering what I was seeing. Yet it was difficult. With a quick look the imagination seemed to picture the tall lean figure of a man with folded arms, meditatively leaning against the tree-trunk. But like a faint star which vanishes when one stares at it, I could not see a single detail. The clothes the face, the very outlines of the body itself seemed to quiver and elude my sight when I concentrated my attention upon them.

Yet the figure, motionless, was there. Half a thousand people were now watching it. Bee said, "See its shoulder, Rob! It isn't touching the tree—it's inside the tree! It's leaning against something else, inside the tree!"

The dark outline of the tree-trunk was steady reality; it did seem as though that shadowy shoulder were within the tree.

A farmer's boy beside us had a handful of horse-shoes. He began throwing them. One of them visibly went through the ghost. Then a man with a star on the lapel of his overcoat fired a shot. It spat yellow flame. Where the bullet went no one could have told, save that it hit the water of the creek.

The scene was unchanged.

The crowd was murmuring. A man near us said, "I'll walk up to it. Who wants to go along?"

"I'll go," said Will unexpectedly; but Bee held him back.

The volunteer demanded, "Officer, may I go?"

"I ain't stoppin' you," said the man with the star. He retreated a few steps, waving his weapon.

"Well then put that gun away. It might go off while I'm down there."

Somebody handed the man a broken chunk of plank. He started slowly off. Others cautiously followed behind him. One was waving a broom. A woman shouted shrilly, "That's right—swipe it away—we don't want it here." A laugh went up, but it was a high-pitched, nervous laugh.

The man with the plank continued to advance. He called belligerently, "Get out of there, you! We see you—get away from there!"

Then abruptly he leaped forward. His waving plank swept through the ghost; as he lunged, his own body went within its glow. A panic seemed to descend upon him. He whirled, flailing his arms, kicking, striking at the empty air as one tries to fight off the attack of a vicious wasp. Panting, he stumbled backward over his plank, gathered himself and retreated.

The white apparition was unchanged. "It just was like a glow of white light," the attacker told us later. "I could see it—but you couldn't feel it. Not a thing—there wasn't anything there!"

The ghost had not moved, though some said that it turned its head a trifle. Then from the crowd came a man with a powerful light. He flooded it on the spectre. Its outlines dimmed, but we could still see it.

A shout went up. "Turn that light off! It's moving! It's moving away!"

It was moving. Floating or walking? I could not have told. Bee said that distinctly she saw its legs moving as it walked. It seemed to turn; and slowly, hesitatingly it retreated. Moving back from us. As though the willows, the creek-bank, the creek itself were not there, it moved backward. The crowd, emboldened, closed in.

At the water's edge we stood. The figure apparently was now within or behind the water. It seemed stalking down some invisible slope. Occasionally it turned aside as though to avoid some obstruction. It grew smaller, dimmer by its greater distance from us until it might have been the mere reflection of a star down there in the water of the creek; then it blinked, and vanished.

There were thousands who watched for that ghost the following night, but it did not appear. The affair naturally was the subject of widespread newspaper comment; but when after a few days no one else had seen the ghost, the newspapers began turning from the serious to the jocular angle.

Then, early in March, the second ghost was reported. In the Eastern Hemisphere this time. It was discovered in midair, near the Boro Badur, in Java. Thousands of people watched it for over an hour that evening. It was the figure of a man, seated on something invisible in the air nearly a hundred feet above the ground. It sat motionless as though contemplating the crowd of watchers beneath it. And then it was joined by other figures! Another man, and a woman. The reports naturally were confused, contradictory. But they agreed in general that the other figures came from the dimness of distance; came walking up some invisible slope until they met the seated figure. Like a soundless-motion-picture projected into the air, the crowd on the ground saw the three figures in movement: saw them—the reports said—conversing; saw them at last move slowly backward and downward within the solid outlines of the great temple, until finally in the distance they disappeared.

Another apparition was seen in Nome; another in Cape Town. From everywhere they were now reported. Some by daylight, but most at night. By May the newspapers featured nothing else. Psychical research societies sprang into unprecedented prominence and volubility. Learned men of spiritualistic tendencies wrote reams of ponderous essays which the newspapers eagerly printed.

Amid the reports now, the true from the false became increasingly difficult to distinguish. Notoriety seekers, cranks and quacks of every sort burst into print with wild tales of ghostly manifestations. Hypnotical young girls, morbidly seeking publicity, told strange tales which in more sober days no newspaper would have dared to print. And in every country charlatans were doing a thriving business with the trappings of spiritualism.

(Continued on page 434)
**Scientific Problems and Puzzles**

*By ERNEST K. CHAPIN*

**HYDROMETER LEVEL**

Bucket containing floating hydrometer is whirled vertically.

An hydrometer is floated in a pail of water. The pail is then whirled vertically at arm's length fast enough to prevent spilling water. When will it float highest, or will its level remain constant?

**WHEN WILL LADDER SLIP?**

As a man climbs the ladder leaning against a wall, the ladder will have a decided tendency to slip when he reaches a certain point. Just what is the location of this point, and why is there a greater tendency to slip here?

**BALLOON ASCENSION**

Does the length of the day have anything to do with the readiness or reluctance with which balloons ascend? If the speed of rotation of the earth should increase, would balloons be able to lift more or less than they can at present?

**SPEED OF LIGHT**

Light is propagated in space at the rate of 186,250 miles per second. It takes light about 8 minutes to reach the earth from the sun. How does this fact affect the length of the day, the time of sunrise, and the time of sunset?

**CHANGE IN WEIGHT**

It is a well-known fact that at the poles, a person's weight is a little greater than elsewhere on the earth. It is also true that he is a little lighter at the equator than elsewhere. What effect do you think descent into a mine could have on the weight of your body?

**BALANCED SWINGS**

Two swings are supported at the opposite ends of a rope which passes over two freely rotating pulleys as indicated in the diagram. If two boys of equal weight are seated in the swings, what would be the effect on the positions of the swings, if one of the boys should set his swing in motion?

**VOLTAGE OF BATTERY**

A voltmeter is shunted across a 6-volt storage battery which is connected to a 110-volt D.C. line. A lamp bank having 20 ohms resistance is connected in series with the battery. If the voltmeter will read only up to 7 volts, can it be used in this circuit? Could it be used on a 220-volt line?

**SPEED OF ROTATION**

Two children swing around a pole on ropes of unequal lengths. A has a longer rope than B, but he is swinging higher. Will A make the trip around the pole in a shorter time than B?

*Answers to these problems appear on page 446*
<table>
<thead>
<tr>
<th><strong>Everyday Chemistry</strong></th>
<th>Some Practical Everyday Chemistry Wrinkles that We Seldom Think About</th>
<th>By RAYMOND B. WAILES</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>1.</strong> A chemical analysis of their stomach contents shows that they live by eating the carbohydrates present in the wood, of which sugars are a class.</td>
<td><strong>2.</strong> Carbon inks have been found to outlive iron, dyes and other chemical inks. Ancient scripts usually contain carbon in a finely divided condition as the ink pigment.</td>
<td><strong>3.</strong> Stumps cannot be burned out in this manner. It would take as much saltpeter as the stump's weight to afford the fuse or touchwood properties.</td>
</tr>
<tr>
<td><strong>4.</strong> Selenium, used for coloring red glass and photo-electric cells, may be incorporated with wire insulation to make them fireproof.</td>
<td><strong>5.</strong> Soap is added to grease stock to give a body to the lubricant and as a supporting means for the grease. It is not an adulterant.</td>
<td><strong>6.</strong> Oxidation, or uniting with oxygen occurs, same as wood of a fire consumes oxygen. Oxygen in a silo is used up in 3 hours, after stocking it.</td>
</tr>
<tr>
<td><strong>7.</strong> This is due to a compound composed largely of casein. It is not the impurities arising by boiling.</td>
<td><strong>8.</strong> Green plants in aquariums give off oxygen to the water and it is this oxygen which the fishes breathe.</td>
<td><strong>9.</strong> Finely pulverized wood, wood-flour, is used as a body in the manufacture of much of the moulded composition radio dials and knobs.</td>
</tr>
<tr>
<td><strong>10.</strong> The (inflammable) liquid is composed of a carrier such as gasoline or kerosene and contains about 5% of dichlorbenzene, the active ingredient. An odorous substance is also added.</td>
<td><strong>11.</strong> Imperfect tinning of the inside of the can causes some of the iron to combine with sulphur in the product, to form (black) iron sulphide, keen inside can. It is not dangerously poisonous.</td>
<td><strong>12.</strong> Plants require chemical salts in solution to make them grow. Pure water such as distilled water does not contain these plant foods or appetizers. A few plants grow in water.</td>
</tr>
</tbody>
</table>
MODEL DEPARTMENT

The photograph here shows the side view looking from the stern of the model Thirteenth Century Man-of-War, the construction of which was considered best by the judges and the Cup which Science and Invention Magazine presents monthly for the best model was awarded to the builder, Mr. Henry O. Havemeyer, Jr. All of the shields on the model are differently decorated with the family designs of the members of the crew. These are made clear in the accompanying print.

Mr. Havemeyer, Jr., who built the model illustrated on this page and also on page 467 of this issue, where the Contest conditions may likewise be found, professes that model making is his greatest hobby. For many years, he has built and operated models of all kinds. This is but one of the many examples of his skillful use of tools and his thoroughness in reproducing historically accurate replicas.

The photograph below gives us a top view of the Man-of-War. Note that the oars, ropes and arrows are correctly placed and lashed.

Thirteenth Century Man-of-War Wins Trophy Cup No. 5

MODEL ENTERED BY HENRY O. HAVEMEYER, JR., WINS THIS MONTH'S AWARD.

The Cup is here photographed along side of the prize-winning model in this month's Contest. Notice how the Cup towers above the model. Perhaps your model will be the next cup winner. Why not send it in? Refer to page 467 for Contest Conditions.

A handsomely engraved cup is awarded monthly for the best model submitted during any month. The full conditions of the contest will be found in this issue on page 467. Is the cup not worth striving for?

Perhaps your Model will Win the Next Cup. Has it been entered?

The blueprints of all Prize Winning models may be purchased from the Model Department.

The photograph at the left gives us a side view of this remarkable little model. Close observation will reveal the extreme care exercised in its construction.
Above we see the complete details of the very excellent model of a Thirteenth Century "Man of War" which was built by Henry O. Havemeyer, Jr., and for which the judges have awarded him this month's Cup and Certificate. The entire hull is ribbed as the specifications indicate and according to the builder is an exact replica, built to scale of ships similar to those which were used in the fleet of Richard Coeur de Lion and the subsequent ruler. Notice that this vessel was steered by a rudder which is not secured to the back of the ship, but hangs down on the starboard side of the vessel. The Model Department will supply blueprints of the above vessel at 50c. See past issues for other ship models and blueprints available.
LIQUID carbon dioxide can now be obtained cheaply and easily in small steel cylinders. Following is an illustrated description of how to make "carbon dioxide snow," and with its aid to perform many very useful experiments made possible by the intense cold obtained.

The cylinder as received is only partly filled with liquid carbon dioxide, the space above being filled with gaseous carbon dioxide under great pressure.

If the valve is opened while the cylinder is in an upright position, the compressed gas merely escapes as a colorless or white vapor, being replaced by more from the liquid carbon dioxide below which boils as the pressure is lowered. The gas coming out is cool, but not intensely cold, and is rapidly dissipated into the atmosphere.

The cylinder is laid down on the floor in an inclined position with the valve end considerably below the level of the other end. This permits liquid carbon dioxide to be forced out of the valve by the pressure of the compressed gas above it. Over the valve outlet is firmly tied a woolen stocking or canvas money bag. The operator may conveniently sit astride the cylinder during the next operation.

Everything being in readiness, the operator should firmly open the valve sufficiently wide to insure the liquid carbon dioxide ample opportunity to escape, bearing in mind, too, that there is absolutely no danger in conducting this experiment. The escape of the gas is accompanied, however, by a rather terrifying loud hissing noise like that of a boiler blowing off steam, together with the production of voluminous clouds of white smoke which roll across the floor in a kind of billowy fog agreeably cool to the ankles to one walking therein. The bag or stocking becomes distended, while gas escapes at every pore, and a kind of hoar frost speedily covers it. In a moment, the bag will be found completely filled with something firm and solid. The valve is now shut off.

The contents of the bag are now shaken up on a woolen cloth, using a cotton gloved hand if necessary to detach any adhering lumps. The snow white solid material always surrounded by a halo of white vapor, is solid carbon dioxide having a temperature of -78.3° C. below 0° C. (109.2 below 0 F.)

The snow is so intensely cold that by reason of the relatively high temperature of objects at ordinary or body temperatures, they are very hot compared to it. As a consequence, the solid snow never really is in contact with objects on which it apparently rests. It behaves, in fact, exactly like drops of water on a red hot stove, dancing around on a cushion of vapor until completely sublimed, since the carbon dioxide passes directly from the solid to the gaseous state. Lumps may be safely and comfortably held on the palm of the hand or between the fingers, so long as they are not pinched.

Getting ready to make carbon dioxide snow. Note bag into which gas is to flow.

The bag is filled with carbon dioxide snow and the gas is escaping through the pores of the cloth.

Solid carbon dioxide snow.

Eating carbon dioxide snow.

Shaking snow out of the bag upon a non-conducting square of wooden cloth. Holding a lump of snow in the hand.

Fascinating Experiments With Carbon Dioxide Snow

By O. IVAN LEE, B.Sc., F.M.S.A.
of the snow dropped in. One by one, the candles will be extinguished, beginning with the lowest.

A few drops of gasoline are placed in a balsing powder tin and ignited. If a lump of the carbon dioxide snow is then dropped in the flame it will be almost immediately extinguished.

A lump of carbon dioxide snow may be safely placed in the mouth, rolling it around on the tongue so that the surface of the tongue does not get too cold in one place.

If placed on water, the lumps of carbon dioxide snow float around like little balls of cotton and slowly disappear. If a lump is pushed under the surface, a continuous train of bubbles of carbon dioxide gas arises. In no case, is any ice formed around the lumps, nor is the water sensibly cooled to the touch.

Placed on ice, the lumps disappear more slowly and melt holes in the ice.

A glass vessel is half filled with acetone, and lumps of carbon dioxide snow added. At first, the lumps melt and disappear, and the liquid foams and boils furiously, but as more snow is dropped in, the mixture becomes quiet and finally resembles a slush of snow and water. This "Slush," however, possesses a temperature of 166 degrees Fahrenheit below zero, or 198 degrees below the freezing point of water. Since mercury solidifies at forty below zero (Fahrenheit and Centigrade) a mercury thermometer is useless for measuring the true temperature and a special spirit thermometer is employed.

A drop of mercury is placed in a small paper spoon and plunged into the freezing mixture. Instantly, the mercury is frozen as hard as shot. When removed, placed on a board, and struck a violent blow with a hammer, it will be driven into the wood, where it will soon melt, leaving a hole.

A piece of pure gum rubber tubing or a rubber band immersed in the acetone solution is frozen so solid that when struck with a hammer it will be shattered into bits as if made of glass.

Experiments with Carbon Monoxide

By J. G. SCHUMAKER, A.B., M.S.

(Continued from page 330, August issue)

Fig. 13. Making carbon monoxide gas from oxalic acid and concentrated sulphuric acid.

CARBON MONOXIDE
Carbon monoxide was first made by F. de Lassone in 1776, by reducing zinc oxide with carbon.

In 1796 Joseph Priestley prepared the gas by heating iron oxide with charcoal. Though Lavoisier knew that the gas burned to carbon dioxide, it was not until 1800 that Cruikshank showed that it was a gaseous oxide of carbon. Minute traces of the gas are found in the air, larger amounts in volcanic gases, meteorites, chimney gases and tobacco smoke.

The simplest way for the young experimenter to make carbon monoxide is to set up the apparatus as shown in Fig. 15. Pour about 50 c.c. of concentrated sulphuric acid into the flask A and about 10 c.c. of formic acid (HCOOH) into the tap funnel B. Heat the sulphuric acid to about 100° C. and then allow the formic acid to drop slowly into the hot acid. Each drop of formic acid produces some carbonic oxide. The velocity of the gas flow can easily be regulated by the rate at which the formic acid is dropped into the sulphuric acid.

The same gas can also be prepared by warming gently a mixture of concentrated sulphuric acid with sodium formate or with oxalic acid (H₂C₂O₄). In the latter case both carbon dioxide and carbon monoxide are formed. The two gases are separated by passing them through solutions of sodium hydroxide (NaOH) or caustic potash (KOH). These solutions will absorb the carbon dioxide.

Carbon monoxide is a colorless, odorless and highly poisonous gas. It will burn in air with a blue flame and form carbon dioxide. The gas is a very active poison and forms a cherry-red compound with the haemoglobin of the blood which is called carbonyl haemoglobin. This fact was discovered by Priestley in 1826. This prevents the blood from carrying the proper amount of oxygen to the tissues and therefore increases the rate of respiration. Whenever moist carbon monoxide is passed over palladium black formic acid can be detected as one of the products. The same acid can be detected when a jet of burning carbon monoxide is directed against a piece of ice.

Carbon monoxide is used as fuel and as a reducing agent. The gas is generated in the flask A and passed through water. Then it is passed over hot copper oxide. The oxide is reduced to reddish metallic copper and the carbon monoxide is oxidized to carbon dioxide. The presence of the carbon dioxide is shown by the white precipitate in the flask D. Collect the rest of the carbon monoxide in E.

Metals like aluminium and magnesium when heated to a high temperature will reduce carbon monoxide to carbon and an oxide of the metal.

Nearly all of the poisonous gases employed during the World War were volatile liquids containing chlorine. Phosgene or carbonyl chloride (COCl₂) is typical of such liquids. Phosgene or carbonyl chloride (COCl₂) is typical of such liquids. It is a liquid which vaporizes at 8° C. Fill one cylinder with carbon monoxide and the other with chlorine. Place the cylinders mouth to mouth and allow the gases to mix. The color of chlorine gas permeates both cylinders. Then cover each with a glass plate and expose one of them to strong sunlight. The color of the chlorine will disappear rapidly. Phosgene has been formed.

If the glass plate is removed from this cylinder, the gas begins to fume strongly because the moisture in the air causes the phosgene to decompose into hydrochloric acid and carbonic dioxide.
A Practical High Frequency Coil

By WILLIS L. NYE

TO the experimenter who builds a Tesla-Oudin coil one of the finest uses is to test insulation of all sorts. This is quite useful and helpful, especially to the transmitting amateur who has leaky insulation in his antenna system which would cause his antenna current to fall to a low value and cause a weak signal. The Tesla coil is hooked on to the antenna and the power applied to the antenna. The coil will energize the antenna and if the insulation is at fault the flashover will be apparent at once if it is performed in the dark. The guys and fastenings of the pole should all be explored very carefully with a neon tube spark plug tester which will glow when it comes in the presence of a high-frequency current. If the insulation is leaky the brush discharge will be to the ground and can at once be found either by glow or exploring with the neon tube. With this method of inspection the leaks in the radiating system of a transmitter can be remedied. Of course it is to be expected that the antenna current will be small while the system is supplied by the Tesla coil and should not be expected to assume large proportions. It should be tested along with the grid leak. Apply one terminal of each of the apparatus mentioned to the high potential terminal of the coil and apply the power. In this way one can see the actual comparison of the insulation qualities of several materials. This is valuable to any one who is using high-frequency current and needs to know the proper insulation. It would be well to test ordinary porcelain insulators that are used for A.C. house current and make an actual comparison.

The Geissler Tube experiments are varied and the wonderful glow effects that can be obtained need not be detailed here. A test of the breakdown capabilities and their resistance of high voltage condensers can be performed very nicely with this apparatus. The condensers are inserted in the line in the usual way and the high voltage applied. It would be well to test some of the fixed variety that now flood the market for radio use.

Bakelite, Celeron, and Formica used for panels for radio purposes should be given a good test for their breakdown to the current.

OTHER TESTS AND EFFECTS

Another test to perform is to fasten insulated wire, varying from No. 36 enamelled to No. 16 enamelled, and determine which will give the best discharges. The length should also be varied to find out which is the proper wire to use. Generally a wire
How to Make a Spinthariscope

By RAYMOND B. WAILES

A picturesque presentation of the bombardment from radium. This action of radio activity lasts for many many years and if we had radium in quantity it would be a very uncomfortable substance because the bombardment or properly speaking radio activity would have a bad effect analogous to burning upon anybody exposed thereto.

Removing a minute speck of radio active material from the hands of a luminous clock. It may be three times the bulk of the head of a pin.

strikes a small particle of the zinc sulphide, a miniature explosion results which can be clearly seen with the aid of a short focus, fairly strong, magnifying glass.

In making the spinthariscope, some of the luminous material from the hands of a luminous clock or watch should be carefully removed with a knife blade. The quantity taken should be about three times as large as the head of a pin, so it can be seen that the effective luminosity of the clock will not be impaired in the least. The bit of material should then be worked up with a tiny amount of glue, spar varnish, colloidon, or even water if desired, and applied to a card such as an ordinary visiting card. To complete one form of spinthariscope, a small magnifying glass of the linen-tester type is placed over the luminous material applied to the card, to be viewed in the dark. The scintillations or miniature explosions which the alpha rays, or ionized atoms of helium as they should rightly be called, make in their collision with the zinc sulphide, can be distinctly seen through the lens.

Another type of spinthariscope which operates somewhat better than the linen-tester type can be made from the "floroscopes" or microscope-like magnifying glasses sold by some jewelers and novelty dealers. These instruments have two lenses, one at each end, at one end is a cubic lens of extremely short focal length, in fact so short that objects have to be placed directly on the plane surface of the lens to be "in focus." To convert this type of magnifying glass into a spinthariscope, it is only necessary to apply the speck of radium-luminous material mixed with the adhesive directly upon the face of the lens, so that it is "in focus. The effects are seen in a darkened room.

To get the best results from this little scientific apparatus, the eyes should be accustomed to the dark by having the observer remain in the darkened room several minutes before attempting to view the little explosions caused by the helium atoms which are constantly being shot off from the minute specks of radium mixed into the luminous composition.

The instrument will last for years if care is taken to prevent anything from coming into contact with the luminous surface.

Wanted!

The Editors of Science & Invention want interesting articles on electricity from the experimental standpoint to be accompanied by illustrations. The illustrations may be rough drawings, or sketches or photographs, and our readers can supply us with the best of materials that they have on hand. We pay our regular rates for these articles upon publication.

Transferring the luminous material mixed with varnish or glue to a card. Spar varnish is an excellent material for the purpose.

Purer Iron Produced Electrically

Pig iron is now the basic form from which all types of iron and steel are made but it may become obsolete and the direct manufacture of suitable iron and steel from ore may follow the invention of a special electric furnace of commercial size that has been built in the great Hagfors, Stockholm, Sweden. Ironworks where iron ore and coal mixed and fused have been made to produce pure iron containing only two per cent. of carbon, and steel that can be worked in the usual manner.

The new process is continuous and fusion ceases only temporarily when the furnace is tapped, while the absence of gases and slag produces a superior product.

The United States leads the world in the number of electric steel furnaces in use, and with the discovery of a process of making iron and steel directly from ore would give a tremendous impetus to the use of the electrical smelting furnace.
Automatic Soldering Iron Holder

By THOS. W. BENSON

IT is very easy to forget that a soldering iron is plugged in and go away leaving it on overnight after a job of soldering is done. Having done this several times, by blowing out the iron, the writer devised and built the holder illustrated herewith and the iron is now always remembered.

The base of the device was a small wooden box 12 inches long and 4 inches square to be secured to the wall as shown. A hole one inch square was cut in the front of the box three inches from the upper end and a support of spring brass for the soldering iron of the shape shown was supported in this hole by a bent brass bracket made from 1/16 inch brass strip 5 inches wide. This forms a spring support that is normally close to the top of the hole but when the iron is hung on it the spring is pulled away from the contact mounted inside the box as shown.

A porcelain socket is mounted on the top end of the box, and there is a snap switch one inch square plug outlet on the front near the bottom. The wiring diagram and other details are given so that it should be easy for anyone to duplicate the device. In operation the iron is left plugged in and hung on the forked hook. When a soldering job is to be done the current is switched on with the snap switch when the light will light up. If the iron is wanted in a hurry it is removed from the hook, cutting off the light, and laid on some non-conductive object on the bench. As the work progresses, the iron is hung on the hook when not actually in use which automatically connects the lamp in series with it. Thus, there is no actual use of the current through the iron is reduced to such a value so as to just keep it hot without overheating and full current is switched on when the iron is lifted from the hook. Should one attempt to leave the current turned on when the work is over the lamp will light and draw the iron's attention and is then being switched off. The proper size of lamp to use will vary with the size of iron. For the small irons used in radio work a 60-watt lamp is large enough, but a 100-watt lamp of the carbon type should be used with the larger irons.

Part II. Experiments With An Electroscope

(Continued from August SCIENCE and INVENTION)

Among the earliest experiments in electricity, the electroscope was used a great deal in detecting the electrical charge upon bodies. Even today this instrument has not been obsolete with the voltaic pile, the cumbersome Whimshur machine, thermal batteries and the like. In fact it has been brought to the front in several fields, in one of which especially, that of radioactivity, it is of great importance. The instrument is very easily made and the experiments described here to be performed with it will afford many interesting hours.

The writer's electroscope was encased in or built upon a small box five inches square, which formerly housed a crystal set. The interior of the box with the exception of the open end was lined with copper foil, such as soldered panel shielding. A binding post connects with this foil lining. A hole about an inch in diameter was bored through the right hand side of the box. This served to support a rubber stopper through which the stopper in turn carrying a three-inch machine screw which in turn carried a binding post at each end, one for external connection and the internal one for supporting a panel of brass. This inside brass panel has a "L" hook soldered to it, one arm of the hook being the double inverted type of binding post upon the inside of the box. The brass panel supports the little strip of gold leaf which can be procured from a sign painter, or Christmas tree tinsel can be used. The foil strip should be about an inch and a quarter long and about a quarter of an inch wide. It is attached to the upper end of the brass panel by means of a minute drop of shellac.

The rubber stopper serves to insulate the internal workings from the wooden case and from its inner copper lining. The external binding post serves to carry a little umbrella device made from a length of stout copper wire five inches long to the top of which is soldered a circle of copper three inches in diameter. This plate acts as a receiver for any of the charges in experiments, a sort of aerial, as it were. A glass front completes the instrument, protecting the sensitive gold or tinsel leaf from stray air currents.

To show that friction produces a current of electricity, stroke a rubber comb through the hair, or some fur, touch it to the receiving plate, then still keeping the comb to the plate, touch the plate with the finger, remove the finger and then the comb. The leaf will be seen to diverge or stand away from the brass panel—it is now charged. Upon now touching the plate, the charge will escape through the hand and the leaf will fall against the brass panel. By quickly whipping the external binding post with a silk or cotton handkerchief, the leaf can be made to diverge, showing that a current has been made by the friction.

The leaf can be made to stand out when dry sand is allowed to fall upon the receiving plate through a funnel. The sand particles striking one another become electrified and impart their charge to the leaf. If flour be sifted upon the plate when the instrument is discharged, the leaf will diverge with tremendous force at the very first impingement of a tiny particle of flour; so it could be said that every kitchen is a miniature power plant.

If a metallic dish containing several drops of mercury is placed upon the receiving plate and the breath blown through the mercury to agitate the drops, the movement will cause a generation of electricity and the leaf will diverge. If the mercury is pure, a negative charge will be imparted to the leaf, while if only a trace of an impurity such as zinc, cadmium or other metallic compounds are present in the mercury, a positive charge is imparted.

It will be found that a charged electroscope will slowly become discharged if left untouched, the charge leaking through the air. The very rapid current which can be noted when a lighted candle is brought near the charged electroscope. The flame causes the air to become ionized, or conductive and the neural charge leaks off with a greater rapidity.

25,000,000 C.P. USED NIGHTLY FOR "WHITE WAY" SIGNS

Flashing 25,000,000 candlepower of light against the sky each night, New York's "White Way" is literally "the brightest spot on earth," it is revealed in the report of an electric sign survey made public by Arthur Williams of the New York Edison Company in connection with the opening of the fourth annual electric sign show held in the company's building at Fifteenth Street and Irving Place. The Edison Company's survey showed that the 17,000 electric signs on Manhattan Island below 135th Street more than 2,800 are restaurant signs, more than 1,300 are barber shop signs, more than 1,000 advertise tobacco, 867 are clothing advertisements, 763 advertise automobiles and their accessories, and 728 theaters take 7th place with 706 electric signs.

Mr. Williams' report shows that approximately 5,000 electric signs were added to New York's night skyline in the last year.
THE CONSTRUCTOR

Constructing An Inlaid Checker Board

By H. L. WEATHERBY
Director of Manual Arts of Public Schools of Montgomery, Ala.

THERE construction of an inlaid checkerboard is not as difficult as it might appear at first glance. It is not really an inlaid board as we think of inlay ordinarily. The small pieces are built up rather than inserted and even the novice might feel proud of his wares. A checkerboard such as the one illustrated in the photographs may be tackled by the game, need not be afraid to tackle the job of building a checkerboard such as the one illustrated.

A machine saw, although not absolutely essential, is desirable for cutting the pieces since more accurate work may be done in that way. However, the veneer from which our squares are made can be cut entirely by hand with a good straightedge and a sharp knife and the remainder of the processes call for no particular tools or apparatus.

The materials called for are as follows:

1. Piece of 1/16-in. sawed veneer, about 12 in. x 16 in. of black walnut, mahogany, or other naturally dark colored wood.
2. Piece of the same size in a good grade of hard white wood, holly, maple, or even a good white hard poplar will do. The above mentioned pieces go to make up the squares.

Now we need a couple of yards of inlay line. This may be purchased in any design desirable from houses handling this type of material, at very small cost.

We will next need a piece of veneer about 6 in. x 16 in. which we will cut into four strips for the border. A piece of walnut or mahogany veneer for the header and a 3/4 in. 3-ply panel; each to be about 16 in. square completes our material list with the excep-

Figure 1. Saw both pieces of veneer for the squares into strips one and one-half inches wide with the grain, using a smooth-cutting saw. In case a machine saw is not available a sharp knife and a straightedge may be employed. In the real sense of the word, this is not an inlaid checkerboard, but really a built-up checkerboard which, when finished, will well repay the maker for the small amount of effort required in its construction.

Figure 2. Tack these strips to a flat board using small brads, driven in only a short way, alternating white and black woods. Glue narrow strips of paper along the joints. Any good wrapping paper will do. Line the ends up against a thin strip of wood. Allow twenty-four hours for glue to set. Walnut, mahogany or other naturally dark-colored wood forms the dark squares and holly or maple makes the light-colored squares of the checkerboard.

Figure 3. Saw the square thus formed into strips one and one-half inches in width across the grain. There will then result strips of wood one and one-half inches in width made of alternate black and white squares. By reversing each piece of wood, end for end, not upside down, the pattern is easily formed.

Figure 4. Tack and tape these strips as in step number 2, being careful to alternate the strips so that the squares come right—that is so that a white square comes next to a black square.

Figure 5. Mitre the inlay line and border, being careful to get good fitting corners. Tack these around the main part of the board in position and tape. This taping should all have been done on one side.

The above diagram illustrates in detail how the checkerboard is made. By following the stages illustrated in the photographs the novice should have no difficulty in reproducing the same.

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MATERIAL

1. Three ply panel 1/8 square.
2. Pieces 6 veneer, black wood, 12 x 16 in., squares
3. Pieces 6 veneer, white wood, 12 x 16 in., squares
4. Hard inlay line
5. Veneer material for border, 1/4 in.
6. Veneer or moulding, or material for same

CHECKER BOARD-INLAI

VENEER BACK

3-PLY PANEL

MOLDING

SQUAIRES

12 x 16

INLAY LINE

BOARD

The above diagram illustrates in detail how the checkerboard is made. By following the stages illustrated in the photographs the novice should have no difficulty in reproducing the same.
tween coats, and then finally two coats of rubbing varnish, allowing a couple of days for drying between varnish coats and then rubbing with pumice stone and oil, or pumice stone and water.

The back side should be covered with a piece of felt which should be glued on, as a protection to the furniture on which the board is placed. If directions are carefully followed the results will be very gratifying, and a checker board fit for a family heirloom will be the result.

The photograph below shows the finished checker-board, the construction of which is here described.

**Rotary Hand Saw Made from Small Motor**

**Figure 6.** The above photograph shows the reverse side of Figure 5.

tion of four mahogany pieces 7⁄4 in. x 11⁄2 in. x 14 in. for the frame. A piece of veneer must be glued to the bottom side of the board to correspond with the squared or top side in order to overcome a tendency toward warping.

The processes of construction are very clearly illustrated by the photographs. After the final assembly the whole board is given a coat of hot linseed oil as a protection and also to enrich the natural colors of the wood, then a couple of coats of white shellac, rubbing lightly with very fine sandpaper between coats, and then finally two coats of rubbing varnish, allowing a couple of days for drying between varnish coats and then rubbing with pumice stone and oil, or pumice stone and water.

The back side should be covered with a piece of felt which should be glued on, as a protection to the furniture on which the board is placed.

If directions are carefully followed the results will be very gratifying, and a checker board fit for a family heirloom will be the result.

**Figure 7.** The parts are now clamped together for gluing.

**Figure 8.** Now glue the parts together with the square of plain veneer on the bottom, the piece of 3-ply panel in the middle, and the squared veneer on top, exerting all possible pressure with the clamps. Be sure not to try gluing the taped side to the panel. Allow ample time for glue to thoroughly set, then scrape paper off and sandpaper.

**Figure 9.** Make up the frame either with a combination plane or with the circular saw. Nail and glue the mitre corners together, then fit the board into the mitre and the frame and glue into place.

**Figure 10.** The finished frame at the left.

**Figure 11.** The finished checker board, right.

**Figure 12.** The photograph below shows the finished checker-board, the construction of which is here described.

**Rotary Hand Saw Made from Small Motor**

**Figure 13.** The diagram at the left shows how a motor-driven circular saw can be easily constructed. Great care should be taken to see that the saw runs in the direction of the arrows, because in this way it will cut down into the wood; whereas if it rotated in the opposite direction it might run away from the work.

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**Figure 14.** The diagram at the left shows how a motor-driven circular saw can be easily constructed. Great care should be taken to see that the saw runs in the direction of the arrows, because in this way it will cut down into the wood; whereas if it rotated in the opposite direction it might run away from the work.

**Figure 15.** The diagram at the left shows how a motor-driven circular saw can be easily constructed. Great care should be taken to see that the saw runs in the direction of the arrows, because in this way it will cut down into the wood; whereas if it rotated in the opposite direction it might run away from the work.

**Figure 16.** The diagram at the left shows how a motor-driven circular saw can be easily constructed. Great care should be taken to see that the saw runs in the direction of the arrows, because in this way it will cut down into the wood; whereas if it rotated in the opposite direction it might run away from the work.

**Figure 17.** The diagram at the left shows how a motor-driven circular saw can be easily constructed. Great care should be taken to see that the saw runs in the direction of the arrows, because in this way it will cut down into the wood; whereas if it rotated in the opposite direction it might run away from the work.

**Figure 18.** The diagram at the left shows how a motor-driven circular saw can be easily constructed. Great care should be taken to see that the saw runs in the direction of the arrows, because in this way it will cut down into the wood; whereas if it rotated in the opposite direction it might run away from the work.

**Figure 19.** The diagram at the left shows how a motor-driven circular saw can be easily constructed. Great care should be taken to see that the saw runs in the direction of the arrows, because in this way it will cut down into the wood; whereas if it rotated in the opposite direction it might run away from the work.

**Figure 20.** The diagram at the left shows how a motor-driven circular saw can be easily constructed. Great care should be taken to see that the saw runs in the direction of the arrows, because in this way it will cut down into the wood; whereas if it rotated in the opposite direction it might run away from the work.

**Figure 21.** The diagram at the left shows how a motor-driven circular saw can be easily constructed. Great care should be taken to see that the saw runs in the direction of the arrows, because in this way it will cut down into the wood; whereas if it rotated in the opposite direction it might run away from the work.

**Figure 22.** The diagram at the left shows how a motor-driven circular saw can be easily constructed. Great care should be taken to see that the saw runs in the direction of the arrows, because in this way it will cut down into the wood; whereas if it rotated in the opposite direction it might run away from the work.

**Figure 23.** The diagram at the left shows how a motor-driven circular saw can be easily constructed. Great care should be taken to see that the saw runs in the direction of the arrows, because in this way it will cut down into the wood; whereas if it rotated in the opposite direction it might run away from the work.

**Figure 24.** The diagram at the left shows how a motor-driven circular saw can be easily constructed. Great care should be taken to see that the saw runs in the direction of the arrows, because in this way it will cut down into the wood; whereas if it rotated in the opposite direction it might run away from the work.

**Figure 25.** The diagram at the left shows how a motor-driven circular saw can be easily constructed. Great care should be taken to see that the saw runs in the direction of the arrows, because in this way it will cut down into the wood; whereas if it rotated in the opposite direction it might run away from the work.

**Figure 26.** The diagram at the left shows how a motor-driven circular saw can be easily constructed. Great care should be taken to see that the saw runs in the direction of the arrows, because in this way it will cut down into the wood; whereas if it rotated in the opposite direction it might run away from the work.
**Unique Knockdown Settee**

In the drawings shown directly above, all of the necessary dimensions and details for the construction of this unusual and handsome settee are shown. The carpentry work required is very simple and can be performed by anyone who is at all handy with ordinary woodworking tools. There is no undesirable complication.

**Power Driven Ice Cream Freezer**

The tedious work of making ice cream with a hand type of freezer can be eliminated by converting the freezer into a power type, using the system suggested in the illustration at the right. To do this, a long shaft is coupled to the regular freezer shaft and a 10 inch gear is fastened to the free end of the new shaft. This is then meshed with a 1/2 inch gear, which is on a shaft driven by means of a 6 inch pulley; this is belted to a 2 inch pulley, driven by a 1/4-horsepower motor. By following these general details and providing suitable bearing and shaft supports, the results obtained will be most satisfactory. Of course, other methods of driving the freezer from an electric motor can be devised, but in any event, the gearing ratio must be such that the dasher in the freezer is turned at a comparatively low rate of speed. This is furthermore important in order that two great a load is not placed on the motor. Also, a chain drive can be substituted for the belt drive if desirable or more feasible.

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*H. W. Secor*
HOW TO MAKE IT

AUTOMATIC FISHING BOAT

The model boat above carries a phonograph motor which automatically hauls in any fish which nibbles on the trigger line.

Motors shown at left. Any sort of trigger release may be attached to the governor brake.—R. J. McHale.

TWO USES FOR YOUR WATCH

A number of practical uses can be found for your watch if you remember that each minute division on the dial represents an arc of 6 degrees. Its use as a protractor and direction indicator is shown by the photograph above. The arc between each consecutive numbers equals 30°.—H. E. Benson.

With the aid of an elementary knowledge of trigonometry, the figures on a watch dial may be used to find out the distance across a stream. The Pythagorean hypothesis (BC = AC + AD) is used here.—Charles Rugler.

NOVEL LAMP MOUNTING

If the lamp is suspended within the shade by means of a three-arm disk a shown at the right, it may be easily removed and carried about. The disk is held in place by its own weight, but it may be modified so that it clips to the top of the shade.—J. T. Hurley.

Printed letters are pasted on wood and cut out with a band saw. The letters are placed in proper position on the surface to be lettered and pressed down tightly. An air brush is used to lay in the background color. The use of an air brush rather than a paint brush, and the pressure exerted on the blocks, prevents the paint from intruding under them. When the block letters are removed, the background color originally painted on the body will show through the air brush coating. Inexpensive duplications are obviously simple.—G. A. Luers.

USE FOR OLD INSULATORS

Telephone-wire glass insulator knobs pushed onto the legs of the kitchen chair will make it hard to tip over and more easily slid around. If the chair is made of soft wood, they may be screwed on.—J. R. Malloy. Rep. No. 12,257.

LETTERING AUTO BODIES

Printed letters are pasted on wood and carried about. They may be easily removed from the casing, showing the two mirrors; on the right, the complete instrument, with the scale and indicating lever at the top. The operator looks through an opening at the top and perceives the image in the two mirrors.—C. A. Oldroyd, Rep. 4433.

SMALL MICROSCOPE

A magnification of 300 diameters may be obtained by the use of a melted sugar lens in the small microscope above. High illumination is necessary because of the very small size of the lens.—E. L. Richardson.

RANGE FINDER FOR SNAP-SHOT CAMERAS

The drawing shows the series of levers which operate the mirror in the range finding device. The scale of distances may be easily seen in the photograph to the right and the relative positions of the rest of the mechanism located.

On the left, the internal mechanism removed from the casing, showing the two mirrors; on the right, the complete instrument, with the scale and indicating lever at the top. The operator looks through an opening at the top and perceives the image in the two mirrors.—C. A. Oldroyd, Rep. 4433.
WRINKLES
RECIPES & FORMULAS
Edited by S. Gernsback

TO REFILL BURETTE
Blow in tube A until solution is above zero mark in the burette. Lower end of tube B is even with zero mark. Excess solution siphoned back automatically into the stock jar. Tube C must always be partially submerged. — David N. Roush, Rep. No. 1017.

FORKED BOTTLE OPENER
By cutting off two tines of a fork may be made. The fork may be used for its usual purpose as shown at the right. — Juan Batista.

USE FOR BOTTLE TOPS
Old crown cap bottle tops may be attached to the handles of carpenter's tools to prevent the handles being split by hammering. Smooth down sharp edges to prevent cutting hands. — Wilson G. Walters, Rep. No. 6385.

TO REPAIR KNIFE
Fill cavity in handle of kitchen knife with paste made of 3 parts resin and 1 part powdered pumice stone. Insert red hot prong of knife blade and it will stay put. — Nina Jeffers.

LUBRICATING LOCK
Graphite powder made from pencil leads if blown as shown, into a generous lock, will lubricate it thoroughly. — Wendell Rich.

TO MELT STEEL
Touch a stick of sulphur to a red hot piece of steel and it will melt as easily as lead. Iron if heated white hot will act the same way. — Vernon Miller.

KEEP THEM IN
A good way to secure the contents of a mailing tube is to sew up the ends with two stitches as shown above. — Arthur A. Blumenfeld.

6-VOLT SOLDERING IRON
Carbon-tipped brass rod inserted into porcelain insulator makes efficient 6 volt contact soldering iron. — W. Codder.

GREASE REMOVER
Dissolve 1 oz. pure pearl ash in 1 pint salt water, add 1 lemon cut up small. Keep open in a place 2 days, strain and bottle. Saturate grease spots with liquid and wash out with clear water. — John H. Varley, Rep. No. 19629.
CAME THE DEAD BE RE-UNITED?

The Editor's recent article in Science and Invention, "Can the Dead Be Re-United?" has been read and after much thought and study of the subject has found no evidence of any substantiated cases. It is also my opinion that such a device would be a waste of time and energy. The idea of communicating with the dead is not new and has been attempted by many throughout history. However, there is no scientific proof that such a device could work. Therefore, I believe that this is a subject that should be left to the realm of imagination and not given serious consideration.

W. STUART LEECH, M. D.
Kearney, N. Mex.

(You may be absolutely correct in your statement to the effect that the union of discarnate souls is one of the greatest subjects for that realm of imagination commonly called the supernatural. For my part, I am more convinced than ever that such a soul or any one in the spiritual world is the result of a delusion. I am convinced that the soul or any one in the spiritual world may be sincerely questioned, and if we are to believe in the existence of such a soul, it is only through the medium of our physical Price Contest has brought to light a theory of the soul which is absolutely untenable. For instance, the Invention Magazine has offered a prize of five thousand dollars for the best theory of the soul, and there have been only two entries. One of these was a theory that the soul is a mere byproduct of the brain, and the other was a theory that the soul is a mere byproduct of the heart. Both of these theories have been proven fraudulent and have been withdrawn from consideration."

LIFE BOATS FOR SUBMARINES

Editor, Science and Invention:

In your recent edition of Science and Invention, you wrote an article on "Safety on Subma-

The great Light or Fireic Fire produces the ideal and physical light, known to us as vibratory and exists in all things being much closer to us than our hands and feet, for it inter-

the contained manufacturing and mechanical processes. The physical light cannot be present without the or its Spiritual Father for it emanates the idea producing the vibrated or the physical light. The Ego withdraws with the mind and with the light and chemical ethers these eastern impressions.

H. G. WELLS.

the greatest living author of scientif-

magazine, ALL NEWSSTANDS.

DISLIKES TORTURE METHODS

Editor Science and Invention:

I have read every scientific and mechanical magazine, including books treating upon the subject of torture, and have found no satisfactory method. If you have any such method, I shall be glad to hear from you.

R. BRADFORD RUSSELL.
New York City.

The latest issue of "Ancient Torture Methods," has been published and for the present there will be no more of those articles."

H. G. WELLS.

the greatest living author of scientific, will be found every month, with one of his thrilling tales, in AMAZING STORIES. Be sure to read the copy this month.

ANOTHER COPY. C/O Science and Invention Magazine, 53 Park Place, New York.
Radio Control of Passenger Planes

CONSIDERING the recent activity in commercial aviation and the realization of its possibilities shown by the American experts in the past year, it should be interesting to the reader to describe the methods of communication between planes used by one of the largest foreign companies, The Imperial Airways, Ltd., with headquarters at Croyden, a suburb of London, operates Continental air routes between Paris, Brussels, Amsterdam and other important cities, carrying passengers and freight at a very moderate rate. This company very soon found it necessary to provide some means of warning its pilots of bad weather conditions which they might unexpectedly run into with disastrous consequences. On the advice of the Air Ministry, they decided to equip each plane with a complete radiophone receiving and transmitting installation, and to provide means at the home field for keeping in constant communication with every plane. The weather reports are received at the control tower of the Croydon Airdrome by radio from the pilots of the planes, and from various observation posts throughout the continent. Here they are bulletinized (see photo) for the benefit of outgoing pilots and passengers and are phoned to the planes in flight once every half hour. In the upper right-hand photograph the airdrome manager is shown reading a chart which has just been checked. He is giving the pilots instructions through his assistant whose microphone is connected direct to the broadcast transmitter shown in the lower right. Above the operator of the transmitting unit may be seen six separate panel units. Each one of these is a receiving set which is permanently tuned to the wavelength of one of the flying stations. The operator on duty at the central station is constantly on the watch for signals from the planes, which he relays through telephone lines to the control tower. In connection with this, it is interesting to note that a similar system of communication has been experimented with to some extent in this country for communication between moving railroad trains. While the system has never been developed to the point of great utility, we may soon expect to equal our English friends in communication efficiency, as laboratory tests have proven the idea quite feasible.

Transmitting apparatus used at the Airdrome for communication with planes in flight is shown at right. The planes of the company are in constant communication with the home field and with each other and receive reports from headquarters in exchange for hourly bulletins as to flying conditions in their area.

The Weather Report Board at the Croydon Airdrome is shown at left. Here British aviators before starting flight get detailed information on weather conditions in their path. Reports are also transmitted to the pilots in flight from the control tower every half hour using the apparatus shown in the photo at right.
WRNY Celebrates Its First Birthday
By CHARLES D. ISAACSON

YES, thank you, WRNY is one year old and doing very nicely. WRNY had its birthday party and there were gay doings; you should have been there. In all probability you were—over the radio. I wonder if any of my readers stayed all through it. I myself was exhausted when it was over, but I danced to the last lingering dance, about two in the morning.

It was a great day: June the 12th, and WRNY just one year old. Grant Mitchell made the cleverest speech of the day. He came over from his successful play, "One of the Family," in which he is starring, to join the theatrical unit; there being units from every walk of life to pay respect to the station. Grant brought a present; it was a small card in which it was a birthday card. Grant said he had a hard time procuring the right kind of card, because the card-seller did not know what sex a radio station is supposed to be. Grant declared that WRNY is a lusty baby in any event, and that probably the reason is that it is out in the air all the time!

Dr. Lee de Forest made the most complimentary speech. The father of radio broadcasting was present at the very birth of WRNY and has watched it through these trying months of its infancy. So he spoke with a great deal of godfatherly pride.

We began with a group of smart youngsters from the National Stage Children's Association, who had previously entertained the President at the White House. Then some of our leading authorities in the women's hour; Ruth Conne on Fashion, Mrs. Mary Fanton Roberts on Arts and Decoration, Mrs. Rose V. S. Berry on Painting and Sculpture, and so on down the long list—each took two or three minutes to administer just a capsule of thought and entertainment.

By noon we felt sufficiently educated, and a whole hour of the wildest, maddest, merriest, bluest and reddest popular and jazz music rent the air. Dr. de Forest was listening and I am wondering what he thought of his responsibility as the father of broadcasting. In any event the young folks, who adore this phase of WRNY's entertainment, sent in dozens of added requests. After luncheon, we returned for a matinee, in which a dozen of WRNY's finest ensembles came in for a fifteen-minute show. Talk about your continuous performances! Now it was grand opera; now it was an instrumental trio; now it was a real concert imported right from Carnegie Hall; now a little army of violinists playing in unison.

At twilight, the members of the Radio Theatre Players, having finished their own Saturday matinees, dashed over to WRNY with a lift in the form of a play "The Surprise." Olive Wyndham was the guest star, and James Durkin, a well-known director, was another guest. Well, from then on, it was a case of one celebrity after another. (Continued on page 462)
THOSE who “roll their own” when it comes to radio sets surely will not stop at building their own cone type loud speaker, especially now since very excellent parts are available upon the market. The unit proper, of course, cannot readily be made by the average experimenter since it requires a great deal of mechanical skill and the use of precision machinery, to say nothing of engineering ability for the electrical and mechanical design of the instrument.

An exploded view of the most essential parts of the cone type loud speaker is shown in the above diagram.

If a regular draftsman’s compass with an extension beam is not available, the circle for the cone may be laid out by means of two pencils and a piece of string.

Cutting out the cone, however, and assembling the parts may be successfully done by the layman and affords an evening of genuine fun and real satisfaction as well as effecting a substantial saving in the price of the speaker.

The first step in the assembly is to describe a circle of the proper diameter upon the parchment paper. The average man probably does not possess a draftsman’s compass with an extension beam, and will therefore have to resort to some other means for making an accurate circle. Two pencils and a piece of string make a very good substitute for a compass. This scheme is shown in one of the photographs on this page. After the circle has been described, a sector is laid out, the exact size depending upon the size of the cone. After cutting away the sector the cone is formed and glued together along the edges formed by the removal of the sector.

The next step is to solder the connecting rod onto the diaphragm. In order to accomplish this the diaphragm is either scraped or sandpapere clean at the center. Great care must be taken not to bend the diaphragm at any point. The exact center of the diaphragm is determined either by means of a combination square or by trial with a compass. The connecting rod is then placed in position and soldered on, care being taken that the rod is as nearly as possible perpendicular to the diaphragm. Only sufficient solder should be put on to firmly hold the rod in place. Too much solder loads the diaphragm unnecessarily and causes the speaker to reproduce poorly. The solder should be evenly distributed around the connecting rod in order to avoid unbalancing the diaphragm.

The connecting rod bushing, the cone-shaped washers and the tightening nut are now mounted on the front cone and the supports for the unit on the back. The horn type of speaker in its usual form must have a place to stand upon, and it is as a rule, placed on top of the receiving set. This often gives rise to a loud humming sound, caused by the mechanical vibration of the tubes. The remedy is to place the speaker at some distance from the set. This practice generally makes necessary the addition of an extra table or stand for the horn. The cone speaker described in this article requires no place to stand upon. In fact, it may be conveniently suspended from a nail or hook in an inconspicuous spot on the wall. A design may be painted on the cone to add to its attractiveness.

The completed cone is shown here suspended from a nail located in a convenient spot on the wall.
Building a Good Box Loop

By HERBERT E. HAYDEN

The outline of the loop end is laid out on a smooth piece of 3/4" whitewood by marking around the edge of a template accurately cut to size from cardboard.

Place the end piece in a vise, being very careful not to dent the wood by too much pressure, and carefully cut out the notches.

Use a sharp knife to even up the notches so that the loop wire will not be damaged when threaded through them.

Three small holes are then drilled in the upper end piece to pass screws fastening it to the dowel sticks.

The two small screw holes and one 3/4" hole to pass the center dowel stick are next drilled in the lower end piece. The center hole should be only slightly larger than the dowel.

The drawings above should be very carefully followed, with the exact dimensions given. Lay out the cardboard templates full size.

(Continued on page 477)
THE "B" eliminator illustrated in these columns and constructed by Mr. L. A. Brans of Brooklyn, N. Y., proved to be such a success that it was greatly sought after by exhibitors at one of the recent radio shows for demonstration in their booths. This eliminator is one that is so versatile in character and is of such neat construction that the underlying ideas should appeal to everyone interested in radio from any angle whatsoever.

A few facts as to what this eliminator will do will not be amiss here. First, as will be noted from the photograph and diagram two Raytheon tubes (R) are used so that an extremely high voltage can be rectified. Then, variable resistances are available for controlling the out-put to the detector, the radio-frequency amplifiers, the audio-frequency amplifiers and for calibrating the voltmeter. Switches are incorporated so that high or low voltage outputs can be obtained. The milliammeter can be cut in or out of the circuit and the output voltage can be changed quickly and easily. Signal lamps are connected in the circuit to show whether high or low voltage is being supplied.

The power supply part of this "B" eliminator consists of two standard center tap transformers (T) of the type designed for use with the Raytheon tube. There are several of these on the market today, but those illustrated combine every desirable feature. They are small and compact and are completely cased in a metal box, which not only shields the coils but protects them from physical damage. Also very convenient soldering lugs are placed near the base of the instruments so that all wiring can be kept low and out of daunger. These transformers are easily mounted, and are especially neat in appearance. Each one supplies current to a single Raytheon tube. Of course, a m.f. fixed condensers (C) to take care of line surges must be shunted across the secondary. This is standard practice.

The outputs are wired to a particularly interesting multiple switch, which was specially constructed by Mr. Brans from standard practice. Probably by shopping around, a manufactured switch can be found that will do the work. It must, however, give the effect of three different switches. Two are to be of the single-pole, double-throw type, and the other of the single-pole, single-throw type. The single-pole, double-throw switches are so connected in the circuit as to enable the operator to change from high to low voltage output instantaneously. It will be noted that what this does is to place only one Raytheon tube in the circuit, or to connect both tubes in series so as to give a double output. It also controls the input. By using this system, voltage outputs of approximately 160 and 320 volts can be obtained.

When switch S is in the low voltage position, switch S1 must be arranged so that its contacts will be open and S2 must be on contact A. When S is in the high voltage position, S1 must be closed and S2 on contact B. In front of the lamps controlled by S2 are green and red bulb's eyes. When the green light shows, low voltage is being used, but when the red light shows, the power supply is being used for high voltage.

In building "B" eliminators it must be realized that high power is being dealt with, therefore, certain precautions must be taken, and one of the most important is in connection with the input circuit. It is a very good idea to use a circuit breaker in series with the 110-volt line and this is indicated by "CO" in the diagram. This instrument is now available on the market and is of a type that opens when a load of over 3 am- peres acts upon it. Thus, if a short-circuit takes place anywhere in the eliminator, this circuit breaker will immediately open and prevent any damage being done to the "B" eliminator apparatus or to the house fuses. This circuit breaker is a decided advance in safety for "B" eliminators. It also acts as a line switch to turn the eliminator on and off.

On the front panel of the eliminator is mounted a standard electric light plug-receptacle. This is for easy and convenient connection to the house lighting circuit, and can be of any type ranging from the crude porcelain to the elaborate flush type plug receptacle. See X in diagram. In order to determine just what current is being drawn by the complete receiver, Mr. Brans inserted a milliammeter in series with the high voltage amplifier lead. This milliammeter can be left in the circuit at all times if so desired. A voltmeter has also been incorporated, but it is rather a superfluous accessory for the average amateur, and need not be used. It is shown in the

In the diagram above, notice the compound switch, S, S1, S2, for change-over from low to high voltage. The voltage control resistances, R1, are an interesting feature and permit fine variation of output. Although 30 henry chokes are specified, it was found that 90 henry chokes improved the output quality. With the Raytheon tubes no hum is noticeable and better quality is obtained.

(Continued on page 465)
In this Department we publish questions and answers which we feel are of interest to the novice and amateur. Letters addressed to this department cannot be answered free. A charge of 50c. is made for all questions where a personal answer is desired.

COMBINATION RECEIVER AND TRANSMITTER


A. 1. The Colpitts circuit is given in these columns. A three-point circuit is connected in the ground circuit to throw the set in position for receiving, transmitting by voice or transmitting by c.w. The tube used may be a 20B with 120 volts on the plate. The diagram shown is known as the Colpitts circuit.

A. F. TRANSFORMER RATIO

(458) Q. 1. Richard Wayne, Rochebor, N. Y.: asks: In an audio-frequency amplifier, is it better to use a transformer having a 3 to 1 ratio in the first step and one having a 6 to 1 or 10 to 1 ratio in the second step or should both transformers have the same ratio?

A. 1. It is advisable to use the smaller radio transformer in the second step rather than in the first stage. In order to avoid distortion, the ratio of both transformers should be as low as possible, consistent with good volume.

B" BATTERY TRANSMITTER

(497) Q. 1. Joseph Langley, Hooker, Oklahoma, asks: In a three circuit system, what are the most obvious causes of too much oscillation? In other words, what causes a receiver to oscillate continually, if not being possible to stop the oscillation and use the receiver for broadcast reception?

A. 1. One of the most common causes of this effect, particularly in home-made receivers, is the employment of too many turns on the tickler coil. The remedy is obvious; remove sufficient turns to cause the receiver to operate correctly as a regenerative set but not to spiral. This should be done with the receiver tuned to the highest frequency on which it is desired to receive. The tickler coil is often found sufficient for a couple to cover the broadcast wavelength.

Another cause of self-oscillation over the entire range of broadcast frequencies is the plate lead. If this lead is not run parallel to each other. Remedy: separate the leads or run them at angles to each other. Also have grid and plate leads as short as possible.

Sometimes the addition of a by-pass condenser across the output of the detector circuit will aid considerably in controlling a continuously oscillating receiver. The adjusting the tickler lead, the detector tube rheostat and varying the plate voltage applied to the detector tube. Changing tubes may be of further assistance.

B" BATTERY SUPPLY

(496) Q. 1. Miss Eleanor Brown, Lancaster, Pa.: asks advice as to the best method of supplying "B" battery current to her receiving set.

A. 1. The choice of the source of current supply for your set necessitates consideration of the efficiency of the several methods commonly used and most popular in the standard dry cell type of "B" battery. This type of current supply is the most efficient known, provided that the batteries used are of high quality. You must be sure that you are purchasing new batteries, because cells which have been standing on the dealer's shelves for any length of time are a source of much objectionable noise in the set due to chemical depreciation. Storage "B" batteries come next in order of efficiency, the only drawback lying in the fact that sulphated plates and poor inter-cell connections are liable to cause trouble. If you have direct current in your home it is comparatively simple to obtain a reliable source of quality source of current. All that is necessary is some sort of approved protective device to prevent the case of a short and a well-constructed filter system. It is quite possible to draw your own direct current from the house line, too, but a transformer and rectifier are necessary to make the current usable for radio purposes.

VOLUME CONTROL

(500) Q. 1. Fred J. Simpson, Lincoln, Nebraska, wants to know: What are some of the methods for controlling the volume of a radio receiving set?

A. 1. One way to control the volume of a set is by detuning the set. This method is not very satisfactory in cases where several stations are broadcasting approximately the same wave-length, since this would result in interference when the set is detuned from the resonance point.

Another method sometimes employed is to vary the filament current of the tube by means of the rheostat. The volume of the set may be controlled successfully in this manner, but the deprecation in quality is very marked when the filament current falls below a certain value. An efficient way to control the output of the set is to connect a variable resistance having a range of approximately from 10,000 to 100,000 ohms across the secondary of the transformer. The resistance absorbs power from the circuit and allows the output to be regulated to the desired value without causing distortion.

RADIO ORACLE

PUSH-PULL AMPLIFIER

(501) Q. 1. William J. Simpson, Shreveport, La.: asks: Will the UV-199 type of tube work well with push-pull transformers, or should it be used with ordinary amplifying transformers?

A. 1. UV-199's may be used quite successfully with push-pull transformers, although the same volume is not obtained with the 20A tubes.

Q. 1. Do push-pull transformers amplify signals without distortion?

Q. 2. The push-pull transformers go a long way toward eliminating distortion, especially in cases where the grids of the tubes are liable to become overloaded, if used with ordinary amplifying transformers.

Q. 3. Will a resistance coupled amplifier work satisfactorily with 90 volt supply?

Q. 4. Yes, very satisfactorily.

RAILROAD INTERFERENCE

(502) Q. 1. Alfred Martin, Akron, Ohio, states that whenever a train passes within the vicinity of his house, the radio receiver on his radio set fades out, and when the train has gone by he has observed that only signals coming from stations located in the same direction as the train fade out, while all other signals are practically constant in intensity with the exception of one.

Q. 1. When a train or other large metallic object is situated between a broadcast station and a receiving set, the train absorbs a good deal of the energy which the radio set would otherwise pick up. If the train is sufficiently close to the receiving set, it may absorb so much of the radio energy, that practically none of it reaches the set. A. 1. If the train is sufficiently close to the receiving set, it may absorb so much of the radio energy that practically none of it reaches the set.
DON'T KNOW—100% CORRECT

An extremely valuable football player had been conditioned for poor grades and was told that he would have to get a passing grade of 50 in chemistry in order to play in an important game. The Professor of Chemistry, who was an ardent fan, said that he would give the student an oral examination and later, announced that he had passed with a grade of 50. When asked what the questions were, the Professor said: "I asked him what color Venetian Red was and he said 'Blue' and he was wrong. I asked him what color Yellow Ochre was and he said he didn't know, and he was right, so I gave him 50 for the exam.—Miss Mabel Overhelt.

STEPPING ON IT

Girl: "Father, look, there is a bug on the ceiling!"

ABSENT-MINDED PROFESSOR: "Well, step on it and don't bother me any more.—Harry Davis, Rep. No. 24442.

NO GRASS ON A BILLIARD BALL

Little Anna asked her father why he didn't have any hair on top of his head.

He answered, "For the same reason that grass won't grow on a busy street. You know why now, don't you?"

"Sure," she replied, "it can't get up through the concrete."—Mrs. C. A. Hardesty.

HE CALLED IT A RUBYIAT

Professor of Literature (who is handling a radio set): "I want a rheostat, thirty Khayyams resistance."

CLERK: "You mean thirty ohms, don't you?"

Professor: "That's right. I knew it was either ohm or Khayyam.—W. H. Hatfield.

SPIDER WEB COILS

"Bridge, what did you leave those cobwebs around the radio for?"

"Sure and I thought they was a part of it. Sor."—Alfred Bogan.

FITS ANYTHING

First Musician: "What key are you playing in?"

Second Ditto: "Skeleton key.

First Musician: "Skeleton Key?"


ETHER MORE OR LESS

"You know, Tom, I think there's only one seta appropriate for Radio Broadcasting."

"Which song is that, Fred?"

"Over the Waves.—Ernest Rin, Reporter No. 11908.

SOME ARE JUST AS GOOD

Radio Fan: "Give me a wave trap, quick, I want to catch a street car."

Clerk: "Sorry, sir, you can't use them for that."—Ernest Rin, Reporter No. 11908.

Scientific Humor

First Prize $3.00

MANY A ONE WE'VE BLOWN OUT!

To Radio Editor:

How can I put out the lights in my radio? I've heard of people blowing out their tubes, but I don't see how it's possible.

(Answered) Anxious.

—Herbert Krause.

ROUGH STUFF ON TOUGH

There was a young chemistry tough

Who insisted on mixing some stuff,

Then heated it, and

After a while

They found his front teeth and a cuff.

—H. S. Postgate, Reporter No. 26469.

We receive daily from one to two hundred contributions to this department. Of these only one or two are available. We desire to publish only scientific humor and all contributions should be original if possible. Do not copy jokes from old books or other publications as they have little or no chance here. By scientific humor we mean such jokes as contain something of a scientific nature. Note our prize winners. Write each joke on a separate sheet and sign your name and address to it. Write only on one side of sheet. We cannot return unsolicited jokes. Please do not enclose return postage.

All jokes published here are paid for at the rate of one dollar each, besides the first prize of three dollars for the best joke submitted each month. In the event that two people tired in the same joke so as to tie for the prize, then the sum of three dollars in cash will be paid to each one.

AND ROSE AGAIN

PROF. TO PHYSICAL STUDENTS: "Now, who broke the barometer?"

No response from students.

PROF.: "I want to know who broke the barometer."

FECKLE-MINDED STUDENT: "Didn't you say the barometer fell this morning?"—Reynold C. Johnson.

A DIRTY DIG

Wire: "Come, let's get down to brass tacks and thresh this thing out once and for all.

Hubby: "No, we'll use ten penny nails. It's easier to see the point with them!"

—Henry A. Courtney.

ON EARTH OR IN HEAVEN?

OLD LADY: "Are you sure that this certain plant will bloom in 100 years?"

FLORIST: "Certainly, ma'am. If it doesn't, bring it back and your money will be returned."

—R. Swath.

ANOTHER TWINKLE, TWINKLE, LITTLE STAR

Sciillate, scillate, luminous constellation!

Interrogatively and inquiringly do I question your constituent elements.

In your prodigious altitude above the terrestrial sphere,

Similar to crystalline carbon suspended in the celestial firmament,—A. Leventhal.

ANTE MORTEM

" Fancy old Bill, of all people, going into the gunpowder shed with a lighted candle!" remarked the proctor of the explosive factory to his foreman. "I s'pose that's what would have been the last thing he'd do.

"Which, properly speaking, it was, Sir!" replied the foreman.—H. S. Postgate, Reporter No. 26469.

THE TRUE ORIGIN

PROFESSOR: "Smith, what is the composition of water?"

SMITH: "Water is composed of two gins, oxygen and hydrogin. Oxygen is pure gin; hydrogin is gin and water.—J. Richardson, Reporter No. 26535.

WAS TRUSSED UP

"Arthur, I don't think you understand the word engineer," said his father. "So try and give a sentence using it."

Arthur replied, "Was the engineer the bridge when the accident happened?"—Irving Callahan.

FIRM TERROR

AVIATOR (to colored man): "Would you like to have a ride?"

RACED MAN: "No, sah; I stays on terrail firmah and the more firm the less terrah."—Wilbur Holland.

VERY PRACTICAL

PROFESSOR: "Give me a practical application of the right hand rule."

STUDENT: "To find the direction of the current in the third rail grasp it with your right hand so that the fingers are curved in the direction of the lines of force, and your thumb will point in the direction the current is flowing."—Frank Schumadella.

ANOTHER USE FOR THEM

Grandma greeting grandpa as he enters the house with a loud speaker under his arm.

"Why Pa, I won't let you go around the streets with that thing sticking in your car even though you are deaf!"—F. Ebbe.

TEN THOUSAND TIMES MORE

"Pop," inquired little Clarence Lilywhite, "what am a millennium?"

"Sho!" said the parent, "don' yo' know what a millennium am, chile? It's jest about the same as a centennial, on'y it's got more legs."—Anna Severid.
LATEST PATENTS

ROACH TRAP

No. 1,578,061 issued to Jacques Ahadie. This trap utilizes the knowledge that a roach prefers an opening only slightly larger than his body to one much larger. The bait is placed in a screened, covered box which is entered through a wedge-shaped passageway containing slots of various widths. The roach, attracted by the bait, chooses the slot most suitable to its size, enters the box and is unable to find the way out.

MILK BOTTLE OPENER AND CAP

No. 1,575,319 issued to Ryk Cruyff. This invention consists of a cap of aluminum or other light metal which, when fitted over the top of an unopened milk bottle, bears a cutting blade which punctures the paper cap and on being turned, cuts it away. The aluminum cap may be used as a cover for the contents after the bottle has been opened.

EXERCISING APPARATUS

No. 1,577,809 issued to Edward T. Ranaldi. This apparatus incorporates many of the features found in expensive gymnasium equipment. A sliding seat permits its use as a rowing machine, and means are provided for the use of coil spring exercisers and Whitney cable exercisers.

HEATER-COOKER-IRONER

No. 1,580,909 issued to Joseph Lavole. This invention relates to a self-contained electric radiant heating unit which is usable in a variety of ways. A rack is contained in the carrying case, shown in the upper half of the illustration, which permits the heating unit to be used for toasting bread or as a small electric stove. A sadiron is provided which contains a receptacle for the heating unit, forming a very efficient electric iron. The apparatus is so arranged that it may be telescoped and packed within the limits of a light metal packing case which is provided. The device is very compact when packed, and should make a handy unit for the traveler.

VANITY CASE

No. 1,580,569 issued to George T. Bates. The latest thing in the way of portable beauty shops is shown above. The metal case contains in one of its halves a firmly cemented glass mirror, the other half containing receptacles for loose powder, rouge compact, two puffs and lipstick. As may be seen above, the cover of the pocket containing the rouge compact is so arranged that, when closed, it holds the lipstick in place. The loose powder is covered by an adjustable sifter-top, which in one position is sealed and will not permit the escape of powder.

SHACKLE COVER

No. 1,574,898 issued to Jason A. H. Johnson. This invention relates to a cover for spring shackles on automobiles. It consists of a boot of leather or similar material, which is laced about the spring ends and shackles bolts and protects the moving parts of the spring assembly from the intrusion of injurious dust and grit. A cover applied in this fashion also functions to prevent the leakage of grease from the spring leaves.

SPOON-SUPPORTING MEANS

No. 1,580,582 issued to Alvin E. Carman. A simple slot cut in the end of the handle of a kitchen utensil acts as a receptacle for the handle of a mixing spoon and keeps the spoon out of the way of the utensil cover and prevents it from becoming overheated.

SANITARY CONTAINER

No. 1,584,261 issued to Alphonso Vuolo. A novel sanitary holder for tooth brushes, nail brushes, tooth-paste tubes, etc., has been invented in the form shown at the right. The container is so arranged that each article is kept in a separate compartment and is prevented from falling out by a flange at the bottom of the receptacle, which forces the article to take the position shown in the drawing. Evaporation is permitted through ventilating holes in the sides of the container, and the top is so constructed that dust is prevented from settling upon the contents. A ring is provided attached to the cap for suspension from a hook.

ELECTRIC TOASTER

No. 1,580,744 issued to Albert Guissart and Edgar H. Barge. The toaster illustrated below incorporates two novelties in design: first, the method of automatically turning the toast without removing it from the holder; second, a self-operated switch which cuts off the current when the holder arms are not in a position for toasting. Turning the knob at the top of the toaster rotates the holder arms so that they change positions and also disconnects the apparatus from the power line when the arms are half rotated.

KNIFE GUARD

No. 1,578,295 issued to Virgil D. Swihart. Here is a device which will make it possible to assign hobby to K. P. duty as official potato-parer without fear of his using up all the potatoes in paring. The wire clip which is made of spring steel fits over the blade of the paring knife and may be adjusted so that strips of any thickness desired may be cut from the vegetable or fruit. The principle on which this operates is practically identical to that incorporated in the design of Gillette and other types of safety razors, but we do not by any means recommend that this apparatus be used to remove hirsute adornment. Try it if you must, but remember that we have no First Aid column.

NOTICE TO READERS. The above illustrated and described devices have recently been issued patent protection but are not as yet to our knowledge available on the market. We regret to advise that it is impossible to supply the names and addresses of inventors of the above devices to any of our readers. The only records available, and they are at the Patent Office at Washington, D. C., give only the addresses of the inventors at the time of application for a patent. Many months have elapsed since that time, and those records are necessarily inaccurate. Therefore, kindly do not request such information. —EDITOR.
THE ORACLE

The "Oracle" is for the sole benefit of all scientific students. Questions will be answered here for the benefit of all but only matter of sufficient interest will be published. Rules under which questions will be answered:
1. Questions must be in typewritten or else written in ink; no penciled matter considered.

TWO-WAY LIGHT CONTROL
(2104) Q. 1. James A. Broadson, Cincinnati, Ohio, says: In many disk brakes the distance between the two parts of the clutch is so adjusted that it is possible to turn the light on or off from either button, regardless of the position of the lever. Please publish the wiring diagram of such an arrangement.
A. 1. The diagram you have given is correct. In these columns:
Q. 2. When a friction clutch begins to take hold, is there a certain amount of friction? When the clutch is fully engaged, is there any friction and also when it is disengaged, is there any friction?
A. 2. The clutch is a device that is always in operation. The friction varies when the clutch is engaged, but is always present when it is engaged. The friction decreases when it is disengaged.

RAPIDITY OF FREEZING
(2105) Q. 1. E. L. Steeter, Weehawken, N. J., wants to know: How much water of the same size are put into a room at freezing temperature, the water in one pan being at the boiling point and the water in the other pan at a temperature of 80° Fahrenheit, which pan of water will be the first to freeze?
A. 1. The water in the boiling point contains the greater amount of heat and will therefore take longer for itself to be turned into the air of the room by the increase of temperature. Consequently the water at the highest temperature will not freeze as quickly as the water at the lower temperature.

WATCH DEMAGNETIZER
(2106) Q. 1. Russell F. Waterman, Columbus, Ohio, writes that his watch has become accidentally magnetized due to the fact that it has been within the magnetic field of a large generator and no longer keeps good time. He desires to know how the watch may be demagnetized and brought back to its normal state.
A. 1. A watch demagnetizer can be made by winding 10 turns of No. 22 D.C. wire on a cardboard tube 4 inches in diameter. This winding is connected in series with an ordinary 60 watt lamp on the 110 A.C. line.
By inverting the watch and pulling it out a few inches, you will be able to completely demagnetize it.

TERPHEMIC PROCESS
(2107) Q. 1. Vinogradoff, Scotia, Cal., wishes to know the proportions of the chemicals used in the Terphe'mic process of welding and the chemical reaction which takes place.
A. 1. The Therm Process is based upon the production of a highly oxidized mixture of asphalt and a metallic oxide. In welding iron the proportions used for the Therm mixture are 3 parts of iron oxide, Fe₂O₃, and 1 part of aluminum powder. When the mixture is ignited, the aluminum combines with the oxygen in the iron oxide, liberating free iron in a molten state. The temperature of the reaction after reaching as high as 3400° Fahrenheit.

RENEWING OLD FILES
(2108) Q. 1. Richard Dietrich, Rochester, N. Y., states that he has several old files which are almost worn out and would like to know how they can be treated to restore their cutting surface.
A. 2. The file should be dipped in a solution consisting of 10 to 20 parts of potassium carbonate and 4 to 8 parts of ammonium borate in 100 parts of water. When this applied the liquid covers the file with a shiny mass and if it should come in contact with iron, carbon dioxide gas is given off, preventing further rusting.
Q. 3. How is deckle-paper made?
A. 3. Deckle-paper is made by coating the deckle with oil, slippage may be prevented.

DYNAMIC BRAKING
(2109) Q. 1. Raymond V. Hatto, St. Louis, Mo., asks: How is the braking action of an electric motor and how is this accomplished?
A. 1. When it is desired to bring the motors to rest quickly, or in the case of crane or hoist, to hold the load after the motor has been raised, they are supplied with brakes. Braking may be accomplished in two ways; namely, mechanical braking and dynamic braking.

If the motor is connected to the motor to operate as a generator for delivering energy to some local circuit or returning it to the supply current, which action regulates the motor. When it is necessary for the machine to hold its load, dynamic braking is supplemented by friction brakes which become operative when the motor is unable to rest and the dynamic braking ceases. In applying dynamic braking to series-wound motors the field current is usually first disconnected in series with a resistance across the line wires to insure the motor building up as a series generator, and thereafter the motor is disconnected from the circuit with the resistance in the diagram. These connections are shown respectively as a and b.

CALIBRATING MILLIAMMETER
(2110) Q. 1. Murray Farmer, Rochester, N. Y., asks: How can an ordinary ammeter be converted into a milliammeter?
A. 1. An ammeter, if it is of the type having a shunt across the movable coil may be converted into a milliammeter by removing the shunt and calibrating the instrument in comparison with a standard milliammeter.

DEFINITION OF SHORT CIRCUIT
(2111) Q. 1. James B. Larson, Indianapolis, Ind., asks: What is a short circuit?
A. 1. The term "short circuit" is a broad one and usually refers to a case where an electric conductor of practically zero resistance is connected across the opposite sides of an electric circuit. Consider the current in that circuit to rise to 10 or possibly 100 times its normal value, the result being that time or other protective devices operate the circuit. If no protective devices are provided, the circuit, the storage battery or dynamo feeding the circuit will be damaged, due to the heavy current caused by the circuit closed by the low resistance "shorting" conductor. If you have 1000 square feet in a house lighting circuit and you suddenly short-circuit a fuse or switch block with a screw driver, a current of 100 amperes passes for the fraction of a second and the fuses melt. If this did not happen, the conductors would not burn out and possibly set your house on fire. A.C. transformers and alternators can stand momentary overloads approximating a short circuit, where D.C. dynamos or storage batteries would be ruined. Cases are on record where a heavy short circuit current has caused a dynamo or storage battery to actually "blow-up" or burst.

Another way of describing a short circuit is to adapt Ohm's law to the conditions on hand. The current which flows in a circuit is equal to the electro-motive force divided by the resistance of the circuit. The smaller the resistance becomes, the greater the current will be. Theoretically when the resistance of the circuit becomes zero, the flow of current will be indiscriminately large. It is quite possible in the case of a battery or generator to short circuit the terminals with a conductor whose resistance is practically zero. Under this condition, the current would rise to infinite proportions if it were not for the fact that the battery or generator has what is called an internal resistance. In this internal resistance is reflected the force of the current down under the short circuit conditions.

The short circuit current for different types of batteries. In the case of the Daniell or gravity battery, a shunt or fuse is used not only because it is necessary but also to prevent the battery from being "polared." The battery is so arranged that high internal resistance limits the short circuit current down to a low value. Most other types of batteries are not so designed. The iron and zinc battery has almost no internal resistance and when short-circuited, the current rises to enormous proportions with resulting damage or explosion. While windings burning out or being so strongly attracted to each other by virtue of their enormous magnetic field that they are actually drawn out of the armature slots and twisted out of shape.
WIRING CIRCUITS

(2119) Q. 1. Clifford L. Richardson, Spring Grove, Minnesota writes: I have noticed in wiring homes and small electric lights that No. 12 B. & S. Gage is used for the main fuse of the circuits No. 14 is used. Is this the correct way of doing it? The water should be shut off before the No. 14 wires would cause the latter to burn out before the fuses on the National Electric Code. A short circuit on any of the wires mentioned will cause the fuses in that circuit to blow. If, for some reason, these fuses will not blow, all of the main fuses will in all probability blow before the main wires become sufficiently heated to burn out.

TESTING OF GASOLINE

(2120) Q. 1. A. Donovan, Seneterre, Quebec. Canada data tells us to test for gasoline, how to detect the presence of kerosene and water in gasoline and to determine the percentage of each.

A. 1. To test for the presence of impurities in gasoline, it is only necessary to pour a few drops in a saucer and build a flame over carrying the open air. The residue, whether it be in solid or liquid form is the impurity. This test will also indicate the presence of kerosene, the latter remaining tied to the sample.

In order to determine the proportion of kerosene, the gasoline is evaporated at a temperature of from 130 degrees Fahrenheit. This should be behind being kerosene, and if the amount is measured, it will give an estimate of the amount of kerosene to gasoline in the original sample. The water in gasoline is that if the pouring some of the gasoline in a test tube and allowed the tube to remain water for a few minutes. The water, being heavier than the gasoline, will separate a layer, if there is any water present in the sample.

MAKING HAIR STAND UPRIGHT

(2121) Q. 1. Walter Gehring, Detroit, Mich. and Ind. Is it possible to make the hair rise by means of radio or electricity? The sound may be sent through a high frequency coil such as a Tesla or Oudin coil. Another method is to stand directly underneath a radio or an experimental belt. The electrically generated will attract the hair and make it stand upright. The second method is performed in cold dry weather. Is it injurious to the hair or skin?

A. 2. The hair or skin is not injured in any way. The performance is natural. The only thing felt is a sharp tickling sensation.

Q. 3. Where can I obtain details and complete instructions for building a device for carrying out the experiment?

Large Tesla coil was described in the March, 1925 issue of the EXPERIMENTER. An article of this nature appears in this issue of SCIENCE AND INVENTION Magazine.

BLUEPRINT PAPER

(2124) Q. 1. R. Clark, Clark, Ill. asks how blueprint paper is prepared.

The ordinary blue photographic print in which white lines appear on a blue ground may be made on paper prepared as follows:

1. Distilled water
2. 10 drops of a 2 per cent solution of oxalic acid
3. 4 ounces of a 5 per cent solution of gelatin
4. 8 ounces of water

The paper is then dried and the developer is applied to the surface of the paper.

PREPARATION OF CONCRETE

(2115) Q. 1. Maurice Putnam, Rochester, N. Y. asks: What is concrete and how is it prepared?

Concrete is as used by engineers in construction is generally formed of an artificial mixture of Portland cement and various other material such as sand or gravel or broken stone. These ingredients are mixed with water either by hand or by machine mixers. When in a semi-liquid state they are poured into place or poured into molds, and gradually harden in either air or water, forming an artificial stone of high strength. The compressive strength of concrete varies with the quality and proportion of the materials; the compressive strength and strength are both tested.

The ingredients are usually measured by volume, the actual percentage of each being determined by measuring the percentage of voids or air spaces contained in the sand and in the gravel or broken stone. The voids in water cemented are based upon completely filling the voids or air spaces in the sand and water and the voids in the gravel with water.

In order to obtain as nearly as possible a perfectly homogeneous and solid mass free from air spaces, the percentage of voids in the sand is determined by filling a pail whose volume is known, placing and pouring the sand into the pail just begging to be poured. The water is then drained out and its volume measured. This gives the percentage of air spaces contained in the sand. The same process is followed in deter-
Van Horne Tubes are manufactured in both the Selected and Certified brands. The Van Horne Certified tube is wrapped with a glassine wrapper and sealed. A characteristic curve sheet, covering the actual readings of the tube, being enclosed. They are in a number of types for all receiving purposes, part of them being illustrated below.

*Adapted Mogul 5 VCX, 5 Volt .50 Ampere Audio Amplifier

To eliminate any necessity of changing set wiring, the Mogul 5 VCX is equipped with a Patented Adapter found on the model 5 VCX. It is designed for those receiving sets in which provision has been made in the circuit for the use of the power tube at extra voltages in the last audio stage.

5 VC, 5 Volt .50 Ampere Audio Amplifier

This model is not equipped with the patented Van Horne Adapter found on the model 5 VCX. It is designed for those receiving sets in which extra voltages are added independently and in addition to the regular set voltages.

5 VAX, 5 Volt, ¼ Ampere Detector Amplifier

The improved manufacturing process, the use of patented thoriated wire and the precision and care with which this tube is made and tested makes it noticeably superior. Packed in both Selected and Certified Brands.

3 VBX Dry Cell Detector or Amplifier

An unusually high reading dry cell tube due to the use of a patented thoriated tungsten filament. Exceptionally satisfactory, where volume with clearness and signal carrying capacity is desired.

**NOTE**

All Van Horne Tubes are Unconditionally Guaranteed.

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**Cushioned to stop vibration— that's why the Cushion Base Tube makes such a wonderful improvement in reception**

Knowing how much tube vibration impairs the tone quality of reception, fans everywhere are equipping their sets with Cushion Base tubes.

Equip your set with Cushion Base tubes and note the surprising softness and fullness of tone of reception that follows the elimination of vibration. Order your set from your dealer today.

*These two unusual tubes, the Adapted Mogul 5 VCX Power tube and the Cushion Base tube, offer the greatest possible improvement in reception. They are manufactured exclusively by the Van Horne Company under patents pending to J. S. Van Horne.

For a great many years the Van Horne Company has manufactured vacuum products. The highly skilled workmanship that goes into every Van Horne tube is the result of years of experience and is one of the factors that make Van Horne tubes the highly efficient and dependable tubes that many thousands of users have found them to be. You are urged to become acquainted with the complete line of Van Horne Selected and Certified tubes. Your dealer will supply you with further information—or write for descriptive matter.

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**THE VAN HORNE COMPANY, Inc.**

903 CENTER STREET, FRANKLIN, OHIO
Answers to Scientific Problems (Continued from page 420)

THE HYDROMETER IN THE PAIL

A pail is whirled around in a vertical circle, and pressure within the water is increased when the pail is at the bottom of its orbit on account of the centrifugal force which is then added to the gravitational weight of the water. At the top of its orbit the internal pressure becomes zero because the weight of the water is just balanced by the centrifugal force of the rotating liquid. With an increased internal pressure at the bottom of the orbit the buoyancy of the liquid will increase and make the hydrometer float higher whereas at the top of its path the decreased internal pressure will allow the hydrometer to sink indefinitely into the liquid.

THE BALLOON PROBLEM

A balloon will rise provided its own weight, including that of the contents, is less than the weight of the air which it displaces. If the speed of the earth's rotation should increase, the centrifugal action would decrease the density of the atmosphere and hence the buoyant force on the balloon. Thus the lifting power would be decreased everywhere and not just at the poles. If the earth should rotate about seventeen times as fast as at present, the weight of the atmosphere would become zero and hence the buoyant force would also be zero. It would then be an easy matter to project even very massive objects from the earth, but the buoyancy of the atmosphere would not cause any objects to move at the fastest.

THE SWINGS

If one of the boys should set his swing in motion he would by that action produce a centrifugal force on his swing which would gradually raise his arm up. The motion would be somewhat jerky because the maximum pull would be exerted when the swing was passing the lowest point in its arc, that is when he was moving the fastest.

THE SLIPPING LADDER

Consider the ladder as a lever system with its pivot at point A on the ground. The man stands the ladder on the ground and it is to turn over. The pivot is at the top of the ladder and the ladder will push against the wall and the greater will be its thrust horizontally against the ground.

VELOCITY OF LIGHT AND THE LENGTH OF THE DAY

Since it takes a little over eight minutes for the light to travel from the sun to earth, we can see that the light which we see at any moment must have started from the sun some eight minutes ago. The apparent direction in which the sun lies & the direction which it had about eight minutes ago. At sunrise we see the sun's image after it was actually set. Thus the day begins eight minutes later and ends eight minutes later.

THE BATTERY AND THE VOLTMETER

The voltage across a storage battery while on charge is exactly the E.M.F. of the battery plus the fall of potential due to internal resistance. This fall of potential is equal to

(Continued on page 448)
SCIENCE SIZES IN CARTRIDGES

7 UN 1

1.75

BIRD RAFT.

All this is actually built up in sections, and may be taken apart at pleasure, thus making it easy to drop them in any bag or pocket as a package. Price 25c. Largest series of different sizes made. JOHNSON SMITH & CO., Racine, Wis.

The "Little Giant" Typewriter

A First Class Writing Machine at a Low Cost

Writing and typing of all kinds is of the greatest importance to every one. Here is a writing machine to suit every purpose and pocket-book. Real writing and typing are now to be had at a cost which was formerly out of the question, and the facilities for the formation of the art are always within reach. This is the "Little Giant," and it is a great improvement over the old machines, being provided with a special mechanism which makes it possible to write with great facility and ease. The "Little Giant" is made in a number of different sizes and shapes, and can be had at a cost of from 

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Greatest boy's book written. You how to make a Finale Capsule, a Telephone, a Mechanical Instrument, Bow Kite, Bead Fence, Bird House, Rabbit Yard, etc., etc. Price: 35c postpaid; 3 for 25c.

REAL PISTOLS

Ministature Watch Charm Pistol

Entire reproduction of the real instrument. Made entirely of black plastic. Triggers, mechanism, etc., are all exactly like the original. Very strong and reliable. Price: 25c.

BOYS! BOYS! BOYS!

THROW YOUR VOICE

Into a trunk, under the bed or anywhere. Lots of fun fooling the teacher, policeman or friends.

THE VENTRILIO

a little instrument, fits in the mouth out of sight, with use for Bird Calls, etc. Any one can use it.


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Smallest Bible in the world. Size of a postage stamp, 200 Pages. Said to be of great religious interest. Mailed to any address. Price: 5c each; 50 for $1.00. 100 for $1.50. Also obtainable in Leather Binding, with note book and pen, for $1.50 per dozen. Use in school with Midget Bible 15c.

Everything about the Ku Klux Klan told in a small book. It is a history of the Ku Klux Klan and its methods in organizing and carrying on its work as a secret society. The book tells the story of the rise and fall of the organization, and gives a full account of the operations of the Klan. Price: 35c. postpaid.

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Furniture, etc., in good condition. It is a complete and interesting account of the story of the first man and woman, and the events that took place after their creation. Price: 35c postpaid.

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This is a small book, but it tells the story of the first man and woman, and the events that took place after their creation. Price: 35c postpaid.

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Upon startling revolutionary facts have been based a remarkable new scientific system of eye-training, which quickly enables you to train the muscles of the eye so you can make them work properly at all times, and without effort or strain. This new system has been prepared by Bernard Macfadden, in collaboration with the eminent ophthalmologist who discovered the real truth about eyes.

Remarkable results were made in the N. Y. City Public Schools from 1903 to 1911. 2,000 children who had defective eyesight were instructed in a few of the simple exercises and in a short time their vision was radically improved. In one school, several children who had been compelled to wear glasses were enabled to discard them altogether.

No claim is made that this course is a cure-all.

MACFADDEN PUBLICATIONS, Inc.,
Dept. Sc-9, 1926 Broadway, New York City

Answers to Scientific Problems
(Continued from page 446)

the product of the charging current and internal resistance. If, for example, a battery had an E.M.F. of 6 volts and an internal resistance a voltmeter connected to its terminals would read just 6 volts no matter what current were allowed to charge the battery. In a good storage battery the internal resistance is not zero but is so slight that the product of the charging current times this resistance is negligible in comparison with the E.M.F. of the battery itself. Hence the reading of a voltmeter connected to such a battery on charge remains practically equal to the voltage of the battery regardless of the voltage of the charging circuit. Certainly it would be a pretty poor six-volt battery if its resistance were so great that a 0—2 volt voltmeter could not be used with it.

CHANGE OF WEIGHT

As a person descends a mine his weight is reduced by the attraction for his body of that portion of the earth which lies above him. If he continued down to the center of the earth his weight would, of course, become zero since the gravitational pull of the earth would be equal in all directions.

THE POLE-SWING PROBLEM

The child that is farthest from the ground will not only move with greater speed in the circular orbit which he describes around the pole, but he will also make a complete trip around the pole in shorter time. This comes from the fact that it takes a higher and higher velocity to give the child sufficient centrifugal force to carry him farther out and higher up in his orbit. If the children were at the same distance above the ground they would be moving around the pole in the same time although the child on the longer rope would be moving more rapidly with respect to the ground.

CORRECTION NOTICE

In the "Experimental Electricians" Department in the July issue in the "Puzzle Lamp Circuit," by W. B. Taylor, four four-way switches should be employed, instead of four three-way switches.

RUN CARS WITH ACETYLENE

The Automobile Club of France announced recently that the tests for the substitution of acetylene for gasoline in automobile motors have given complete satisfaction.

An enthusiastic report states that the economy amounts to about 50 per cent, with no increase in the consumption of lubricants and that no bad effects on the valves, cylinders or pistons.

VAPOR TRAP

The small rubber bulb attached to the overflow pipe of an automobile radiator saves water and alcohol because it forms a trap for the vapor. Presumably does not store up.

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In this Department we publish such matter as is of interest to inventors and particularly to those who are in the habit of applying for patent protection. The cost of applications for patents and besides being necessary to be submitted is also paid by the inventor as is of importance that it be done in order to protect the inventor as far as it is possible to do so.

Shall be advised by those interested in an invention.

Note:—Before mailing your letter to this department, see to it that your name and address are upon the letter. Many letters are returned to us because of the name of the inquirer or address is incorrectly given.

A. The system you described in your letter of recent date has been published in various periodicals of different radio periods. Owing to its originality, it is expected that more such radio patents will be issued. However, you wish us to comment specifically upon it. It will be necessary to show how the device operates. However, if it is not in operation, it may be designed by any other device which has been specially designed to accomplish the above purpose and would not advise you to rely on it.

B. The patent described in your proposed combination letter and if the idea is essentially very old, it cannot be patented. Many years ago, several designs of a similar nature were patented. However, if the principle illustrated in your drawing and specifications is new, it is necessary to show how the device operates. If it is not in operation, it may be designed for a different purpose and would not advise you to rely on it.

C. The use of the device is for the purpose of obtaining electricity from water. If you are interested in obtaining electricity from water, you will find the device of interest.

D. The patent described in your letter is not patentable. However, if you are interested in obtaining electricity from water, you will find the device of interest.

E. The device is not patentable. However, if you are interested in obtaining electricity from water, you will find the device of interest.

F. The device is useful in radio work. If you are interested in obtaining electricity from water, you will find the device of interest.

G. The device is useful in radio work. If you are interested in obtaining electricity from water, you will find the device of interest.

H. The device is useful in radio work. If you are interested in obtaining electricity from water, you will find the device of interest.

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J. The device is useful in radio work. If you are interested in obtaining electricity from water, you will find the device of interest.
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while others were reduced

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a much better position, where my salary
is nearly four times as much as I was
making previously. I would not be able
to hold my present position had I
not taken your Course. Recently I re-
cieved a nice increase in salary, while
other men were being reduced."

Read that last sentence again—Recently I re-
cieved a nice increase in salary, while
other men were being reduced.

There could be no greater proof of the value of an
I. C. S. course than that. It shows that the trained
man is given preference over all others and paid
more money, even in slack times, if his work de-
ersifies. It shows that there are always bigger,
better jobs open for men who have the forethought
to prepare for them in spare time.

Why don't you study and get ready too? We'll
see you in the future.

Today. This doesn't obligate you
be prepare for them in spare time.

A man

while

It's more than mere visibility—
an actual encounter. These four men were
of the type who could be believed. The report
was reliable. And the next night, in a Kan-
sas farm-house, the farmer and his wife
were awakened by the scream of their
adolescent daughter. They rushed into her
bedroom. She was in bed, and bending over
her was the apparition of a man. Its fingers
were holding a lock of the girl's long black
hair. At the farmer's shout, the ghost
turned its hand; its hand was raised—and the farmer
and his wife both saw that the shadowy
fingers had lifted the girl's treasures which
they were clutching. Then it dropped them
and moved away, not through the walls of the
room, but out through the open window.

The girl was dead. She had suffered from
heart trouble; was dead of fright, unfortu-
nately. It was the beginning of the era of
menace. And that next afternoon Wilton
Grant telephoned me. His voice had a
strange tenseness to it, though it was grave
and melodious as always.

"Come out and see us this evening, will
you Rob?"

"Why yes," I said. I had not seen them
for over a month—astrangement which I
had not understood and which hurt me
terribly, had fallen between us. "Of course
I will," I added. "How's Annie?"

"She's been quite ill... No, not danger-
sous, she's better now. Don't fail us, Rob.

In late July the thing took another turn.
A new era began—a sinister era which
showed the need for something more
than all this aimless talk. Four men were
walking one night along a quiet country
road near a small English village. They
were men of maturity, reputable, sober,
middle-aged citizens. Upon the road level they
observed the figures of four or five male
figures, which instead of remaining motion-
less rushed forward to the attack. These
ghosts were ponderable! The men distinctly
felt them; a vague feeling, indescribable,
perhaps as though something soft had
brushed them. The fight, if such it could
be called, amounted to nothing. The men
dashed their arms in sudden fear; and the ap-
paritions sped away. Greenish, more sobri-
looking than those heretofore seen.

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sous, she's better now. Don't fail us, Rob.
Groping at the Unknown

Wilton Grant was at that time just under forty. He was a tall spare man of muscular build, lean but powerful. His smooth-shaven face was large-featured, rough-beaten, with a shock of brown hair above it—hair turning grey at the temples. Beneath heavy brows his grey eyes were deep-set, somber. His ruddy-brown complexion, the obvious strength of his frame at a quick glance gave him an out-of-doors look; a woodsman cast in the mould of a gentleman. Yet there was something poetic about him as well; that wavy, unruly hair, the brooding quality of his eyes. When he spoke, those eyes frequently twinkled with the good-nature characteristic of him. But in repose, the somberness was there unmistakable; an unvoiced, brooding melancholy.

Yet there was nothing morbid about Wilton Grant. A wholesomeness, mental and physical, radiated from him. He was a jolly companion, a man of intellectuality and culture. His deep voice had a pleasing resonance suggestive of the public speaker. Normally rather silent, chary of speech, he could upon occasion draw fluently from a vocabulary of which many an orator would be proud.

He was a bachelor. I often wondered why, for he seemed of a type that would be immensely attractive to women. He did not resemble them in one respect; a woman-hater would have been abhorrent to him. Yet no woman to my knowledge had ever interested him, even mildly. Except his sister. They were orphans and she was his constant companion. They were both in fact, rather chary of friends; absorbed in their work, in which she took an active part.

Their home and laboratory was an unpicturesque frame cottage in a Westchester village of suburban New York. They lived quietly, modestly, with only one automobile, and no 'plane.

Will opened the door for me himself, smiling as he extended his big, hearty hand.

"'Well? You came, Rob? You're very forgiving, ain't the mark of a true friend." He led me into the old-fashioned sitting room. "I'm not going to apologize—"

"Don't," I said. "I knew of course you had some reason—"
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Cartoonists earn from $60 to far over $300 a week. Why tie yourself to work that is drudgery when through a remarkable easy method you can easily learn to make a home in spare time to draw cartoons that sell?

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Will faced us. For a moment he was silent. Then he began, "I have a good deal to say, Rob—I want to be brief—"

I interrupted impulsively, "Just tell me this. Is it—is it, this thing whatever it is—does it concern the ghosts?"

I was aware of a shudder that ran over Bee. Will did not move. "Yes," he said.

"It does. And they ghosts have changed. We knew they would—we've been expecting it."

"That poor girl," Bee said softly. "Dead—dead in her bed of fright. You read about it, Rob?"

"A menace," Will went on. "The world is just realizing it now. Ghosts, changing from shadow to substance—" He stopped, then added abruptly, "We've never told you much about our work—our business—have we? Reticent, peculiar friends—"

They had in truth always been reticent. I had never been in their laboratory. They were engaged I understood, chiefly with soil analyses; some earth-bound spirits! As telepathy they would consult me out to consult them. Beyond such a measurer idea I knew nothing about it.

Will said abruptly, "Our real work we have never told anyone. It concerns—well, a research into realms of chemistry and physics unknown. I have been delving into it for nearly ten years, and then Bee grew old enough to help us. We've made progress—" His smile was very queer. "Tonight—I'm ready to show you something that I can do."

They seemed to torture Bee, these words of her brother's. I heard the sharp intake of her breath, saw her white fingers locked Edition in her lap.

"Not—not tonight, Will."

"Tonight—as good a night as any other... They would surprise you to know we anticipate the coming of the ghosts years ago? Not that they would come, but the possibility of it. Ghosts! What do you think they are, Rob?"

"Why ghosts—ghosts are..."

"Spirits of the dead made visible?" His manner was suddenly vehement; his tone contemptuous. "Our ghosts! Earthly bodies housing souls whose human bodies are in their graves! Rubbish! These are not that sort of ghosts."

I stammered, "But that—is that what they are?"

"Call them ghosts, the word is as good as any other."

"His voice grew calmer; he went on earnestly, "I want you to understand me—it's necessary, and yet I must not be too technical with you, too abstruse. Let me ask you this—you'll see in a moment that none of this is irrelevant. How many dimensions has a point?"

At my puzzled look he smiled. "I'd better not question you, Rob, but you won't find me hard to understand. A point—an infinitesimal...
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American Radio History

November 1926

Vol. 12 No. 10

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"I know light is vibration," I responded. "And sound. And heat—and—"

He interrupted me, "The very essence of matter is vibration. Do you know of what matter is composed? What is the fundamental substance? Let us see. First, we find matter is composed only of molecules. They are substances, vibrating in space. But of what are molecules composed? Atoms, vibrating in space. Atoms are substance. Of what are they composed?"

"Electrons?" I said dubiously. "Protons and rings of electrons. Let us cling to substance, Rob. These electrons are merely negative, disembodied electricity—not matter, but mere vibration. They—these electrons—revolve around a central, positive nucleus. This then, is all the substance that matter has. But when you penetrate this inner nucleus, what do you find? Substance? Not at all. This proton, as they sometimes term it, this last inner stronghold of substance, is itself a mere vortex in whirlpool space?"

I groped at the thought. Matter, substance, everything tangible in my whole conscious universe, robbed of its entity, reduced to mere vibration in empty space. Vibration of what? I knew that there was no human mind to give the answer.

"It's appalling, Rob, the unreality of everything. Metaphysicians say that nothing exists save in the perception of it by our human senses... I was talking of the dimension, time. It is the indispensable factor of vibration. That's obvious. Motion is nothing but the simultaneous change of matter in space and time. You see how blended all the factors are? You cannot deal with one without the others. And mark you this, Rob—you can subordinate matter until it becomes a mere vortex in empty space. Can you wonder then?"

I had noticed Bee gazing intently across the room. "Will?" she said suddenly; her voice was hardly more than a whisper of repinio. "It's there now, Will?"

The room was brightly illumined by a cluster of globes near the ceiling. Will left his seat, calmly, unhurriedly, and switched them off. There was only the small table electrolier left lighted. It cast a yellow circle of light downward; most of the room was in shadow. And over in a corner I
If you have done.

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They saw the glowing apparition of a recumbent man no more than ten feet from us.

Will said, "Come, Rob—let me show you this." His voice was grave and unfurled. As I crossed the room hesitatingly, Bé was with me, forcing herself to calmness. She said, "It's been most of the time. Watching us! It seems to be on guard—watching—always!"

Will drew me beside him. Together we stood within a foot of the spectre. It took my courage, but after a moment the grew-some element seemed to leave me for Will stood as though the thing were a museum specimen, examining it.

I saw, so far as I could put the sight into words, the vibrating white shape of a man reclining on a bed. It was slightly below the level of the floor, most of it within or behind the floor, the outlines of which were plainer than the apparition mingled with them. The head and shoulders were raised about to the level of our ankles.

A man? I could not call it that. Yet there was a face which after a moment I could have sworn was human-featured; I could almost think I saw its eyes, staring at me intently.

Will stooped down and passed his hand slowly through the face. "You can feel nothing. It has visibility—that property only in common with us. Try it!"

I forced my hand down to the thing, held it there. It was like touching one's fingers into a dim area of light.

"Is it—it is alive?" I asked.

"Alive?" Will's tone was grim. "That depends on what you mean by alive. It can reason, if that answers you."

"I mean—can it move?"

"It moves," said Bé. "It watches us—follows us." She shuddered.

The details of the figure? I stepped back to see it better. It seemed now a man clothed in normal garments—a mulevont face, with eyes watching me. Was that face my imagination, or did I really see it?

I must have shranned my thoughts aloud, for Will said, "What we see, and what really exists, has puzzled metaphysi-

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"These things are materializing, Rob. They have become a menace. That's why I'm planning to do something about it. Bee! Will you please not interrupt me?" It was the first time I had ever heard his tone turn sharp with her, and I realized then the strain he was under. "Rob, listen to me. Science has given me the power to do what I'm planning, but we won't discuss that now. Call this anything you like. What I want you to know is that there is another realm of thought—that under given conditions—our consciousness can penetrate. Call it the Unknown. The realm of Unthinkable Things. A material world? I've shown you, Rob, that nothing is substance if you go to the inside of it."

Dimly I was groping at a hundred will-o'-the-wisps, my mind trembling upon the verge of his meaning, my imagination winging into distant caverns of unthought things that hid in the elusive dark. Could this be science?

He was saying, "My mind cannot fathom such another realm, nor can yours. You think of land, water, trees, houses, people. There are only words for what we think we see and feel. But there are beings—sentient beings—in this other state of consciousness we can now be aware of. For Rob, they are coming out! Don't you understand? They have already come into the borderland between the consciousness of their realm and our own.

He would not let me interrupt him. "Wait, Rob! Let us say their realm is inferior. Or they have a lust for adventure—or a lust for something else—they are coming out nevertheless. A menace to us—that girl in Kansas is dead." He swept his hand in a gesture at the apparition behind him. "That thing is watching me. As Bee says, it is on guard here. Because, Rob, I found a way of transmitting my identity out of that realm, my mind trembling upon the verge of his meaning, my imagination winging into distant caverns of unthought things."

"And so they're on guard—watching me."

He paused for the space of a breath. Bee, white-faced, tremulous, turned to me. "Don't let him do it, Rob!"

"I must," he declared vehemently. "Rob, that's why we needed you here—to wait here with Bee. I'm going in there tonight—into the shadows, the borderland, whatever it is. These—nameless things are striving to come out—but I'm going to turn them back if I can!"

(To be continued)

LEAD TETRAETHYL FOR AUTOMOBILES

It will be remembered that some weeks ago that such excitement was occasioned by the idea that tetra-lead-ethyl, which was recommended as an addition to gasoline for use in automobiles, was liable to occasion cases of lead poisoning. A most extensive investigation was made under the auspices of the United States Public Health Service and two hundred and fifty-two subjects were exposed to different conditions, some to the lead ethyl conditions, others to ordinary conditions in garages, and it was found that no harm whatever resulted from the proposed addition to the gasoline. Curiously enough, lead poisoning symptoms were detected in garages in which none of the compound was used. This was supposed to be due to the presence of lead in some of the solutions of the shops. The investigation is so thorough and so well checked by comparative tests that there is no doubt that the alarm was entirely needless, at least in degree. The committee believes that the investigation should be continued but the conclusion so far as evolved is substantially that stated above.

The Telephone and the Farm

There was not a farmer in the world fifty years ago who could talk even to his nearest neighbor by telephone. Not one who could telephone to the doctor in case of sickness or accident. Not one who could telephone for the weather report or call the city for the latest quotations on his crops. Not one who could telephone to his agent. A neighborly chat over the wire was inadmissible for the farmer's wife or children.

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WRNY Celebrates the First Birthday
By CHARLES D. ISAACSON
(Continued from page 436)

The Corporation Counsel of New York City, Arthur Hilly, poured forth some of his inimitable jokes. If you ever want a speaker to keep any crowd in stitches, engage Arthur Hilly.

I'm not going to attempt to repeat the list of folks who were there. But Dr. Miller, spokesman of the Protestant churches of the city; Dr. Goldstein of the orthodox synagogues; Dr. Landman of the Jewish Circle, and Dr. Reisner were the religious leaders.

Arthur Guterman, the literary, and Wolf Gilbert, the popular song leader, were also present.

And at 9 o'clock there came the demonstration of the Edison Hour, the latest radio musical instrument, invented by Mr. Hugo Gernsback, Editor of Radio News. The Pianorad uses a keyboard like a piano, 25 vacuum tubes, and 25 loud speakers. The instrument gave beautiful flute-like tones that could be changed to the quality of an organ when desired. It is a development of the well-known Staccatone. It will be described in the October issue of Radio News.

THE EDISON MUSIC BOOK

The Edison Hour goes merrily along. Harry T. Burleigh, the negro singer, came back, and Beniamino Riccio, the operatic baritone, made his debut with the Edison Ensemble, while the Ukrainian Chorus gave a colorful program. Speaking of the Edison Hour reminds me to offer you their new wonderful book, "A World Tour of Music," which is very important, in that it tells you about the music of nine nations, their composers and important compositions, and is beautifully illustrated.

And talking of things complimentary, I am also empowered to offer a free pass to the wonderful amusement park, Starlight Park, to anyone who writes me here. To New York visitors this assures one solid evening's pleasure (bathing, opera, shoot the chutes, etc.) And, one further—Madame Helena Rubinsteiin, famous beauty expert, who is now speaking over WRNY, is giving a free beauty reading to the ladies. Her fee is ordinarily by a high order. She has been adviser to empresses, queens, leaders of society and the stage, but if you who read these words will write Madame Rubinstein, care of WRNY, and ask her for advice, she will be glad to help you.

NOVELTY PROGRAMS

I am particularly proud of the novelties, which have crowded WRNY's famous Friday night 10:15 hour. There was the epic of June Brides which apostrophised life, love and marriage. Then came the group which were transported from Hawaii and other points distant by Wally Gluck. Did you join us the night we had the "Campfire in the Woods," or did you travel to Czecho-Slovakia when we had a "Night in Prague?"
The Czech Consul, Mr. Broz, was there to guide us on the last mentioned affair.

Far from the fields of novelties, came the heralded debate of Norman Thomas and Hugo Gernsback. The Socialist leader, former minister of the conservative Brick Presbyterian Church, a sometime candidate for the Governorship, attacked with sincerity the radio "interests." Mr. Gernsback defended them "interests," but the interjection of the radio industry and broadcast operators.

That was the night when Alice Brady appeared in the Edison prize play, The Return of Mary Ellen," following Grant Mitchell, and preceding Louise Closser Hale and Olive Wyndham.
"Oh, Miss Mason has no set charges. She conducts her spiritual gatherings without charge but donations to carry on her wonderful work are gratefully received." "What are the usual donations?" I asked, not to be outdone in generosity. "Two dollars seems to be the amount that is ordinarily placed upon the plate," I was informed, "although some pay as high as five and ten dollars." The little maid, who had left the reception room now reappeared, and told us that the medium would soon be with us.

More conversation followed among those present and notes and data were exchanged about the past, present and concerning present room was that not to charge.

"Science as well told of the things the medium had predicted to see! Several when down to listen sister bright. I soon." 51st Madam Thelma will years. I stock hopes and medium would controls. 

"What entered?" asked another. "Acute appendix," was the answer. "My doctor says I am but well again. My trunk must be the cheapest and others compared. She was a tall, middle-aged woman, firm pitched to cope. As if a buzzer the medium. Through you.

"What are the usual donations?" asked another, "my sister had the same trouble and died several weeks after she was pronounced cured." What price glory thought I. And settled down to the talk of these women. Time seemed to drag. It usually does when one thinks of the marvellous one is about to see! Several others compared notes and told of the things the medium had predicted as well as the things they were going to ask. A buzzer in the room, which we had not supposed would ring. As if knowing just what they were supposed to do the gathering filed into another room. We followed. Seating ourselves in available straight-backed chairs all conversation ceased.

Enter the medium. She was a tall, middle-aged woman, with large features and a firm jaw. Here was a woman who was able to cope with any emergency or circumstance. In a firm, medium-pitched voice she began to speak.

"Any questions you care to ask my controls for I am but a machine speaking the thoughts of the hovering spirits must be concentrated upon. Through me they will communicate with you. We will open the seance with a few brief hymns. I will have my assistant distribute books among you for."

This was done. We all turned to the proper page and the song was rendered. Several more hymns were sung and the books collected and stacked upon the table in front of the medium.

More talk on the Great Beyond and spirit controls. Gazing dreamily into space the medium began to get seeming messages. At first she did not speak. Impressions must have been arriving.

One after the other, in quick succession, things were told the gathering. Messages said Sir Ernest Benn, an eminent British publicist, after a tour of America's industrial plants. He was deeply impressed with our vast investment in labor-saving machines.

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I began to come, the words issuing from behind clinched teeth. One woman was told about her recuperating the appendix operation. Another about the copper bonds and the mortgage.

I was given a message from my dead sister. (I never had a sister). But I had spoken in the reception room of a sister and her name.

This is perhaps the key to the solution of the entire mystery.

The thing was out.

The elderly lady who had been there on several occasions was truly the spirit, but not a reincarnated one. The astral force was that which was emphasized through the lips of the medium.

She of course gathered all the conversation heard in the ante-room and what little more she needed was supplied by general conversation while we were waiting for the medium's entrance into the den of mystician.

The elderly lady must, at one time, have been a stenographer of some sorts, inasmuch as she took down our conversation which seemed to be transmitted by the medium practically verbatim.

This information was written in short hand in the hymn book handed her, which the assistant took pains to keep on top of the stack, when the books were later on collected.

This book containing the necessary information about those who had departed across the threshold...about my sister that never was...and the rest of the collected talk...was opened directly in front of the medium; an action apparently careless, but strictly necessary, as this so-called ghost woman must have also been a student of Isaac Pitman and could read stenographic notes very well.

The information she imparted to me and likewise to my associate did not upset our spirits or any marked degree, inasmuch as a short while later, we were seated in a restaurant enjoying the food products of the living, rather than feasting upon the psychic thoughts of the dead.

One fact, however, was quite apparent...my friend did not seem to be over anxious to discuss the happenings of the evening.

Later, comfortably ensconced in a cab, we lighted cigarettes and, looking at another...we indulged in a hearty laugh.

(No. 3 will appear in the next issue.)

New Trickle Charger
160 and 320 Volt "B" Eliminator
By A. P. PECK
(Continued from page 439)

photograph, however, and the wiring for it is also indicated in the diagram. A three- point switch serves to throw the voltmeter from one to another output circuit, so that each one can be measured separately. It must be remembered that extremely high resistance instrument has to be used in connection with such "B" eliminators, to obtain results of any accuracy at all.

Since we are dealing with high voltages it is necessary to have resistances of rather high load capacity to control the various outputs. There are several reliable resistances on the market today that are especially adapted to this work. One should be chosen that will not heat up under an ordinary load. A fixed resistor of the composition used made variable resistors and a fixed resistor can be used at the discretion of the builder.

In order to further simplify the wiring for the amateur, Dr. Brams employs a block type of filter condenser, wherein all the condensers are in one casing and handy terminals are provided. The various photographs will show clearly how such a procedure simplifies the wiring as compared with some of the original "B" eliminators using a many-separate condensers. Although the condensers are placed in block formation, they are shown separately in the diagram so their respective positions in the complete circuit can be made more clearly seen.

An eliminator of this type will be a decided addition to any radio receiving set. With it a power amplifier using a UX-120 tube can be employed, and thus great volume will be obtained. When less volume is desired the power amplifier can be cut out of the circuit and the low voltage output of the "B" eliminator employed. Of course, as can be seen in the photographs Mr. Brams "dolled up" his eliminator to a very great degree, but only because of pride in his workmanship.

SAYS GAS WILL OUST COAL

That gas as fuel will in a few years take the place of coal and all coals is the prediction of Dr. Julian C. Smallwood, Associate Professor of Mechanical Engineering at Johns Hopkins University.

"The days of anthracite are numbered," he said recently. "There is too little anthracite and it is too expensive. Many people have told me that they have no intention of resuming its use after the interruption this winter. Under present conditions this means increased use of soft coal, with a consequently greater nuisance.

Dr. Smallwood expressed himself as opposed to ordinances regulating the evil. The enforcement of such ordinances in other cities, he said, "is a tremendous demand for magic entertainment. Clubs, Lodges, Charity and Social affairs—all will pay high fees to the man who knows Magic. Dr. Harlan Tarbell really gets as high as $250 a night and deals or $300 a week. Opportunity everywhere to make money aside from your regular occupation. Salesmen find a tremendous asset. Find out all about this unprecedented opportunity to learn Magic. The coupon brings full details without any obligation. Mail it TODAY."

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Incredible things occur, yet, as the author himself explains, there is today no knowledge to refute the amazing sights the explorer sees.

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Other big features in September issue

THE PURCHASE OF THE NORTH POLE, by Jules Verne, in which some enterprising mathematicians and scientists attempt to bring the North Pole to a temperate zone—or bring the temperate zone to the North Pole. A stroke of lightning sets things flying in the mathematician's room and an error gets into the calculation. Of course, that upsets their plans considerably.

A COLUMBUS OF SPACE, by Garret P. Serviss (2nd instalment) in which our adventurers continue their marvelous experiences with the Venus-tians on the light side of the planet Venus.

STATION X, by G. McLeod Winsor (Conclusion) in which our adventurers continue their marvellous experiences with the Venus-tians on the light side of the planet Venus.

THE MOON HOAX, by Richard Adams Locke, is a classic science fiction story containing excellent science along with some obvious mistakes, which were not detected even by a scientific audience. It is probably the greatest scientific hoax that was ever perpetrated upon a credulous public.

BLASPHEMERS' PLATEAU, by Alexander Snyder, wherein some eminent scientists successfully experiment with infinite secrets, until they become drunk with their power. Then another scientist arrives on a friendly visit. It is a powerful and gripping story which is sure to hold your interest.
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Model Department
(Continued from page 422)

Rules for Model Contest

1. A handsome trophy cup engraved with your name, will be awarded as the prize for the best model submitted during the month. The decision of the judges will be final and will be based upon, A—novelty of construction; B—workmanship; C—operating efficiency of the model as related to the efficiency of the device which the model simulates, and D—the precision in design, and in submitting to us sketches and other details covering the model.

2. Models of all kinds may be entered. They may be working models or not, according to the subject that is being handled.

3. Models may be made of any available material, preferably something that is cheap and easily obtainable. Models made of matches should not be submitted to this department but should go to our Matchcraft Contest Editor.

4. Models must be submitted in all cases. Good photographs are also highly desirable and where the maker does not desire the model to be taken apart, legible drawings, with all dimensions covering parts that are not accessible must be submitted.

5. Models should be securely crated and protected against damage in shipment and sent to us by parcel post, express or freight prepaid. Models will be returned when requested.

6. Models for entry in any particular contest must reach this office on or before the 25th of the third month preceding date of publication. For instance, models for the October contest must reach us on or before the 25th of July.

7. Address all entries to Editor Model Department, Science and Invention Magazine, 53 Park Place, New York City.

Lightning Rods

The Wisconsin Industrial Commission in urging property owners to install lightning rods stated that 500 people are killed and 1,200 injured annually by lightning in the United States and Canada. In Wisconsin alone the property loss caused by lightning in 1924 amounted to $823,210. The U. S. Bureau of Standards asserts that lightning rods reduce the fire hazard as much as 80% to 90% in the case of homes and by as much as 99% in the case of isolated farm barns. In spite of this simple and inexpensive means of protection, fires started by lightning in the United States in the year 1923 caused losses amounting to $10,922,-660, according to the National Board of Fire Underwriters.

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Will you be one of the 800,000 who will die this year of preventable disease?

Of the hundreds of thousands who die from respiratory diseases, bronchitis, pneumonia, kidney diseases, tuberculosis, influenza, and intestinal disorders, a large proportion would not have died if they had been able to recognize early symptoms and had known how to treat themselves.

Nature always warns of impending sickness. The occasional headache, that tired, exhausted feeling, loss of appetite, a casual cold and other slight disarrangements are Nature’s warnings to you that your body isn’t functioning properly or that you are not living and eating correctly.

You can rule your health just as surely as you can rule your actions, if you are not enjoying perfect health today it is because you haven’t employed the method provided by Nature to keep you well. If you don’t know what her requirements are, you are sure to blunder into some kind of sickness—perhaps fatal disease.

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EVERY person more than ten thousand people die of bronchitis, sixty-four thousand die of pneumonia, seventy-five thousand die of kidney trouble, fifty thousand die of respiratory disease, one hundred and six thousand die of tuberculosis, approximately eighty-five thousand die of influenza, and more than ten thousand die of intestinal trouble.

Barring accidents and suicides, only a small percentage of these thousands should die.

It is a fact that only about one person out of three enjoys good health. And those who are physically a little "off" right now will more than likely be the ones to succumb to preventable diseases this year. And they are the ones who should die.

Nature is constantly warning you of impending sickness. Seemingly trivial symptoms tell of serious trouble taking root in your body. And yet, ninety-nine out of every hundred will absolutely ignore these danger signals. As long as they are not flat on their backs, they will fool themselves into believing that they are all right.

Nature is merciless. If you do not understand her laws and her methods of preventing and curing sickness, you suffer. She knows no excuse—she accepts no apologies.

The Average Person Pays Thousands of Dollars in Doctor’s Bills

Those who do not know Nature’s methods of preventing and curing sickness are ill an average of 21½ days each year. In fact, it is estimated that the average person in a lifetime spends $4,100 on doctor and hospital bills, loss of time from business, medicine and other expenses due to illness.

Thousands of people are living half-powered lives because they are ignorant of the laws of Nature. Many of these people will fill an early grave, when they might easily have lived to enjoy a ripe old age.

What would it be worth to you to be able to instantly identify in its earliest stages any sickness or disease that might overtake you or any member of your family? To enjoy perfect health, almost completely free of sickness, doctor and hospital bills, and no days of suffering and worry, or salary lost through sickness?

How to—

Possess exhilarating health every day in the year

Know your own body

Eat for health

Diet for the cure of disease

Know the art of food preparation

Build a powerful physique

Correct physical imperfections

Become a physical director

Avoid unhappy marriages

Avoid disease

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Give first aid in misconceptions

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Recognize diseases by manifestations

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Treat the common form of disease

Understand the process of reproduction

Benefit by laws of sex and marriage

Treat diseases of women

Diagnose diseases

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Odd and Unusual Patents

(Continued from page 405)

Any cyclist who has had his heels slipped by a dog will appreciate the value of the "dog clamp" patented by a young lady. This invention provides two perforated boxes to the forks of the bicycle. The boxes were to be filled with flour, pepper, or other pulverized material calculated to repel vicious canines who annoy cyclists, and were connected with tubes to a bulb fastened to the handlebars. The bulb need only be compressed and the patent is secured upon the dog. The inventor claimed that the dog ceased to annoy after having a pepper spray.

There is no disputing the statement that a vast amount of thought and consideration has been given to the problem of sleeping while asleep. The patent records show that at least three men wanted to rid mankind of its most distressing foible—over-sleeping. The first secured a patent on a combined alarm clock and bedstead. The inventor provides for "the dropping of a bolt, as the hour hand of the clock passes the ap- pointed hour," to let loose a set of bars which holds up the mattress which in turn swings upon central pivots dropping the sleeper upon the bed. The second covered an alarm clock connected with a container and a tube. The tube has a perforated end to be fastened about the neck of the sleeper. Before retiring, the sleeper fills the container with water, and at the hour set a spring actuated by the clock releases the water from the container into the tube and the sleeper is given a cold shower. The inventor speaks of this device as "an easy awaken." The third patent is called "an alarm and walking bed." This contraption consists of a clock, which, upon striking the set, releases a bar and the head portion of the bed collapses, thereby giving the upper part of the sleeper's body a very unusual position.

The realm of courtesy is brought into contact with the field of invention by a gentleman from Seattle who patented a self-tipping hat. This ingenious man constructed a hat which would tip itself without the aid of the hands. The hat contained a curious mechanism which was held in a case clamped to the head band and released by a spring in the case. The inventor speaks of this device as "an easy awaken." The second patent is called "an alarm and walking bed." This contraption consists of a clock, which, upon striking the set, releases a bar and the head portion of the bed collapses, thereby giving the upper part of the sleeper's body a very unusual position.

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Odd and Unusual Patents
(Continued from page 469)

feelings of the horse are considered, it is fortunate that the treadmill-car was not a success.

Ingenuity knows no bounds or rules. Some clever chap secured a patent on a raincoat with a gusset that could be turned below the hem of the coat is turned up form a gutter and is inclined so that the water will run to one side where a tubular spout several inches long should be provided to carry the water. The idea being, of course, to keep the legs dry.

Snoring is still the great menace to society although in the past the Patent Office has been issued an Anti-Snoring Device. The patentee alleged that "a person cannot sneeze while lying on his side," and to prevent lying any other way, he provided us with "an arch of hard material secured between the back of the shoulders by means of straps about the waist and thereby preventing the person from sleeping on his back." Snoring is thus easily eliminated by a removal of the cause. We also find among the patents a guillotine for decapitating poultry.

Book Review


This is a very suggestive book. It tells about drawing without a ruler, tee square or triangle, and teaches one of each method. A very interesting book. The position of the hand for drawing straight lines and curves is given carefully, and the point that the work and manipulation of a left handed draftsman is considered. Even the shapes and sizes open the book, and then we come to geometrical drawing with numerous illustrations in perspective. The course that free-hand work leads to the production of perspective views is given in depth, and the shape and triangle always tries to do everything in the highest possible manner. It is given to homological sketching, which may be turned in a sense, the idea to the observer, it is, however, perspective with the observer so far away that the cutting process ceases to exist. No better practice could be found for one who has occasion to make these quick sketches than to follow right through the book and copy the many very characteristics and instructive examples given.


The old homestead and some long known to the scientific world are issuing a series of books called the "Wiley Farm Series." They are edited by Professor A. B. Getman, Supervisor of Agricultural Education at the University of Illinois. This book is the first of the series and the only one so far published. About the world’s imagination which is included, such as harness repairing, (Henry Ford has not yet driven such a machine as well."

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a good idea of their construction may be had. The three large ones are 30 inches long, 13¼ inches wide and 6½ inches deep. The four smaller 9 inches long, 6½ inches wide and 4 inches deep.

An ogee molding 1 inch wide and 1½ inches high is used at the bottom of the desk as shown. The back legs are formed by a part of each side piece, the front legs are of composition in the style of claw feet. They are screwed to the bottom frame.

The brass locks, hinges, glass knobs and sliding drop lid support can be had at any furniture maker's supply house. The composition legs can be obtained there also.

The upper section or bookcase part of the desk is assembled first with two sides, each 41 inches long, 9 inches wide and 3¼ inches thick. A top 1 inch thick, 33 inches long and 10 inches wide is put on just as the top of the lower section is mortised and tenoned. Both tops are the same size and thickness. A molding is cut on three sides of these two tops. It may be "sucked" on by machinery. The back is 1½ inch plywood and is 41 inches long and 29½ inches wide. A ½-inch plywood bottom is used with mortise and tenon construction; it is 30½ inches long, including the tenons, and 8½ inches wide.

The door frame for this section is formed of the sides, bottom and a ¾-inch square maple cross-piece at the top (as shown). A ¾-inch plywood door stop is made using two ½-inch square uprights and a cross-piece 1½ inches wide and 3½ inches thick (see illustration). Four ¾-inch square plywood cleats are used to support the shelves. The shelves are made and 29½ inches long and ¾ inches wide.

Before working on the door, it may be best to study the construction of a door and window sash by observing these two articles in their finished state. The outer upright pieces are called stiles, the cross-pieces are called rails and the thin pieces, forming the wooden parts of the sash, are called glass, or panes. The sash are grooved at the joints and the rails have tongues to fit the grooves. When glass is used, the opening made by boring these pieces together is rabited or cut out for the glass. These bars are made to fit into the rabbed portion and into their own rabbed portions (with tongues). They are held in the door part and to each other by mortise and tenon joints. For furniture all joints are glued.

The door is ¾ inch thick, 29½ inches wide and 40½ inches long. The bars are ¾ inch square, the stiles 5 inches wide, and 40½ inches long, the bottom rail 1½ inches wide and 79½ inches long, including tongues, and the top rail 13¾ inches wide and 20½ inches long with tongues. The center upright bars are 30½ inches long, with tenons, the half circle 7 inches in diameter, and each of the cross bars 7½ inches long, with 3½-inch tenons at each end. Molding is put on as shown and before described.

Maple is usually stained some dark shade and finished with little or no gloss.

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Eighty thousand foot pounds of energy are used by an athlete in running 100 yards in 11 seconds, according to recent tests.

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Book Review


This book takes up, in a very fundamental and systematic way, the elementary principles of radiotelegraphy. The author has chosen a general manner for his book, mathematics being explained to only that necessary to make explications more complete. The style of the book is divided into various parts, each containing precise and well-chosen information, and every chapter is given due consideration. The author not only gives a very concise and easy treatment of this subject, but he also outlines the most important facts in a very clear manner. Hence this volume should prove interesting and instructive to a semi-technical general reference on modern radio.


One is often impressed with the idea that it is a waste of time to make a model for after all what can a little steam locomotive, perhaps only inches long, do in the way of any service, and what is the object of constructing boats that are only twelve inches long, but there is a great deal to be gained in reality. It is given as an admirable training in mechanical construction. It necessitates the study of engineering products, so that at once skill in the use of tools, the study of machinery and naval construction, the mechanical drawing and laying out of work, all apply, so that the time is far from wasted. The English model makers probably do the most in this line, and throughout the book we find that we can discern the English influence to say no more. The book is profusely illustrated; it ranges from the steam locomotive, steamboat and similar things to electricity and various other novelties, including if we may term it a mechanical model, a sailboat, the British cutter type. The book contains an adequate index.


Harvard University some years ago issued a synopsis of experiments in physics required for entrance examinations, and the book was quite clever, they did seem a little bit elementary. In this book we have described a number of most interesting and more advanced experiments in use in Stanford University, Columbia University, the authors being connected, one with a western university, the other with a note and university. The idea is to give the full directions for experiments in physics, and to point the student in the laboratory, not merely for reference on calculations. The illustrations are so worked that the student has the apparatus itself in front of him, works with the apparatus itself, and so many illuminations are needed. We fnd a diaphragm of a potential set which should be interesting to our radio friends who apply the term potentialmeter somewhat too loosely. There is an appendix containing notes on apparatus, and an interesting part of this section contains data for direct calculations, because there are always liable to be invariable errors, but the reader is left in to what we may call the circumstances of the case.


This book is of special interest to the present reviewer, whose religion and profession involve dealing with the vegetable subject of its pages. A number of very patient souls are now taking up foot-power weaving in an effort to prove the reviewer is one of those. Therefore it follows that this book rather reaches the market of the one hundred and pages and over four hundred illustrations. A most interesting portion treats of artificial silk, which is now coming into such extensive use, although it must be conceded that the durability of its extensions is not sufficient to the filament of the silk worm surpasses it in quality. Microscopic views of the artificial silk, treated throughout the pages, mercey-cotton, another modern development, is described in considerable detail with illustrations of the machinery used in making and husting it.
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Hunting Whales With Airplanes
(Continued from page 402)

second group (the toothed whales) which includes the Sperm whales, Dolphins and Porpoises, all have teeth, varying in number from a single pair to sixty or more. They feed on fish, squid and cuttlefish.

As will be seen from the foregoing, the whale is just like a human being swimming in water. A man can swim under water for a few minutes holding his breath, and the whale simply goes him one better, having a tremendous pair of lungs, by means of which he can hold sufficient air to oxygenize his blood with while submerged for a period of twenty to thirty minutes. But he may swim under water for five miles in a period of thirty minutes while submerged, and thus it is while hunting whales, the fishermen often are surprised to see a whale dive and then see him again until he reappears and bluffs several miles behind the ship.

Those interested in whales, one of the most fascinating subjects the writer has ever met with, should get the most remarkable new book entitled, "Whale Hunting With Gun and Camera," by Roy Chapman Andrews.

Some people who first see a whale or his skeleton, such as those exhibited at the museums, frequently compare the whale with a submarine. They are more correct than they think, for imagine what power a whale has when, after being harpooned, he has fought courageously for ten hours and pulled a 90-foot steam-driven whaling boat after him at a speed of ten miles an hour, when the engines and screws of the whaling boat were set in full reverse or astern. Many a man has lost his waiting expectations, simply by the swish of a whale's tail at close quarters, this powerful tail crashing him as flat as a flounder. Remember, one swat of his tail represents tons of meat and blubber crashing down upon you. If a whale charges an average small whaling steamer and hits it right in the angle, he is quite likely to buckle in the plates and sink the boat. Sixty to seventy tons of solid meat and bones are not to be conjured with when it comes to mauling you at a speed of ten to fifteen miles an hour, the average speed of the whale when swimming. In Mr. Andrews' book you will find many instances where whales after having been harpooned have towed the whaling boat for hours, with the boat's engines in reverse and half or full reverse. If you live anywhere near a museum where you can see a whale on exhibition, you should by all means go and have a good look at him. They are one of the most awe-inspiring sights you can imagine.

The question is often asked how big is a whale's birth. The common impression seems to be that they are the size of a shark, or 7 to 12 feet in length. The baby whale is the most astonishing "little fellow" and would scare you right out of your boots if you ever met one in the water while swimming. The "babies" measure 12 to 25 feet in length, or from 5 to 15 the length of the mother whale when she gives birth to it. Many offspring have been born just at the point where the whale mother is hunted and killed by steam-driven whaling stations; but if the mother expired shortly before, the baby whale is either born dead or is found in the stomach of the mother, as the blubber cut away. The outer skin of the whale is very interesting, being of a tough, hairless nature about one-half inch thick and the heavy layers of blubber or fat underneath this skin vary from 8 to 12 inches in thickness, and serve to keep the blood of the whale warm.
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(Continued from page 438)

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