

SCIENTIFIC AMERICAN

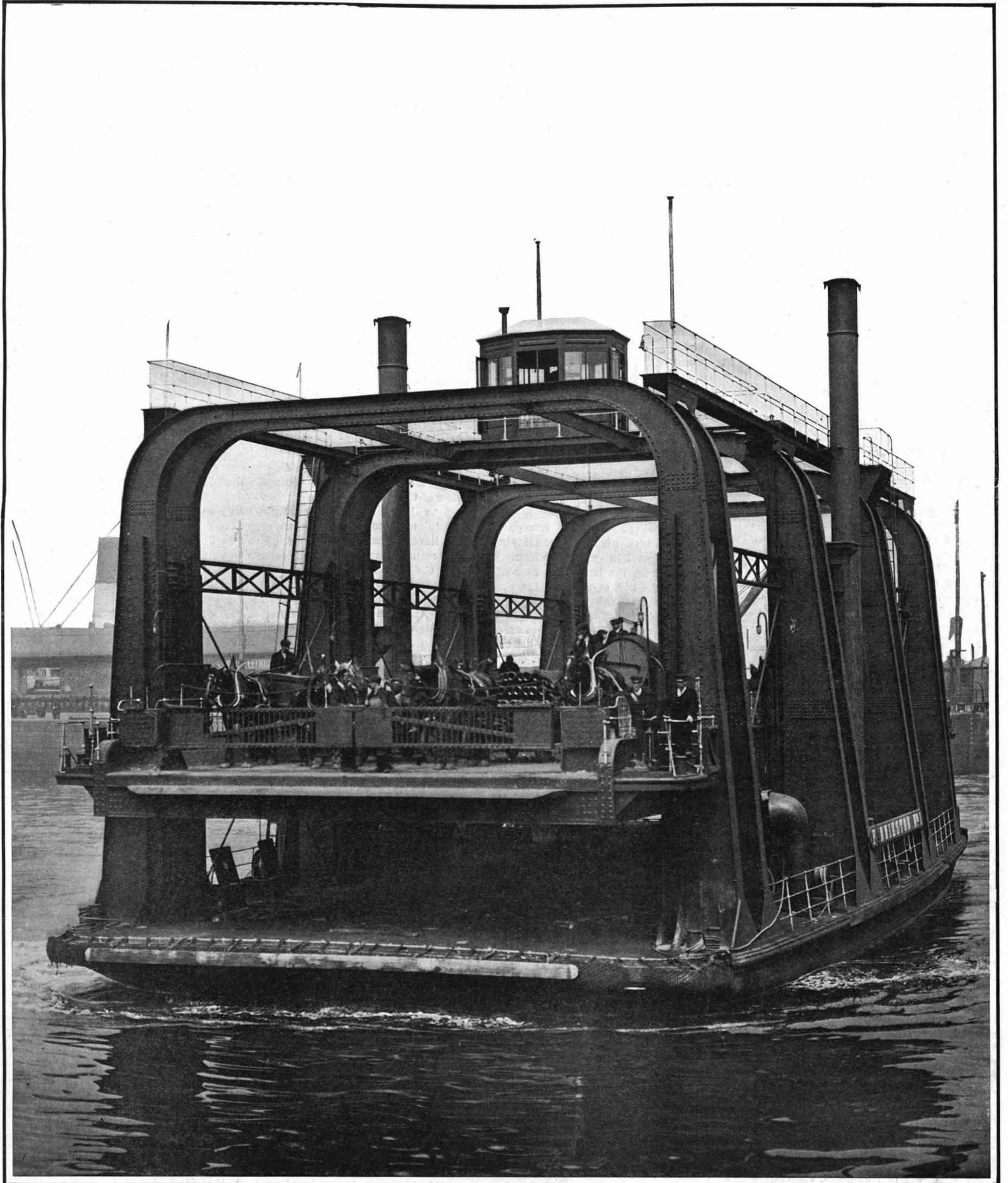
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A NEW SCOTCH FERRYBOAT WHICH HAS A DECK THAT CAN BE RAISED AND LOWERED FLUSH WITH THE LANDING.—[See page 48.]

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ESTABLISHED 1845

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The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are sharp, the articles short, and the facts authentic, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

LONGER DAYLIGHT.

There are a great many things to be said in favor of, and a few against, the proposal to advance the clock by one hour during the summer months. Although the suggested change is startling, there is in it nothing of the ludicrous or farcical, as some of its critics have suggested. The principal object of the movement is to apportion a larger part of the period of daylight to evening rest and recreation than is now possible in latitudes embraced by the United States. Under present conditions the close of the working day is so near sunset that, by the time the evening meal is over, twilight has commenced, and the stretch of remaining daylight is too short for any lengthy outdoor sports or pastimes of the kind which require daylight for their exercise.

Those of us who have spent part of the summer months in northern latitudes, where the later sunset and longer duration of twilight combine to make the summer evenings the most lengthy and delightful period of recreation, understand perfectly well the motive and force of the arguments which have led to the present widespread movement in favor of what has popularly come to be known as a longer daylight day. The evening is the ideal time for outdoor recreation. The mind and body are relieved of the stress of the day's occupation, and the cooler temperature, which is a consideration, even in the northern latitudes, becomes of double importance in the more southerly regions, where temperatures during the day run up to 90 or even 100 in the shade.

The proposed arrangement as advocated by the National Daylight Association in this country is that from and after 2 o'clock in the morning of the first day of May in each year, until 2 o'clock on the morning of the first day of October, the standard time shall be one hour in advance of the standard time now in use. This result is to be secured by advancing the hands of the clock one hour on May 1st and moving them back one hour on October 1st. The change would involve a shortening of the hours of sleep only on the last day of April. Subsequently through the summer months people would get up and retire by the clock as usual, and the regular schedule of railroads, factories, and all social institutions would be maintained as before. The only perceptible difference would be that instead of the twilight ending at from 9 to 9:30, it would last from 10 to 10:30, according to the latitude, and the public would have the benefit of two or three hours of daylight after the evening meal, instead of one or two hours as under the present arrangement.

We cannot quite agree with the circular of the Daylight Association that no adjustment of railroad schedules would be necessary. Some adjustment would obviously be needed on the two days which marked the opening and close of the longer daylight season; but with those two exceptions regular schedules could be maintained without interruption during the 150 days or more of the late spring, summer, and early fall months.

At the present time there is a bill before the British Parliament which provides for a change similar to that related above. That the matter is being seriously regarded in that country is shown by the fact that it has the indorsement of the Education Committee of the London County Council, of over one hundred municipal corporations and town councils, of the National Convention of Royal Burghs of Scotland representing about two hundred towns, and of one hundred and thirty chambers of commerce, associations, and clubs. A similar bill is now before the Canadian Parliament, and the report of the special committee to whom it was referred says that in view of the almost unanimous

support in favor of the bill, and that its object can be so easily attained, they consider that it should be put in force as soon as possible. It is probable that a similar bill, which has already received wide journalistic indorsement, will be introduced in France.

SUBURBAN TRAFFIC IN LONDON AND NEW YORK.

Geographically considered, the ideal conditions for the rapid inflow and outflow of the population of a great city to and from its business center are that the city shall be located inland, and that the traffic movement shall not be obstructed by any natural topographical features, such as are presented by the sea or wide and deep rivers or estuaries. Judged by this standard, London, Paris, and Berlin are admirably located, whereas New York is at a great disadvantage. In a diagram accompanying the last report of the London Traffic Branch of the Board of Trade, the density of railway traffic and its distribution on the various suburban railways are very lucidly shown. The diagram was drawn from statistics of the railroad companies of the number of passengers who entered the business center of London in the month of October, 1907, from all stations within thirty miles of the city. It includes the number of trips taken to the city by the season-ticket holders. The figures show that of the 9,743,669 persons who entered within a four-mile radius of Charing Cross by railway in this month, 8,071,785, or about 83 per cent, came from localities not exceeding ten miles from Charing Cross, 8.5 per cent entered from distances between ten and twelve miles, and less than 8.5 per cent from distances lying between twelve and thirty miles from Charing Cross.

An analysis of the table shows that 2,232,201 passengers came from the first zone, which is from four to six miles distant from Charing Cross, and that they averaged 35,584 passengers to the square mile; that 3,406,588 passengers came from the six to eight mile zone, and that the average was 38,729 passengers per square mile; that 2,432,996 came from the eight to ten mile zone, and averaged 21,512 passengers to the square mile. From the ten to twelve mile zone the travel consisted of 843,780 passengers, who averaged 6,104 to the square mile; 331,213, averaging 592 to the square mile, came from the fifteen to twenty mile zone; and 107,614, averaging 124 to the square mile, came from the twenty-five to thirty mile zone.

Turning now to the traffic problem in New York city, we find that before the period of big bridges and tunnels, Manhattan Island was most unfavorably situated for the rapid and comfortable handling of daily passenger traffic. Shut off on one side by the sea and on two others by broad and deep rivers, the city was denied those advantages, accruing to large metropolitan cities in Europe from an inland situation, which permit of the laying out of lines of railroad travel in every direction. When the railroads radiate from the business center of a city as the spokes from the hub of a wheel, the congestion of traffic decreases theoretically as the square of the distance from the center. The figures quoted above for London show how quickly the outgoing crowds at night are disembarked from the trains, over one-half of the total of nine millions having left the cars by the time they have passed some six miles beyond the central zone. In Manhattan, however, before the era of bridges and tunnels, the greater part of the rush-hour travel moved in parallel lines up and down a long and narrow island, and many miles had to be covered before any relief was noticeable. The intolerable congestion due to these conditions hastened the construction of the subway, which was completed only just in time to save the transportation problem in New York from an absolute deadlock. With the approaching completion of all of the eleven tunnels and three great bridges, which have been built during the last decade and a half to connect Manhattan Island with New Jersey and Long Island, New York city will be favored with the diverging system of transportation which characterizes London and other great cities of Europe. The splendid facilities for comfortable and rapid travel to the vast suburban areas lying to the east and west of Manhattan, are certain to act with a loosening up effect upon the present congestion of our elevated and subway lines of travel in Manhattan. It will need only the construction of the Fourth Avenue line in Brooklyn, with a tunnel beneath the Narrows to Staten Island, to place New York city in practically as favorable a position for all-round radial travel as London itself.

INCONCLUSIVE TESTS OF THE SCOUT CRUISERS.

The possession by the United States navy of three scout cruisers, the "Birmingham," "Chester," and "Salem," absolutely identical in size and model, but driven by three different types of engine, presents an unrivaled opportunity for determining the relative all-round efficiency of the three types for naval purposes. We are free to confess, however, that the tests which have already been carried out, elaborate and costly though they have been, do not seem to be conclusive. In fact, the further the tests have gone, the more bewildering do the results obtained appear

It is absolutely necessary, if the data secured at such trials are to be of value, that the conditions in the case of the three competitors shall be absolutely identical. It was the intention of the Navy Department that they should be so; but, unfortunately, with the exception of the government standardization trials at Rockland and the water-consumption trials made early in the year, there were certain disturbing elements, some accidental and others incidental to the conditions under which the tests were made and quite unavoidable, which so greatly vitiated the results that they have lost their value.

Such facts as have been clearly established are a verification, as far as the relative merits of reciprocating and turbine marine engines are concerned, of previous results obtained with the two types. At the lower speeds, or what are known in the navy as "cruising speeds," the reciprocating engines of the "Birmingham" proved to be more economical; but at the higher speeds, and notably when the ships were driven under full power, both the Parsons and the Curtis turbines showed a marked superiority in coal consumption, and drove their respective vessels at considerably higher maximum speeds. As far as the published official figures show, there is not much to choose between the two types of turbine, sometimes one and sometimes the other showing a slight advantage in both the standardization and in the water-consumption trials.

It is when we come to the long-distance trials at sea that the confusion begins. In the coal-consumption tests which were carried out a few months ago, at the rate of 15 knots an hour, the "Birmingham" showed a coal consumption of seventy-one tons, the "Chester" of eighty-five tons, and the "Salem" of one hundred and seven tons a day. The disparity between the consumption of the "Birmingham" and the "Chester" was not unexpected, but the consumption of the "Salem" was inexplicable. At the conclusion of the trials the "Salem" returned to the builders' yard, and on opening the casing, it was found that a loose bolt, which had probably fallen by accident into the casing, had bent over the edges of a large part of the blading, thereby obstructing the passage of the steam and running up the coal consumption.

Shortly after the conclusion of the trials, the "Chester" and the "Birmingham" sailed for Liberia on the coast of Africa; and, after repairs had been made on the "Salem," she was dispatched to join the other two ships. On the return trip the three scouts, starting from Madeira, steamed side by side for five consecutive days across the Atlantic. All three were careful to maintain the same speed, and everything was done to render this a fair, five-day trial of the engines. There was no attempt made to run at high speed, and the average rate per hour for the five days was 13.8 knots. The test has furnished the latest bewildering coal-consumption figures of the many which have been obtained with these vessels; for the results of the first sea trials have now been completely reversed, the "Salem" having burned an average of ninety-five tons per day, the "Birmingham" one hundred and ten tons, and the "Chester" one hundred and thirty tons per day. The explanation of the reversal of form on the "Birmingham" and "Chester" given by the officers of these ships is, that while they were anchored off the coast of Liberia the bottoms of the ships became, as they always will do in tropical waters, very foul. On the other hand, it was explained by the officers of the "Salem" that while they were lying in the mud at the Quincy yard for repairs, they were at a similar disadvantage.

Now, in the face of the above figures, it seems that something must have gone wrong with the "Chester's" turbines, a fact which will no doubt be determined as soon as she can get to a repair yard; but the moral of these very bewildering results is that, in view of the enormous importance of the turbine question, the Navy Department should undertake a fresh series of trials of these three ships, in which every care should be taken to render the conditions identical. Moreover, the trials should be of such a length, and be carried on under such varying conditions, as to settle beyond all question of doubt which is the best type of drive to install in the future warships of the United States navy. We do not hesitate to affirm that this is to-day the most important question affecting the physical characteristics of the ships of our navy. Of the reliability of the turbine, whether it be the Parsons or Curtis type, there is no doubt whatever; and it is because of its reliability when driven for long periods of time at full power that it is vastly superior to the reciprocating engine for naval purposes. The question between the two types of turbine, however, is one of coal consumption, and the question of coal consumption is intimately related to the question of radius of action, or total steaming distance, one of the most important elements in a warship. When two similar cruisers cross the Atlantic with a difference in coal consumption of over 35 per cent, it is clear that the demand for further examination into the range of efficiency of their turbines is well made.

ENGINEERING.

ing to statistics furnished by the United Forest Service, the art of wood preservation in this country during the year 1908 called for the use of 56,000,000 gallons of creosote, 19,000,000 pounds of zinc chloride, with small quantities of corrosive sublimate, crude oil, and other chemicals. Of the creosote, nearly seven-tenths was imported, most of it from England and Germany.

The longest pipe line in the world is that which extends from the Oklahoma oil wells to New York harbor. At the present time the oil field of Oklahoma is the most active in the United States. It is not likely that the line will be put to immediate use for conveying oil over the whole distance. The completion of the system is regarded rather as a provision for emergency, and to meet the future conditions, when the Pennsylvania and West Virginia fields shall have been depleted.

The final dimensions of the great drydock which the United States navy is building at Pearl Harbor, in the Hawaiian Islands, show that the government is wisely building for the future. The dock will be 1,152 feet long from the coping to the outer sill, 140 feet wide at the top, and will have 35 feet of water over the entrance sill at mean high-water level. There will be a sill at the middle of the dock, for an intermediate caisson which will divide it into two docks, 575 feet and 532 feet long respectively.

On July 6th the United States Reclamation Service announced that the headings had met in the great Gunnison tunnel, which the government is building in western Colorado to carry the water of the Gunnison River into the Uncompahgre Valley, where it will be used for irrigation. The tunnel, which will be cement-lined throughout and will have a finished cross section of 10½ by 11½ feet, will be the largest underground waterway in the world. It is six miles in length, and will carry thirteen hundred cubic feet of water per second. Its cost will be over \$2,500,000.

On July 19th the twin tunnels extending beneath the Hudson River from the Pennsylvania Terminal Station in Jersey City to the Hudson Terminal Building in Manhattan, at Cortlandt Street, will be opened for operation. Trains will run from a five-track station, eighty feet below the Pennsylvania Terminal, to a five-track loop station beneath the Terminal Building. As soon as sufficient cars can be obtained from the builders, the twin tunnel, running parallel with the Hudson shore line on the Jersey side, and extending from the Pennsylvania to the Lackawanna terminals, will be also placed in operation.

From every point of view the round-the-world cruise of the battleship fleet was a pronounced success, and the crowning indorsement of all has been the recent announcement of the Assistant Secretary of the Navy that the repairs to thirteen of the sixteen battleships that made the voyage have been completed at a total cost to the Engineering and the Equipment bureaus of \$50,280, or less than \$4,000 per ship. Many were the predictions of trouble, damage, and even disaster, at the time of the starting of the fleet; but not one has been fulfilled. On the contrary, the benefit to the navy in the increase of its physical efficiency and the improvement of its morale has been invaluable.

A test was recently made in England of a steam engine designed to work at pressures of as high as one thousand pounds per square inch. According to our contemporary, Engineering, the tests showed a steam economy of 13.5 pounds per brake horse-power per hour. The engine is of the inverted-V type, with eight cylinders, the high-pressure two inches, low-pressure five inches in diameter, each pair being arranged in tandem on two cranks. The stroke is four inches; the speed, eight hundred revolutions per minute. Forced lubrication is used, the oil being pumped into the steam on its way to the cylinders. In the test the steam pressure was five hundred pounds, temperature 720 degrees, the revolutions seven hundred per minute, and the brake horse-power developed 32.65.

With a view to enabling marine turbine engine propellers to work at higher efficiency, Mr. Yasuzo Wadagaki, in a paper before the Northeast Coast Institution of Engineers and Shipbuilders, proposes to use a metallic casing surrounding the screw propeller, the forward and aft ends of which are flared into bell-mouth shape, with a cross-sectional area gradually contracting from the two ends toward the screw propeller. By this arrangement the forward velocity of the water, which is imparted by the frictional pull of the ship's side, is accelerated, until at the most contracted part of the channel, where the water is acted upon by the screw propeller, the velocity rises to a maximum, the propeller operating "in water having a relative velocity much higher than the forward speed of the vessel." By this device Mr. Wadagaki believes the slip will be reduced and the screw propeller efficiency proportionately increased.

ELECTRICITY.

In a recent lecture before the Royal Institute, London, Prof. W. E. Dalby showed that for long distance traction at speeds under 55 miles per hour steam is much more economical than electric drive. Electricity possesses an advantage for high speed travel because the power is limited only by the number of axles to which motors may be applied.

The largest electrically-controlled switch tower in the world has just been put into service at Providence, R. I., on the New York, New Haven & Hartford Railroad. The tower is equipped with 77 switch levers, providing 266 combinations. Elaborate precautions are furnished to prevent the giving of a wrong signal. The power used is taken from the feed wires of the railway, but as a precaution two other sources of power are provided, which may be drawn upon in case of emergency.

The old-style gasoline lights which have been used in Central Park are to be displaced with 1,400 or more than twice as many electric lamps. A very artistic lamp post has been designed for the new lamps. One of the objections to the gasoline lamps was the fact that the leakage of the oil ruined the grass around these lamp posts. Furthermore, the lamplighters did much damage by making short cuts through the flower beds along their routes from one lamp to another.

From time to time we hear of some enterprising amateur driving an electric generator by means of a windmill, and thus obtaining electricity without cost except that of the installation, and with it lighting his house and operating various household machinery. Recently a German company has gotten up a special electric generator equipment adapted to be operated by wind power. The installation comprises a dynamo and a storage battery, the latter serving to store the excess power until such time as it is required. The apparatus is entirely automatic, and requires absolutely no attention except in time of storm, when it is necessary to reduce the sail area of the wind wheel. A special regulator used with this apparatus automatically keeps a constant pressure on the lighting circuit, this being entirely independent of the number of revolutions of the dynamo or the condition of the storage battery.

One of the large new steamers of the Orient Steam Navigation Company plying between England and Australia has been provided with a model electric equipment, even including an electric laundry. The wash is first boiled in a tank, where the water is kept at boiling point by means of steam pipes; thence it is carried to a pair of washing machines driven by an electric motor. The clothing is dried by means of a hydro-extractor driven at 640 revolutions per minute by a 2-horse-power motor. There is a Decoudon machine driven by an electric motor, which is provided with a safety device to prevent the operator's fingers from being caught under the rollers. If the fingers come too near the roller, the motor which drives the machine is automatically stopped. The laundry is equipped with an electrically-driven ironing machine and with several electric irons.

Many hospitals in England are provided with a special apparatus for extracting iron and steel fragments from the eye by means of powerful electro magnets. The magnet employed has a core three feet long and six inches in diameter of the best Swedish soft iron. Two hundred pounds of insulated wire are wound in two coils about the core. The end of the magnet is threaded to receive terminals of different shapes to suit various conditions. The magnet is mounted on ball bearings, and can be moved in any direction. The strength of the magnetic field may be varied at will by means of a rheostat. When used at its maximum power, the magnet exerts a pull of 30 pounds per square inch at a distance of an inch. A special type of apparatus is provided for reclining patients. In this case the magnet is mounted on trunnions, and is tilted by means of suitable gearing operated by a hand crank.

A new form of electrical vacuum meter has recently been devised. It possesses a distinct advantage over other electric vacuum meters in the fact that it requires no instrument for measuring the current resistance or intensity. The device consists of a glass tube which communicates with the vessel in which the vacuum is formed. A wire passes through this tube, and forms part of a circuit through which a current of constant pressure is fed. At the center of the tube a small weight is attached to the wire. The current passing through the wire heats it to a certain degree, dependent upon the intensity of the current, and also upon the amount of heat carried off by the gas surrounding the wire. As the gas is rarefied it dissipates less and less of the heat, causing the temperature of the wire to rise. The increased temperature expands the wire, making it sag. The glass tube is graduated so that the extent of the sag may be observed, and thus the degree of rarefaction is determined.

SCIENCE.

A new parasite which attacks the vine at the root was discussed at the Académie des Sciences by M. Guignard, chief of the College of Pharmacy. It is designated "clandestine," as it is quite invisible in general, so that it is all the more dangerous. The parasite is believed to be a fungus of the phanerogam family. Experiments upon it are being continued at the biological laboratory of Nantes.

The New York Aquarium has acquired an octopus after considerable expense and difficulty. The specimen was captured in Bermuda waters, and conveyed to this city in a large tugboat, which was specially chartered for the purpose. During the forty-eight-hour trip from Bermuda to New York, seamen were kept busy pumping water into the tank which contained the octopus.

The Smithsonian Institution of Washington will erect on the very summit of Mount Whitney, Cal. (altitude 14,500 feet) an observatory which will enable investigators to study atmospheric conditions at great elevations, in dry air, and in clear skies. The observatory will be erected from the Hodgkins fund, and will comprise a three-room structure of stone substantial enough to stand for centuries.

Dr. Osler has stated that the question of preserving the teeth is more important than the liquor question. No doubt much dyspepsia is due to decayed and defective teeth, which preclude complete mastication of the food (even if anybody in America had the time to eat properly). Dentists, like doctors, are now beginning to realize that their true mission is not "a general rebuilding system," but a systematic and well-considered effort to prevent and overcome the decay and loosening of human teeth.

A French microscopist has devised a method of detecting and recognizing traces of blood on knife blades and other opaque objects even when the stains cannot be seen with the naked eye. The light of a Welsbach burner is concentrated upon the part of the object under examination through a tube which is placed obliquely above the object glass and which carries an iris diaphragm, a condensing lens and a total reflection prism. A photographic camera may be substituted for the eyepiece.

The freedom from corrosion and other properties of tantalum suggested the employment of this metal as a material for pens, but tantalum pens have failed to pass the test for durability which is applied (in France) to steel pens. This test consists in loading the pen with a weight of 180 grammes (6 1/3 ounces) and moving a band of paper beneath and in contact with a pen, at the ordinary speed of writing, until 10 kilometers (6¼ miles) of paper have passed. The loss in weight of the pen should not exceed 0.7 milligramme (0.0108 grain). The tantalum pens were found to lose more than twice this amount, but the loss has been reduced to 0.8 milligramme (0.0123 grain) by slightly oxidizing the tantalum.

A recent issue of the Gazette Astronomique of Antwerp announces that the great telescope of the Paris exposition of 1900, with two objectives, visual and photographic, 47¼ inches aperture, a coelostat mirror 6½ feet in diameter and various accessories, the whole costing more than \$150,000 to construct, is offered for sale by the receiver of the exposition. On this announcement, Cosmos, which had vainly endeavored to find out what had become of the monster telescope, makes two comments; first, that the receiver has not been unduly precipitous in converting the assets into cash, and secondly, that here is an exceptional opportunity to procure an extraordinary instrument, probably for less than one-tenth of its cost, as there will be few purchasers for a telescope which requires for its housing a building more than 130 feet long.

A bulletin recently issued by the United States Department of Agriculture sets forth the results of a long series of experiments carried on by Dr. Benedict and Mr. Carpenter with the remarkable respiration calorimeter at Wesleyan University, which in the hands of Atwater and Benedict has added so much to our knowledge of metabolism. As a result of these investigations, it seems that the human body is a machine of such wonderful efficiency that one-fifth of the energy expended by it can be utilized as work, and that this efficiency is more or less the same in men of all types. The longest and most thorough training does not change this ratio. The professional athlete, if he is able to outstrip the novice, does so, not because he has better muscles, but because he is able to put more energy in the shape of tissue change into action. Training, besides preparing the heart to stand great strain, acts to increase the subject's power of using up his tissue, and by giving him more muscle tissue to use rather than by teaching him to conserve his energies. In other words, the professional has a more powerful engine because he is able to use more fuel, and not because he wastes less steam; if we may employ a mechanical simile.

AN ENGLISH ELECTRICALLY OPERATED EVAPORATIVE CONDENSER PLANT.

BY FRANK C. PERKINS.

The accompanying illustration shows the construction of an English evaporative condenser constructed to do for the atmospheric condenser what the Contraflo does for the ordinary wet-surface condenser, utilizing compartmental drainage. This plant was installed to deal with 60,000 pounds of exhaust steam per hour and to maintain a vacuum of 25 inches under severe conditions, there being no available water except from the city main.

It will be noted from the illustration that the condenser is formed of two sections of pipes supported by a base of brick and concrete, forming an enormous tank. Each of the two groups or sections is divided into smaller sections, collectors being placed at the end of the coils for separately draining them in such a way as to separate the water from the vapor. The water of condensation then flows into a seal box, and an electric motor-driven pump carries a larger part of it away directly to the hot well, while still at a high temperature.

Sectional drainage is regulated to suit the load on the condenser, in order to obtain at the same time both a high vacuum and a hot feed. Care was taken in the design of the installation to prevent all the water of condensation from being drained from the pipe, for in order to obtain efficient condensation of steam, the effervescent action is necessary. Valves are arranged so as to provide the adjustment of the sectional drainage to synchronize with the load and to secure a hot feed on light load as well as on peak load.

A slow-speed electric motor is utilized for driving each of the two sets of three-cylinder air pumps. In the same pump room are located two direct-connected electric-motor-driven centrifugal pumps for circulating the water over the condenser pipe.

A NEW ELECTRIC TRAVELING SCALE CRANE.

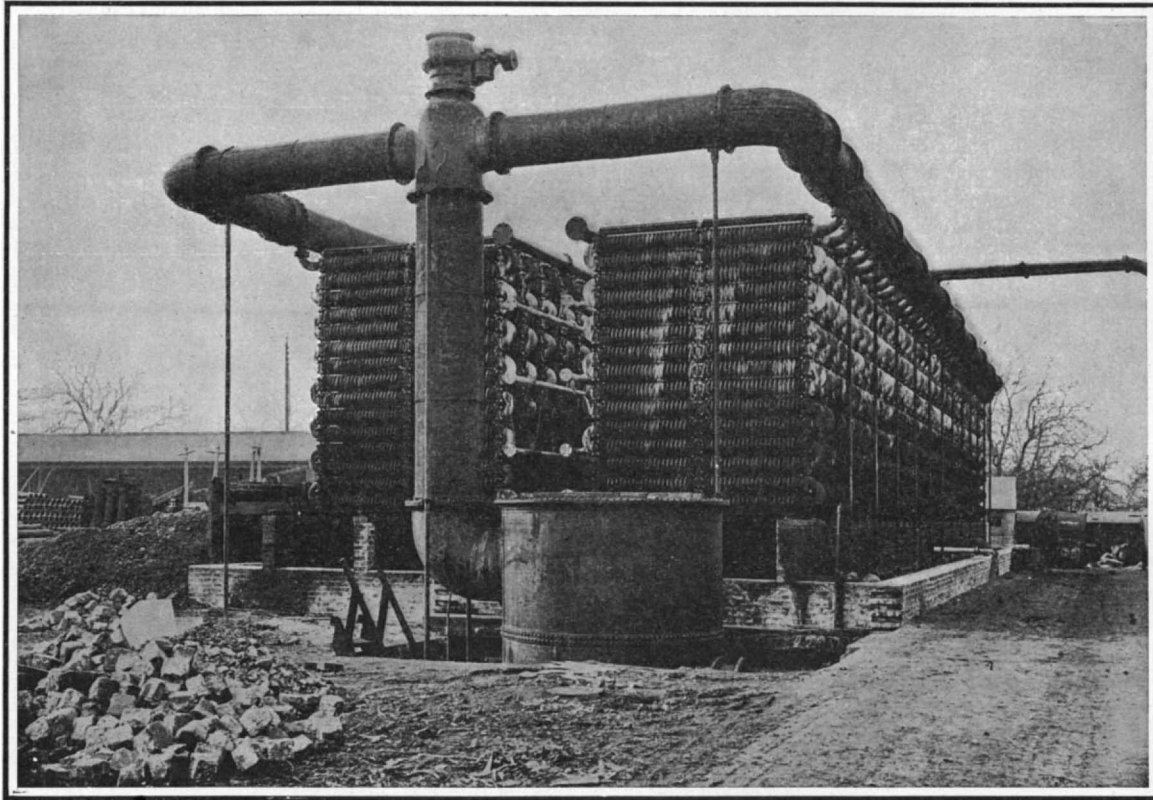
BY WALTER BAILEY.

The accompanying illustration shows the construction and method of operation of a three-motor electric traveling scale crane, all movements of which are accomplished by electric power. The scales are supported on a trolley truck frame and carry the hoisting mechanism on an independent steel framework, while the scale beams are in the cage suspended from the trolley, and readings are taken and recorded by the operator.

It is of interest to note that the crane is provided with three beams, two scale beams with several recording poises and one tare beam, permitting the scale weights of several different items of material to be easily and accurately determined. A movement of the hand lever transfers the load from the knife edges of the scale to the trolley truck frame when desired, and the operation thereafter is the same as with an ordinary trolley.

It will be seen that an open side platform is furnished for carrying long pieces such as bars and rods, this platform being designed to suit the material to be handled. The crane is adapted for weighing material when loading, checking invoiced weights, and for loading for shipment as well as for inventory.

The illustration shows a three-motor electric traveling scale crane fitted with alternating-current 3-phase 60-cycle 220-volt motor. This construction is used in warehouses for handling freight, structural material, or any other class of goods of which the weight is desired. The scale beams are so arranged that record of the weight of each piece can be made automatically.



A HUGE EVAPORATIVE CONDENSER.

The scale mechanism can be thrown out of service and the carrying beam cast off, so that the crane may be used as a standard traveling crane for general work.

"Speaking" Dynamos and Transformers.

The human voice is perfectly transmitted a considerable distance by undulatory or induction currents, produced by periodic alterations in the magnetism of a magnet. Prof. W. Peukert, of Brunswick, Germany, has tried to magnetize an iron core by currents of the kind produced when a microphone is spoken into. To this effect he inserted a coil surrounding a closed bundle of soft iron wires in the

by feeble, variable magnetizing forces. the idea of subjecting the iron simultaneously to a constant magnetizing force. With this object in view the core was surrounded by a second coil of wire, energized by direct current. The iron core immediately began to give out intense sounds. In fact, by passing a direct current of proper intensity, speech was loudly reproduced as to be distinctly audible at a distance of several yards.

In another arrangement a coil and soft iron core were inserted between the poles of an electro magnet. Again a very intense and distinct reproduction of speech was produced. The sound intensity, in this case as well, depended mainly on the excitation of the electro magnet. A reproduction, though of considerably less intensity, is also obtained when using a coil without iron core.

These experiments having shown a considerable permanent magnetization to be the main factor, the substitution of a large steel magnet for the electro magnet was suggested. Accordingly, a horse-shoe magnet, on a wound iron core, was used with excellent effect. Speech was reproduced very distinctly. By properly choosing the shape and dimensions of the various parts it thus was possible to obtain a novel telephone apparatus, remarkable for its simplicity, and free from the disadvantages of vibrating plates or membranes. This telephone comprises a magnetic circuit as perfectly closed as possible, whose ultimate particles partake in the oscillation, insuring—because of the magnitude of the vibrating mass—a considerable sound intensity. These effects can even be increased by using an acoustic funnel, the whole system constituting an extremely simple loud-speaking telephone, free from the upper harmonics that usually spoil the timbre.

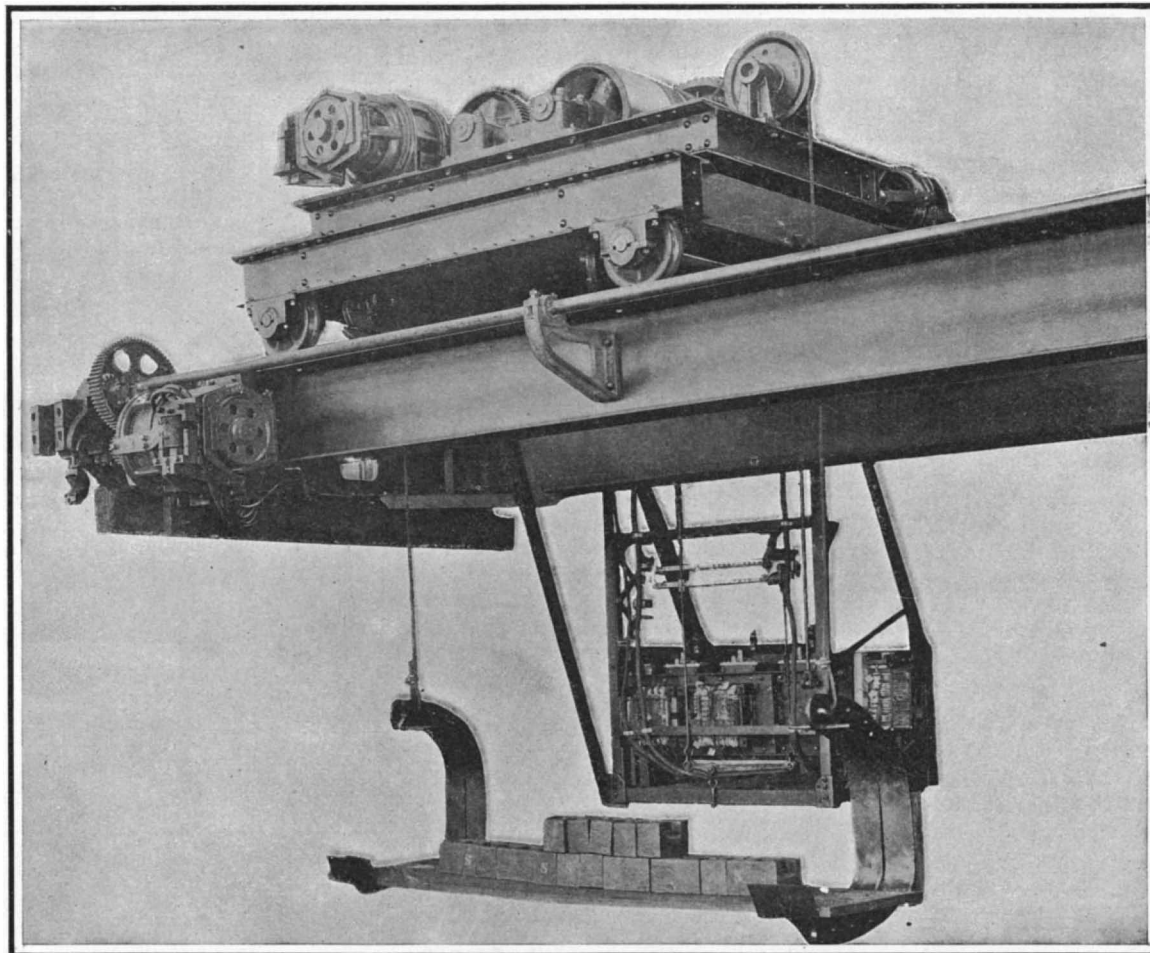
Similar experiments with equally satisfactory results were made on different alternating-current transformers. Even a dynamo could be made to talk. The field magnets of the dynamo were excited from a special source of continuous current. The microphone circuit being applied to the brushes, the dynamo repeated with perfect distinctness the words pronounced in front of the microphone. Speech and song were reproduced with equal clearness, a small 500-watt shunt dynamo producing sounds distinctly heard throughout a hall of fair size.

While large-sized machines show the same effect, the sound intensity of the reproduction by no means increases with the size of the machine, the microphone current undergoing no corresponding increase.

It is doubtless an interesting physical phenomenon that the heavy iron masses used in connection with dynamos and transformers should be acted upon to such an extent by feeble microphone currents.

The government commission appointed to regulate the Russian platinum industry has, in conjunction with representatives

of that industry, drawn up a scheme for the formation of a compulsory syndicate. In connection with this scheme, the exportation of unrefined platinum is to be prohibited, its production is to be regulated by law, and credit is to be allowed on platinum by the State Treasury until the export trade in that article to foreign countries shall have become more favorable.



A NEW ELECTRIC TRAVELING SCALE CRANE.

circuit of a microphone. The sounds pronounced in front of the microphone caused the iron core to vibrate slightly, thereby rendering conversation with perfect distinctness, though so feebly that the ear had to be brought close to the iron core.

It is well known that the permanent magnetism of iron under certain conditions is markedly influenced

Wireless Telegraphy and Meteorology.

Acc. **States** this of C. been voyage, experiments which demonstrated the feasibility of transmitting weather indications from ship to ship in this way. The coast wireless stations which are most important for communication with vessels navigating the Atlantic Ocean are those of the English Channel, the west coast of Ireland and the eastern shores of the United States and Canada. Several of these stations can make themselves understood to a distance of 2,000 miles, so that vessels can receive intelligence from land during the entire voyage across the Atlantic. The wireless transmitters on shipboard, however, are much less powerful. Their radius of action never exceeds 500 miles, and they cannot send messages directly to land from a greater distance than this.

During the summer of 1908 Dr. Polis made an experimental voyage across the Atlantic and back, on the Hamburg steamer "Kaiserin Auguste Victoria." He had arranged with several steamship companies to take part in the experiments, and from their vessels he received 25 wireless messages on the outward and 19 on the return passage.

In addition, the Aix la Chapelle observatory sent him, via the wireless station at Clifden, Ireland, daily reports of meteorological observations made on the English and French coasts. The transmission was perfectly successful up to the end of the fourth day of the outward voyage, when the ship was about 2,000 miles from the Irish coast. The messages, which were in cipher, were transmitted without a single error.

When the ship came within the zone of influence of the American stations, it received daily reports from the Weather Bureau at Washington. These reports were transmitted more rapidly than those from Aix la Chapelle, but they were often curtailed, a fact which was attributed to the employment of code words instead of ciphers.

Conversely, meteorological observations made on the ship were sent out daily by wireless, for transmission to Aix la Chapelle. During the first two days of the westward voyage these messages were received directly by the wireless stations on the English Channel. Afterward, the messages were transmitted indirectly through vessels nearer shore. This system was employed until the ship was in mid-ocean, and the transmission of the message to Aix occupied two full days. The messages sent directly on the return trip reached Aix in less than 13 hours—one of them in one hour and forty minutes.

Daily weather charts were drawn from the reports received from land in combination with observations made on board. A German commission has since been appointed for the purpose of conducting a more extensive series of experiments.

Collaboration between meteorological and wireless stations, ashore and afloat, would benefit navigation as well as meteorology, for the captain of a ship at sea has a profound interest in forthcoming weather changes. The receipt of various meteorological data from a few stations would not always suffice, but the void would be filled if the wireless stations on the coast should send out daily, at a predetermined hour, weather forecasts obtained from neighboring meteorological stations, for the benefit of all ships within the zones of influence of the wireless stations. In particular, effective warnings of approaching storms might be given in this way.

An attempt in this direction has already been made in Holland. The police schooner of the North Sea fisheries receives daily, while within the zone of influence of the wireless station of Scheveningen, the weather forecasts of the meteorological institute at Bilt. Whenever it is possible, special storm warnings are also sent to the schooner, which transmits the messages to the fishing boats by flag signals.

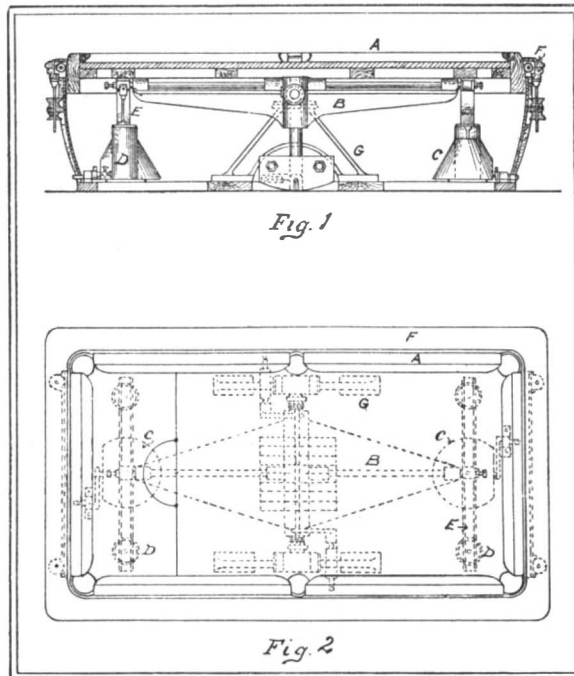
It may be expected that, as the number and frequency of weather reports sent by vessels to meteorological stations increase, the forecasts will become more accurate and more valuable to the vessels which receive them.—Cosmos.

Experiments in abrasion conducted at a French mint have proved that aluminium coins will be less rapidly worn by use than coins made of gold, silver, or even bronze.

A BILLIARD TABLE FOR SHIPS.

BY HAROLD J. SHEPSTONE.

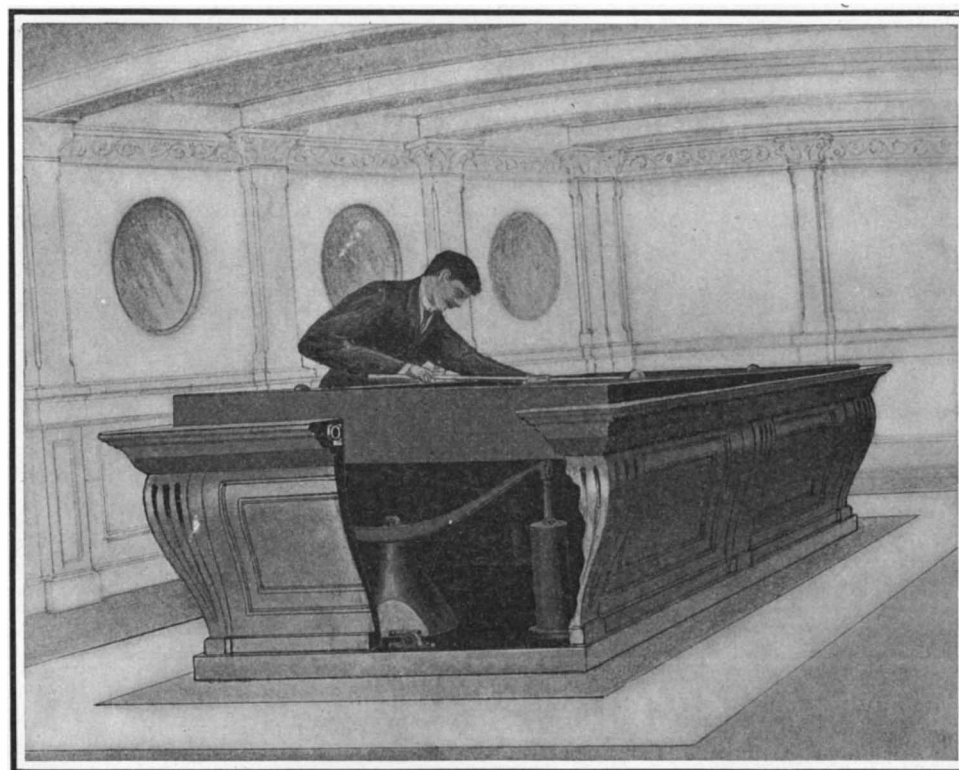
To the wide range of amusements now found on the leading liners, billiards may be added in the near future. This has been rendered possible through the invention of an ingenious movable table top by two London inventors, Messrs. Terrey and Warren. Hitherto it has been impossible to play billiards at sea, chiefly for the reason that billiard balls, like other things, are inexorably subject to the law of gravitation. It seems an undoubted fact, nevertheless, that a billiard table was put into the "Great Eastern." The assumption may possibly have been that the huge proportions



SIDE AND PLAN VIEWS OF THE BILLIARD TABLE.

of the mammoth liner would insure so stable a platform at sea, at all events in ordinary weather, that the balls would not cannon of their own account. If such was the expectation, however, it was doomed to disappointment. To-day it would be just as impossible to play billiards on the "Lusitania" or on the "Adriatic," unless they were at anchor, as it was on their precursor of fifty years ago.

A comparatively modern idea—for the question of a suitable billiard table for ships has received the attention of the makers for a considerable time past—was to fit up a ship with a saloon so suspended that it would remain unaffected by the vessel's movements.



A BILLIARD TABLE FOR SHIPS.

Its floor, it was hoped, would remain perfectly horizontal, whatever the rolling or pitching, and its occupants would be immune from sea-sickness. This notion, despite its humanitarian motives, was doomed to disappointment. The swinging cabin did not work satisfactorily in practice. For one thing, it proved too jerky, and did not add to the safety or comfort of the ship.

A reference to our plans will show how these desirable qualities have been secured. A is the bed of the table, which is secured to transverse girders, situated near the ends of the table. Each girder carries, at the center of its length, the hollow element of a pivot

whose axis is longitudinal to the table, the solid element of the pivot consisting of the shaft B. This latter is secured to a cross piece, to which is also secured a transverse shaft, which is carried in brackets G, bolted to the deck of the billiard saloon of the ship. The horizontal position of the bed of the table is maintained by depending counterbalance weights, of which there are three, namely, one at each end, secured to the transverse girder, for counteracting the effect of the list of the ship, and a central counterbalance, for counteracting the effect of a change of trim. D is a dashpot to hold the opposite end of the table in balance. The two shafts are each carried on ball bearings for the purpose of eliminating friction as much as possible. The table shown in our illustration measures 6 feet by 3 feet, or three-quarters size. A full-size table, of course, could be erected on the same principle, but space being valuable on board ship, it is probable that the smaller size would be chosen.

A Project for the International Exploration of the Atlantic.

At the international geographical congress which met recently in Geneva two delegates called attention to the necessity for an international exploration of the Atlantic Ocean, and suggested the formation for this purpose of an association similar to that which has already been formed for the study of the seas of northern Europe. All Atlantic exploring expeditions of recent years have proceeded southward from Europe and have confined their observations almost entirely to the southern half of the Atlantic. Since the memorable voyage of the "Challenger" (1872-1876) and the last American expedition no ship equipped with modern apparatus has made explorations in the Gulf Stream and the northern Atlantic, although thorough knowledge of these waters is necessary to a complete understanding of the phenomena of the south Atlantic. Almost nothing is known about the laws and range of temperature and the velocity of currents in the north Atlantic, although the variations of temperature of the Gulf Stream undoubtedly exert a powerful influence upon the climate of all northern Europe. A study of the meteorological conditions of the northern Atlantic is also greatly needed, for through this region sweep the barometric depressions, the frequency and paths of which seriously affect the crops of western Europe. The connection between hydrographic and atmospheric phenomena, about which so little is known, also demands study.

Many biological problems, too, await solution. The larvæ of the European eel have been found in the Atlantic, west of Ireland, at a depth of 3,300 feet, and Dr. Hjort has found larvæ of other fishes at great depths in the ocean between Norway and Jan Mayen, so that a systematic and scientific north Atlantic fishery would probably produce surprising results. In this connection the quantity and character of the plankton, which both directly and indirectly influence the migration of fishes, demand thorough study. Finally, the exploration of the waters of northern Europe cannot be regarded as complete, so long as we remain in ignorance of the currents, temperatures and biology of the Atlantic, of which the North Sea, the Baltic, the English Channel, etc., are dependencies.

It is the more remarkable that the north Atlantic is one of the least known of oceanic regions, as the most important highways of traffic traverse this region. It is true that the profile of the sea bottom has been made known, in rough outline, by the work of the cable layers, but we know very little more of the physical characters of this region.

The Gulf Stream requires especially thorough study, because of its great influence on the climate of Europe. Voyages of exploration should be made four times each year and the operations should always include measurements of temperature and salinity at various depths and the collection of specimens of plankton and sea bottom. All the expeditions should use identical instruments, methods, units and constants, so that their results may be directly compared with each other. In order to save expenses the proposed plan does not include an international bureau of operation, but merely an international commission to prescribe instruments and methods and assign to each government the field which it is then to explore with its own men and at its own expense. The participation of individuals will also be welcomed and sought, and the assistance of the great steamship companies is confidently expected.

SECOND HONORABLE MENTION ESSAY ON THE FOURTH DIMENSION.

BY "PLATONIDES" (F. C. FERRY.)

(Judges—Prof. Henry P. Manning of Brown University, and Prof. S. A. Mitchell of Columbia University.)

The schoolboy early becomes familiar with linear measure, square measure, and solid or cubic measure. He understands them respectively as "the measurement of lengths," "the measurement of surface which depends on length and breadth taken conjointly," and "the measurement of volume which depends on length, breadth, and height all taken together." The first involves one dimension, length; the second, two mutually

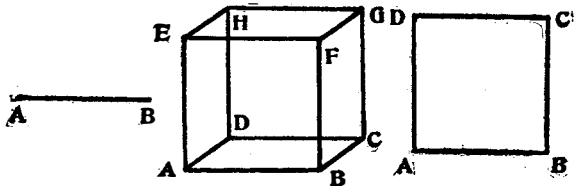


FIG. 1.

perpendicular dimensions, length and breadth, multiplied together; and the third, three dimensions, each perpendicular to the other two—length, breadth, and height, all multiplied together. Let the units of these three kinds of measure (e. g., foot, square foot, and cubic foot) be represented by a line *AB*, a square *ABCD* with that line as side, and a cube *ABCD-G* with that line as edge and that square as base (Fig. 1). The unit *AB* may be regarded as made up of an indefinitely large number *M* of points arranged continuously from *A* to *B*; the square *ABCD* then contains $M \times M = M^2$ points; and the cube *ABCD-G* contains $M \times M \times M = M^3$ points. One can go from any point in *AB* to any or every other point therein by following the one fixed direction of *AB*; similarly, from any point in any or every other in *ABCD* by moving in the two fixed directions of the bounding lines; and likewise in *ABCD-G* by moving in the three fixed directions of the bounding lines (direction forward or backward being regarded as the same in every case). Hence, with regard to motion from one point to another, the first unit is one-dimensional, the second, two-dimensional, and the third, three-dimensional.

Man can make no motion which cannot be resolved into a combination of three mutually perpendicular directions; he can reach no place which cannot be

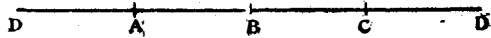


FIG. 2.

reached by going north or south, east or west, and upward or downward; he can find no point in a room which cannot be found by moving in the direction of the length, breadth, and height of the room. Sight reveals two dimensions directly, the breadth and the height of the object beheld, while the third dimension, the distance of the object, is estimated by means of the muscular turning of the eyes to focus them on it. No sense calls for a fourth direction, perpendicular to the other three; in fact, all of man's experience leaves him satisfied with three dimensions.

Leaving experience behind and reasoning wholly from analogy, the fourth dimension is introduced as follows: Four-dimensional measure depends on length, breadth, height, and a fourth dimension, all multiplied together. It involves four linear dimensions, each perpendicular to the other three; consequently the fourth dimension is at right angles to each of the three dimensions of the three-dimensional measure. Its unit must have *AB* as edge, the square *ABCD* as face, and the cube *ABCD-G* as base. It contains $M \times M \times M \times M = M^4$

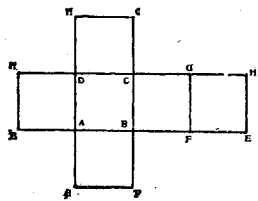


FIG. 3.

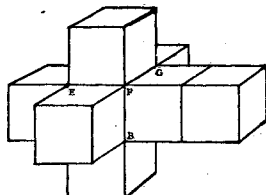


FIG. 4.

points. To travel from any point to any or every other point in it is possible by moving in the four fixed directions of its bounding lines.

The square *ABCD* (Fig. 1) is derived from the line *AB* by letting *AB* with its *M* points move through a distance of one foot in a direction perpendicular to the one dimension of *AB*; every point of *AB* in this motion describes a line, and *ABCD* contains, therefore, *M* lines, as well as M^2 points. The cube *ABCD-G* is derived from the square *ABCD* by letting *ABCD* move one foot in a direction perpendicular to its two dimensions; its *M* lines and M^2 points describe respectively *M* squares and M^3 lines; accordingly *ABCD-G* contains *M* squares, M^2 lines, and M^3 points. Similarly, the four-dimensional unit is derived from

the cube *ABCD-G* by letting that cube move one foot in a direction perpendicular to each of its three dimensions, i. e., in the direction of the fourth dimension; its *M* squares, M^2 lines, and M^3 points describe respectively *M* cubes, M^2 squares, and M^3 lines; accordingly the four-dimensional unit contains *M* cubes, M^2 squares, M^3 lines, and M^4 points. Considering the boundaries of the units, *AB* has two bounding points, *ABCD* has four, *ABCD-G* has eight—four each from the initial and the final positions of the moving square—and the four-dimensional unit has 16—eight each from the initial and the final positions of the moving cube. Of bounding lines, *AB* has one (or is itself one), *ABCD* has four, *ABCD-G* has twelve—four each from the initial and the final positions of the moving square, and four described by the four bounding points of that square; and the four-dimensional unit has 32—twelve each from the initial and the final positions of the moving cube, and eight described by the eight bounding points of that cube. Similarly, of bounding squares, *ABCD* has one (or is itself one), *ABCD-G* has six—one each from the initial and the final positions of *ABCD*, and four described by the bounding lines of the moving square—and the four-dimensional unit has 24—six each from the initial and the final positions of the moving cube and twelve described by the bounding lines of the moving cube. Finally, of bounding cubes, *ABCD-G* has one (or is itself one), and the four-dimensional unit has eight—one each from the initial and the final positions of the moving cube, and six described by the bounding squares of the moving cube.

If the bounding lines of the square *ABCD* are supposed to be made of a continuous wire and that wire is cut at *D*, the boundary may then be folded down into line with *AB*, forming a one-dimensional figure

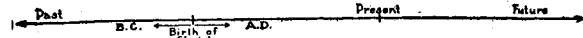


FIG. 5.

(Fig. 2) of four linear units. The original linear unit *AB* has one linear unit at either side of it and an extra one, *CD*, beyond on one side. If the cube *ABCD-G* has its bounding squares supposedly made of a continuous sheet of tin and that sheet is cut along the lines *EF*, *GH*, *HE*, *AE*, *BF*, *CG*, and *DH*, the square faces can be folded down to form a two-dimensional figure of six squares. The square *ABCD* has a square at each side of it and an extra one, *EFGH*, beyond on one side (Fig. 3). Likewise, if the four-dimensional unit has its bounding cubes made of connected solid wood and this wood is cut through the appropriate planes, the cubes can be folded down to form, by analogy, a three-dimensional figure of eight cubes. The cube *ABCD-G* has a cube at each side of it and an extra one beyond on one side (Fig. 4). These eight cubes, now forming a three-dimensional figure, constituted the boundary of the four-dimensional unit.

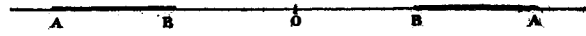


FIG. 6.

The following table shows the results obtained for the contents and the boundaries of the four units considered:

CONTENTS.				
	Points.	Lines.	Squares.	Cubes.
One-dimensional unit	M	1	0	0
Two-dimensional unit	M^2	M	1	0
Three-dimensional unit	M^3	M^2	M	1
Four-dimensional unit	M^4	M^3	M^2	M

BOUNDARIES.				
	Points.	Lines.	Squares.	Cubes.
One-dimensional unit	2	1	0	0
Two-dimensional unit	4	4	1	0
Three-dimensional unit	8	12	6	1
Four-dimensional unit	16	32	24	8

The reasoning used is capable of extension at once to units of five, or even more, dimensions.

If the one-dimensional unit is extended indefinitely to the right beyond *B* and to the left beyond *A* so that its length becomes greater than any number one can name, it represents a one-dimensional space. Similarly, the indefinitely great extension, equally in every dimension, of the other units gives a representation respectively of two-dimensional, three-dimensional, and four-dimensional spaces.

The one-dimensional unit is separated from the rest of the one-dimensional space in which it lies by two points, the two-dimensional unit from the rest of its two-dimensional space by four lines, the three-dimensional unit from the rest of its space by six squares, and, similarly, the four-dimensional unit is separated from the rest of the four-dimensional space in which it lies by eight cubes. To inclose an object of any

number of dimensions in space of the same number of dimensions demands, in one-dimensional space, two points, in two-dimensional space, at least three lines, in three-dimensional space, at least four planes, and, in four-dimensional space, at least five three-dimensional spaces.

As with the units, so with the spaces, any point can be reached from any other in the same space by moving in as many fixed directions, each perpendicular to the rest, as that space has dimensions.

Time represents a one-dimensional space; for it proceeds in one direction only from an indefinitely remote past to an indefinitely distant future (Fig. 5). The present is a point traveling through time (or



FIG. 7.

allowing time to slip past it) with uniform velocity; and any point in time can be reached by traveling through a definite distance (in years, months, etc.) from one chosen fixed point (e. g., the birth of Christ).

Any portion of the earth's surface, regarded as a plane, represents a portion of a two-dimensional space; and the two fixed directions are those of latitude and longitude. An illustration of three-dimensional space is that space—to man's perceptions—in which the universe is placed. Man can find no illustration of a four-dimensional space.

If two lines, *AB* and *B'A'*, in the same one-dimensional space are symmetrical about a point *O* of that space (Fig. 6), *AB* cannot be so moved in that space that the corresponding points shall coincide (*A* with *A'*, *B* with *B'*, etc.). To effect such coincidence, it is necessary to rotate *AB* through two-dimensional space about *O* as a center; or, roughly speaking, *AB* must be taken up into two-dimensional space, turned over, and put down on *B'A'*. Likewise, if two triangles, in the same two-dimensional space, are symmetrical with respect to a line (Fig. 7), such coincidence of corresponding points and lines can be effected only by rotating one triangle through three-dimensional space about the line of symmetry; or, roughly speaking, one triangle must be taken up into three-dimensional space, turned over, and put down on the other. Again, if two polyhedral figures in the same three-dimensional space are symmetrical with respect to a plane (Fig. 8), coincidence of corresponding points, lines, and planes can be effected only by rotating one polyhedral figure through four-dimensional space about that plane; or, roughly speaking, one of the polyhedral figures must be taken up into four-dimensional space, turned over, and put down on the other. A right hand and its reflection (a left hand) in a mirror are symmetrical with respect to the plane of the mirror and rotation about that plane would effect coincidence. Such rotation would make a right glove become a left glove; or, roughly speaking, a right glove tossed up in the direction of the fourth dimension and turning over there will fall back a left glove.

The inability of man to locate the fourth dimension or to detect the existence of a four-dimensional space, even if it be close at hand, is comparable with the inability of a two-dimensional man, inhabiting a two-dimensional space, to locate the third dimension or to detect the existence of three-dimensional space, even though his own space might be part of it, as a plane is part of a solid. Suppose the two-dimensional

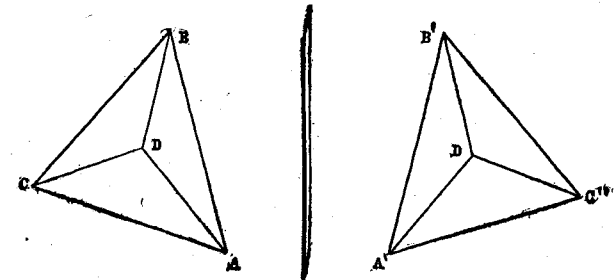


FIG. 8.

space represented by this page to be inhabited by two-dimensional beings. They have length and breadth, can move in those two dimensions, and are supposedly conscious of them. They have no thickness, cannot rise from the paper or sink beneath it and are unconscious of any dimension in such a direction; they have no "upward" and no "downward." Let them have intelligence concerning all within their space to the extent that man is intelligent regarding his universe; let them possess houses and barns, and in general let their life be as rich as may be. Their houses and barns will have no roofs and no floors, for the bounds of the space itself alone are there. Three lines are sufficient to inclose any object in their world, and the flat-man himself is ex-

posed only along his polygonal contour; the interior of his polygon—his own interior—is to be reached only through this contour, for there is no "above" and no "below" within his cognizance. To convince him that a third dimension of "upward" and "downward" exists, touching and leading from even the interior of his polygon—his own internal parts—would be a hopeless task. Even if he accepts the arguments from analogy as to the properties of such a dimension, he would rebel at the idea of looking within himself to find it. Yet, even there, at right angles to the two dimensions which he knows, it is to be found—as well as everywhere else in his space. And, similarly, within himself, quite as much as anywhere else, must man look if he is to find the fourth dimension.

Were one to explain to this flat-man that a three-dimensional being, approaching from the direction of that unknown third dimension, could reach within his most securely locked barn and remove its contents without opening a door or breaking a wall—or could touch the very heart of the flat-man himself without piercing his skin—the flat-man might still be none the nearer to an appreciation of the third dimension. Equally impossible is it for man to understand from what direction a four-dimensional robber must come to steal the treasures from the soundest vault without opening or breaking it—or by what way of approach the four-dimensional physician would reach to touch the inmost spot of the human heart without piercing the skin of the body or the wall of the heart; yet the route of such a robber and of such a physician lies along the fourth dimension. By that route must come the four-dimensional being who is to remove the contents of the egg without puncturing the shell or drink the liquor from the bottle without drawing the cork. Such four-dimensional creatures, inhabiting a space containing the three-dimensional space where man lives, would constitute the most perfect of ghosts for man's world; and the absence of such ghosts argues against the existence of a four-dimensional space so situated and so inhabited.

Algebra demands that geometry picture all its problems; and since an algebraic problem may contain four or five or more unknown quantities quite as well as any lesser number, algebra demands a four-dimensional, five-dimensional, or higher space for its use quite as imperatively as the spaces of lower dimensions. Perhaps certain phenomena of molecular physics or the mechanical principles of the electric current may find a complete explanation only with the use of the fourth dimension. Perhaps the fourth dimension escapes man's discovery only because the measurements in its direction are always very minute in comparison with the measurements in the three other dimensions. Thus far, however, the space of four dimensions—and all spaces of more dimensions—may be only "the fictitious geometric representation of an algebraic identity."

A NEW SCOTCH ELEVATING FERRY.

BY WILLIAM CARLIN.

The front-page illustration shows the construction of the new elevating vehicular ferry steamer "Finnieston No. 1," recently constructed at Port Glasgow for the Trustees of the Clyde Navigation, under the direction of G. H. Baxter, Esq., mechanical engineer. The vessel was launched with machinery aboard and steam up, the illustration being a photograph taken immediately after the launching. The leading dimensions are, length 104 feet, beam 45 feet, and molded depth 12½ feet.

It may be stated that the elevating platform which carries the vehicles has a range of 17 feet and is carried on eight double-threaded buttress screws of forged steel. The screws are hung on collar bearings in cast-steel brackets, which are supported by the framing legs. The platform is built up of H girders connected with massive built steel girders on either side of vessel. The supporting screws are fitted with worm wheels at their lower ends, and mesh with forged steel worms.

A triple-expansion, three-crank engine raises or lowers the main platform. An automatic gear is fitted to this engine, so that the platform may not be raised or lowered beyond its intended travel. A brass gage in the engine room also indicates the position of the platform in feet and inches.

The lower or main deck is of steel plating, and has no projections above 10 inches. As a result, the platform may drop to its lowest level.

Vertical three-crank triple-expansion engines are used for propulsion, each engine driving two propellers, one forward and one aft, with two thrust blocks fitted on each line of shafting. The engines are controlled from the house on the top of the framing by balanced rods, which actuate the steam valves on the direct-acting steam and hydraulic reversing engines. There are no rudders, the vessel being maneuvered entirely by the propelling machinery. Two reversing handles are situated in the wheel house, one on each side of the man at the wheel.

Correspondence.

THE EGYPTIAN STEAM CULTIVATOR.

To the Editor of the SCIENTIFIC AMERICAN:

In March last I noted a short article in your paper speaking of a steam cultivator by Boghos Pacha Nubar, a farmer in upper Egypt. The description and purpose of this cultivator are both identical with a machine that I was interested in some ten years or more ago, together with a number of others here, a company to promote which was formed, but failed to produce a thoroughly commercial machine. By that I mean that although several machines were built, with from two to six rotary disks or tools, as we call them, owing to lack of capital we were not able to put out a machine that would work day in and day out without a break of some kind. This we know was only a question of capital and experiments.

I write you so as to correct any impression that may exist as to the originality of the machine you speak of; for I may add this principle was patented here in Canada more than twenty years ago, and should you desire to know more of it, the information could be secured.

H. J. ROSS.

Montreal, Canada.

THE PROPOSED MONTREAL DRYDOCK.

To the Editor of the SCIENTIFIC AMERICAN:

I read in the press of a proposal to have a floating drydock in Montreal, and the following suggestion flashed into my mind as being most suitable for local reasons: Instead of a floating dock, why not excavate a dock, near the exit of the Lachine Canal, in two sections, one the real drydock with the floor just above the level of high water at Montreal, the other in continuation with floor at level of present harbor bottom level.

Vessels could then run into the lower section, gates be closed, and water run in from the canal through sluices, which would raise the level some 50 feet, or as required; pass the boat into the inner section, close sluices and open outflow, letting the water run out, thus saving pumping, time, and expense.

At the beginning of navigation, perhaps some pumping might be required during the freshets.

This, in my opinion, would be the easiest, cheapest, and most permanent way to build a drydock at Montreal.

VICTOR F. CONNOR, L.R.C.P.I.

Great Village, N. S.

THE NUMBER OF OUR ANCESTORS.

To the Editor of the SCIENTIFIC AMERICAN:

May I suggest that Mr. McCullough has not solved the problem put by Mr. Venning?

No one will deny that, shall we say, John Brown had a father and a mother, that his parents each had a father and a mother, and so on, for (all?) previous generations. It would appear, then, to follow that x generations back, John Brown had 2^x ancestors! This is what Mr. Venning says appears to be the fact. He does not say it is the fact; indeed, he asks for an explanation of the difficulty he is placed in, in not being able to reconcile this apparent fact with common sense.

Would any of your readers explain where the error creeps in? John Brown we know had 2 parents; we know he had 2^2 grandparents; we know he had 2^3 great-parents. Why then is it not true that for the x th generation back he had 2^x ancestors?

Bristol, England. F. C. CONSTABLE, M.A.

SIGNALING TO MARS.

To the Editor of the SCIENTIFIC AMERICAN:

The possibility of signaling to Mars is merely a question of elementary mathematics. That it should have excited such widespread interest and discussion can have astonished no one more than the writer. That in spite of this widespread and in many cases correct exposition by the newspapers, there should still remain some who fail to grasp the elementary principles of the problem is my only excuse for what may seem to many of your readers a wasteful use of valuable space in your paper.

Reference is here made to two communications in your issue of June 26th. The first is by a gentleman connected with Adelphi College, Brooklyn. This criticism is that if the signals were sent when Mars was in opposition they could not be seen. The obvious answer would seem to be: "Then why send them when Mars is in opposition?" There are two positions of the earth in its orbit when it is invisible from Mars. One is when it is between Mars and the sun, and the other when it is on the opposite side of the sun. So it would hardly seem desirable to send signals to Mars under either of these circumstances. Signals could be sent in any other relative position of the two planets, as has been fully explained in several of the daily papers. This statement will also answer the criticism of the gentleman regarding the perfectly logical and correct suggestion of Prof. Wood,

that a signal might also be sent by means of a dark area upon a white field.

The first mistake of the other writer is due to the fact that in the cases which he cites, and with which he is familiar, the angular size of the mirror is greater than the angular size of the sun. The object of the silvering of the mirror is to change the direction of the rays of light, but it really has nothing to do with the question in hand, and we may consider for convenience that the mirror has been removed during our experiments, and that the sunlight is simply shining through the hole in the frame. If now we are very near the mirror, so that we see the whole of the sun's disk through the aperture, a 2-inch mirror will transmit just as much light as one ten feet in diameter. If, however, we go to a distance of several miles, the large hole will clearly let through much more light than the small one.

The second mistake of this correspondent is to suppose that the signal would only be seen over a small portion of the surface of Mars. In point of fact, when Mars was distant one hundred millions of miles from the earth, the signal would be seen simultaneously over an area one million miles in diameter. No great accuracy would therefore be required in pointing the mirror, as he seems to suppose.

In closing, the writer would repeat that the proposition of signaling to Mars is merely a question of the most elementary mathematics. It is a problem which any astronomer can work out in ten minutes' time and which involves no uncertainty whatever. When Mars is at a distance of one hundred millions of miles from the earth, a beam of sunlight half a mile square would appear to its inhabitants of the same brightness as a fifth magnitude star. On account of the brightness of the earth, however, it would be quite invisible to eyes resembling our own, unless aided by a powerful telescope. Whether there are the equivalents of human eyes and telescopes upon Mars is another question entirely and has nothing whatever to do with the case.

WILLIAM H. PICKERING.

Harvard College Observatory.

Official Meteorological Summary, New York, N. Y., June, 1909.

Atmospheric pressure: Highest, 30.23; lowest, 29.69; mean, 29.97. Temperature: Highest, 92; date, 25th; lowest, 53; date, 19th; mean of warmest day, 82; date, 24th; coolest day, 56; date, 9th; mean of maximum for the month, 78; mean of minimum, 63; absolute mean, 70.5; normal, 69.1; excess compared with mean of 39 years, 1.4. Warmest mean temperature of June, 72 in 1888, 1892, 1899, 1906; coolest mean, 64 in 1881, 1903. Absolute maximum and minimum of June for 39 years, 97 and 45. Average daily excess since January 1st, 2.0. Precipitation: 3.17; greatest in 24 hours, 0.70; date, 4th and 5th; average of June for 39 years, 3.21. Accumulated deficiency since January 1st, 0.19. Greatest precipitation, 7.70, in 1877; least, 0.86, in 1894. Wind: Prevailing direction, southwest; total movement, 7,014 miles; average hourly velocity, 9.7; maximum velocity, 43 miles per hour. Weather: Clear days, 7; partly cloudy, 12; cloudy, 11; on which 0.01 inch or more of precipitation occurred, 12. Thunderstorms, 22nd, 25th, 27th, 28th.

The Current Supplement.

The opening article of the current SUPPLEMENT, No. 1750, discusses wild animals in captivity. A novel electric locomotive is described and illustrated. The astronomical clock at Lyons is an interesting article by Charles A. Brassler. The indestructibility of matter is treated by Prof. G. Zenghelis. Col. Sir Frederic L. Nathan's admirable paper on guncotton and its manufacture is concluded. W. C. Horsnail writes illuminatingly on the subject of tidal power. The article should prove most helpful to inventors of tidal and wave motors. A résumé of F. W. Lanchester's discourse on aerial flight presented before the Royal Society of Arts is published. An apparatus is described for studying the friction of metals experimentally. An interesting article is that by C. Ainsworth Mitchell on the making of handwriting. Prof. John Joly, the distinguished geologist, contributes an article on radio-activity of deposits and the instability of the earth's crust.

The smelter production of lead in the United States in 1908, as given by C. E. Siebenthal, of the United States Geological Survey, under date of May 24th, was 408,523 tons of 2,000 pounds, against 442,015 tons in 1907, and 418,699 tons in 1906. The production of refined primary lead, which embraced all desilvered lead produced in the country, and the pig lead recovered from Mississippi Valley lead ores, was 396,433 tons, against 414,189 tons in 1907, and 404,669 tons in 1906. The antimonial lead produced was 13,629 tons, and the recovered or secondary lead 18,283 tons. In 1908 the lead smelted from domestic ores was 310,762 tons, and from foreign ores and foreign base bullion (almost wholly Mexican), 97,761 tons.

CONSTRUCTING THE CONCRETE LOCKS OF THE PANAMA CANAL.

BY H. PRIME KIEFFER.

The final plans for the locks of the Panama Canal have just been adopted, and the accompanying drawings will serve to illustrate the colossal proportions of these great engineering works. They are to be constructed wholly of that newest of building mediums—concrete; and it is extremely doubtful whether the great waterway would have been designed upon its present ambitious lines, had not concrete gained the powerful prestige as a building material which it now holds. A number of other giant structures, such as the Gatun spillway, and various dams, culverts, diversion tunnels, etc., are being carried out in this medium; but the most interesting of all will be the mammoth locks. They will be by far the largest and longest concrete structures of the kind in the world, and it is improbable that they ever will be exceeded.

The locks will be six in number, three at Gatun on the Atlantic side of the Isthmus; one at Pedro Miguel; and two at Miraflores, both of these latter points being on the Pacific side of the Isthmus. The channel from Gatun to Pedro Miguel will lie in Gatun Lake, at an elevation of 85 feet above sea level.

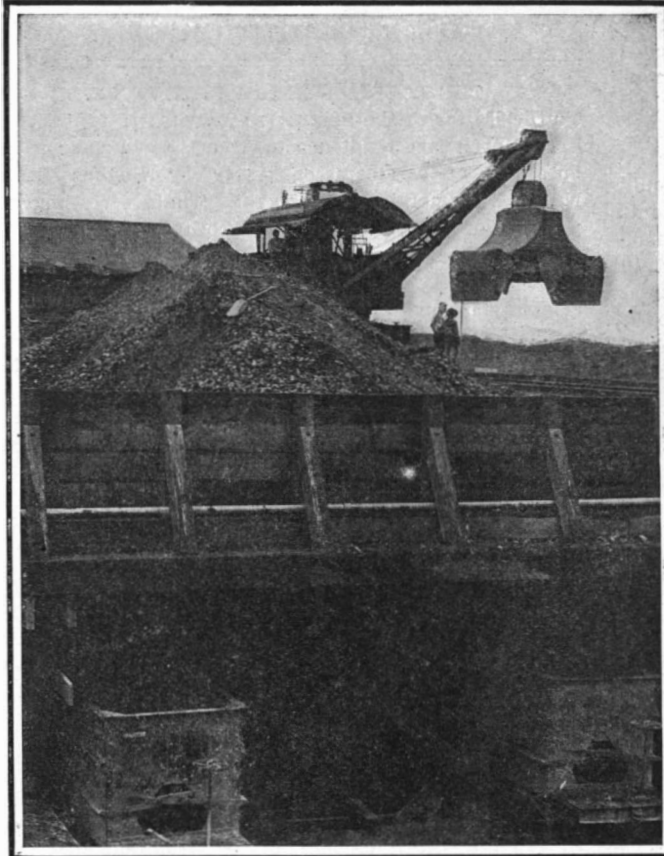
The adopted plans call for locks 1,000 feet long, 110 feet wide, and all in duplicate, that is to say, with two sets of locks side by side. The three locks at Gatun will be built as a continuous structure, and together with the piers at either end they will have a total length of 3,800 feet, all of massive and continuous concrete work. At Pedro Miguel the one lock with piers will have a length of about 1,800 feet, and at Miraflores the two locks and piers will be about 2,800 feet in length. The building of these locks will necessitate the use of about 8,000,000 cubic yards of concrete, which, if loaded on the 20-yard cars in use on the canal, would reach sixty times across the Isthmus; or it would make a string of such cars reaching from New York to Chicago, to New Orleans, and back to Chicago again. Cement alone to the amount of 900,000 tons will be employed.

In addition to their size, the locks will present many interesting studies in their safeguarding features and in the mechanical and electrical devices for the opening of the gates, the rapid unwatering of the locks, towing of vessels, etc. These appliances, as well as the very locks themselves, have been designed with such care and skill, that the factor "human frailty" cannot possibly play the important rôle, which the enemies of the lock type would have us believe.

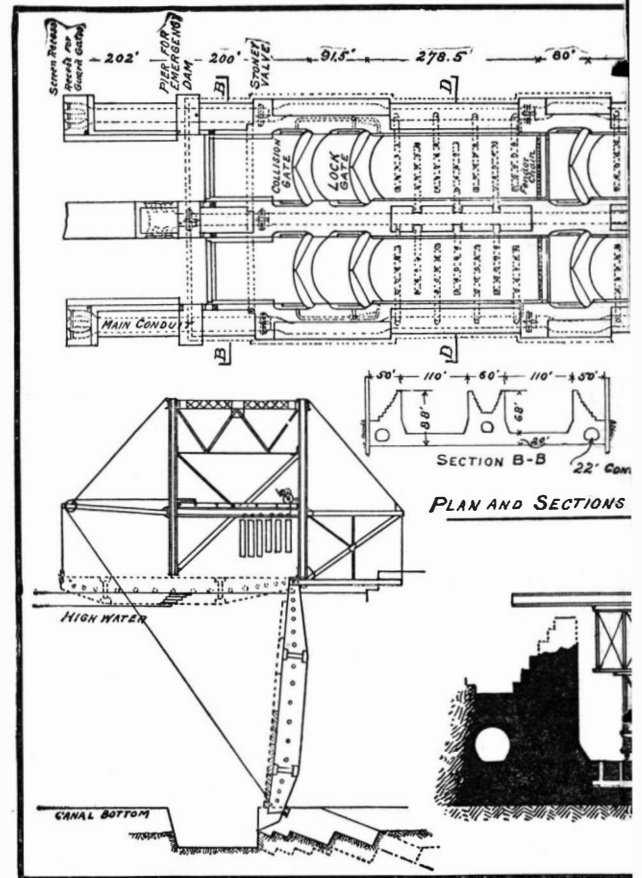
The locks will have plate-steel, hinged arch gates in duplicate, and these gates will be protected by massive fender chains stretched across the locks ahead of the gates, to take up the shock in case a vessel approached the gates too rapidly. Although these chains are not designed to absorb the total shock, they will check the vessel's speed, and thereby protect the gates. In addition to this precaution, the vessels will be required to come to anchor at the piers outside of the locks, and the towing ropes will there be made fast. Then, by the aid of mechanical "mules," located on top of the lock walls, the vessel will be towed through the locks at a uniform speed, and the vessel held in perfect control. This can be readily accomplished, as there will be no tides or storms with which to combat. The gates are of exceedingly massive construction, set in walls of solid concrete 40 to 60 feet in thickness.

As a precaution against the carrying away of the lock gates by a similar accident to that which recently occurred at the Soo Canal, they are being built in pairs, with a water space of about 80 feet between them. The first gate will serve a similar purpose to that of the heavy guard chain above referred to. Should a vessel break through the guard chain, which would check its speed, it would bring up against the first set of gates, which are of such enormous strength that they would be certain to check the vessel's way. Should they be broken, the water would still be held by the second set of gates. As an additional precaution, however, and in the inconceivable event of both gates being broken down, at the Gatun end of the lock there will be built a huge structural steel, wicket, swinging dam, similar in principle to that which was used effectively in stopping the rush of water at the Soo Canal. The structure is nothing more nor less than a massive swinging bridge, similar to a railroad drawbridge. On the under side of the floor are attached about a dozen heavy steel girders, which are hinged at the edge of the bottom floor, which is downstream when the dam is swung across the canal entrance. The other ends of the girders are attached to hoisting and lowering cables, electrically operated. To close the waterway the dam is swung around across the entrance, the girders are lowered until their bottom ends rest upon bearings countersunk in the floor of the canal, and then a series of transverse steel plates, or "wickets," are lowered in succession across the face of the girders, gradually closing the channel from the bottom upward, until the passage is entirely shut off.

Another feature of the locks which, because of its great magnitude, is of unusual interest, is the system

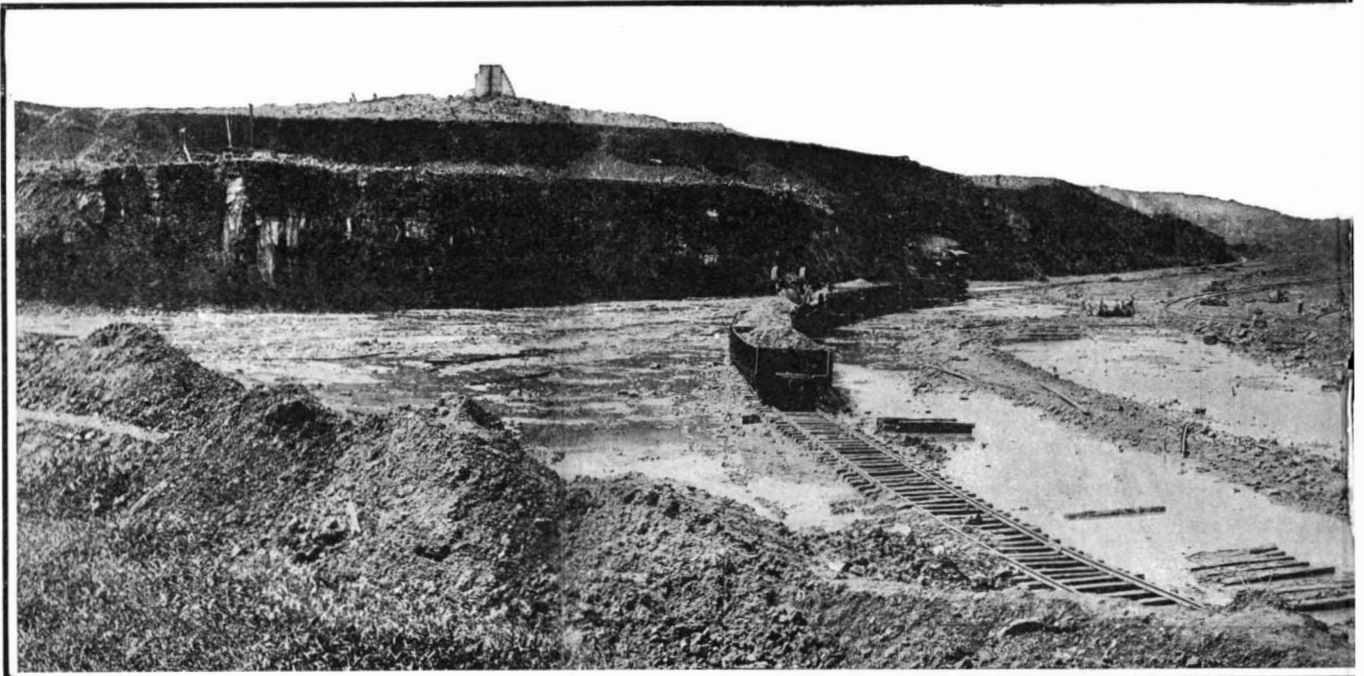


Portable grab-bucket crane unloading crushed rock from scows in the old French canal at the Gatun docks.



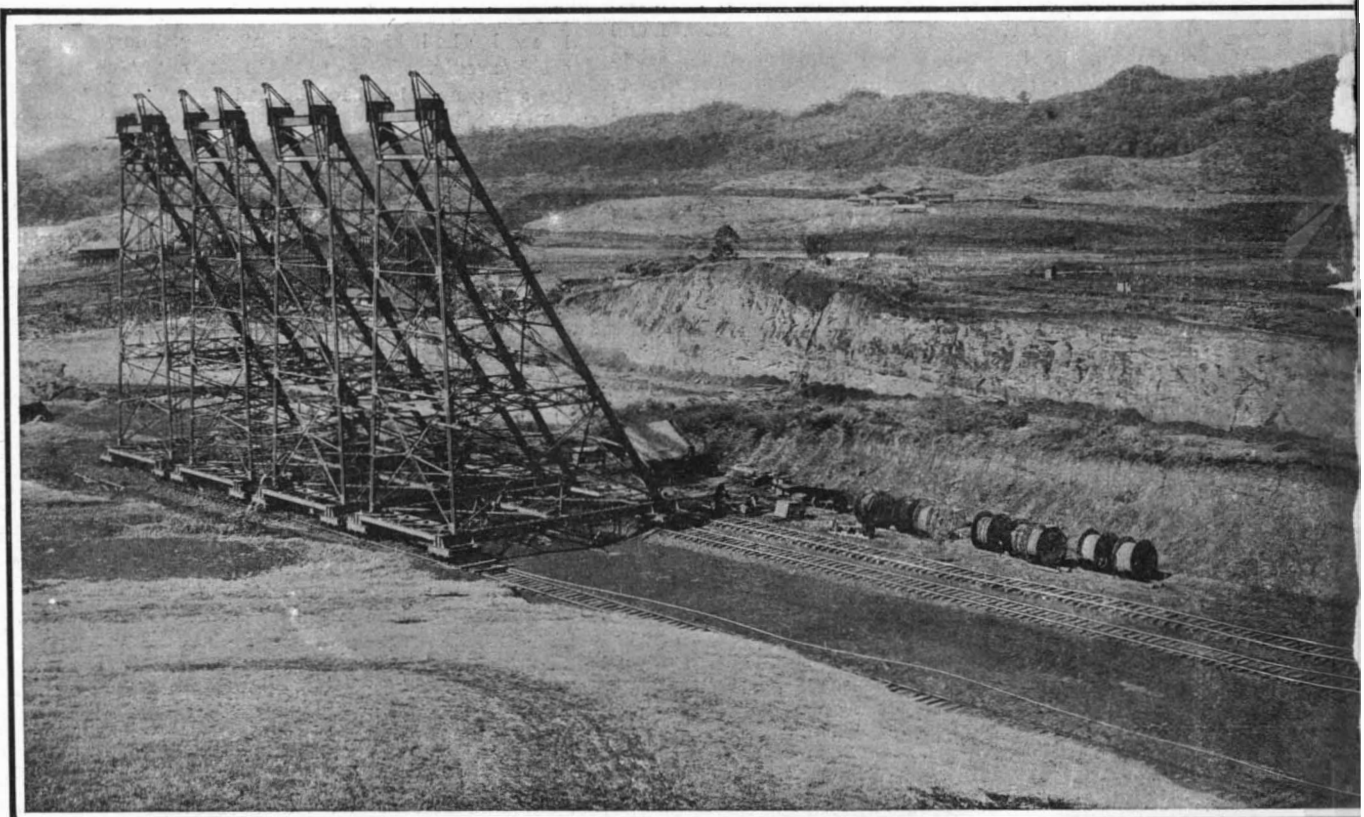
Cross-section of emergency dam in the closed position, with wicket girders down and sliding gates partly in the lowered position. Diagram showing are lifted fr

How the 4,000,000 cubic yards of concrete are bei



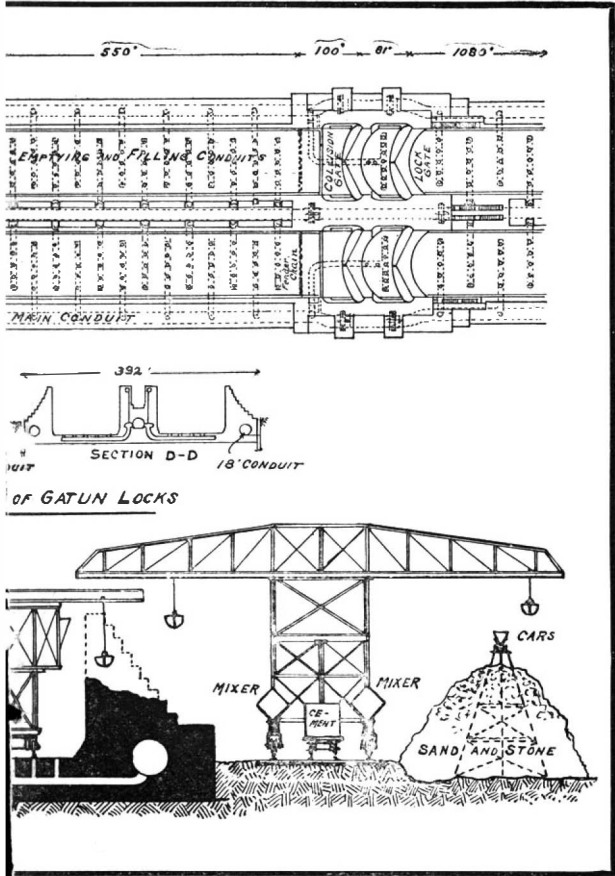
The Gatun dam is 115 feet high, 2,400 feet wide, and about 9,000 feet long. Near the center is a natural hill of rock, through which it was decided to build both on floor and sides. Concreting has

Excavation for spillway



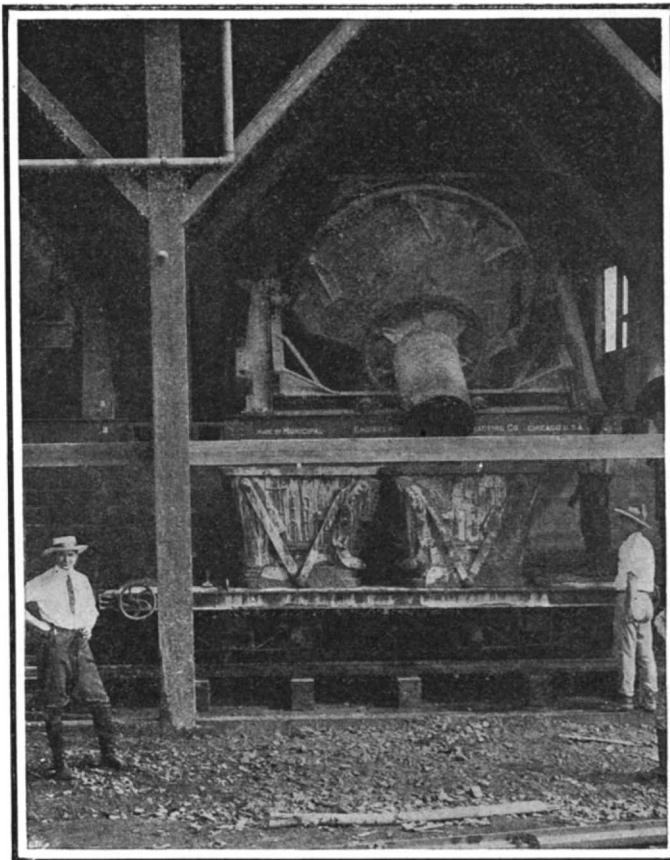
In the forefront are four completed towers of the cableways which will span the twin locks. In the distance are four corresponding towers in course of erection, containing 4,000,000 cubic yards of concrete. The concrete will be brought to the cableways fr

Excavation for the Gatun locks, showing the lo
CONSTRUCTING THE CONCRETE



method of building the locks at Pacific end of canal. Sand and stone on the stock pile to the mixers, and from the mixers the concrete is carried to the lock site by the two cantilever cranes.

is mixed and built into place at the Gatun locks.



One of the concrete mixers dumping its load into steel cars for transportation to the overhead cableway that spans the Gatun locks.

of conduits by which the locks will be filled and unwatered. Below the floor of the locks, and arranged transversely to their axes, is a series of large conduits, fed by numerous openings through the floor. These conduits lead into larger conduits built in the walls of the lock, which range in diameter from 18 to 22 feet. In the latter are set the huge gates by which the flow of the water into or out of the lock is manipulated. There are over one hundred ducts opening into each lock; and, because of their number and uniform distribution, there will be no disturbing currents in the water, and the filling and emptying will be done with unusual rapidity.

MATERIAL-HANDLING PLANTS FOR THE LOCKS.

Naturally, the plant employed in the construction of such large structures, involving the laying of 8,000,000 cubic yards of concrete, is extraordinary in size and calls for much ingenuity of design. There are in the United States and in Germany some very large, interesting, and economical plants for the mixing, transportation, and placing of concrete, but the one now about completed at Gatun will surpass in magnitude anything ever attempted. The plant at Gatun will be used for all three of the locks, as they are to be built practically as one monolithic structure. The lock at Pedro Miguel and the two at Miraflores will, for several reasons, demand entirely different material-handling plants.

At Gatun about 4,000,000 cubic yards of concrete will be employed. The crushed stone, the sand, and the cement for this concrete will be handled in the following manner: The crushed stone will come from Porto Bello, a small hamlet about 20 miles east of Colon along the Atlantic coast. The rock will be taken from the quarry by steam shovels, and sent by gravity to the giant crushers, and thence by gravity to the barges in the harbor. From this point it will be carried to Cristobal, at the Atlantic entrance to the canal, and thence, *via* the old French channel, to the docks at Gatun. Here it will be unloaded into storage bins by giant grab buckets, operated from cableways suspended between two sets of towers on either side of the channel.

The sand will come from Nombre de Dios, about 40 miles along the coast from Colon. It will be taken from the sand pits by clamshell buckets, loaded into steel barges, and taken to Gatun, where it will be unloaded by a process similar to that of unloading the crushed rock. The cement is now being shipped from New York. At Colon the cement will be transferred to barges and taken *via* the old French channel to Gatun and unloaded to the storage yards. The rock and sand storage piles have a capacity of about 300,000 cubic yards, while the cement yard accommodates about 100,000 barrels. From these storage buildings, the rock, sand, and cement will be delivered through valves to charging cars running underneath. These cars, which are electrically operated, carry the materials to the concrete-mixing machines located nearer the locks' site and discharge it direct to the machines. About eight of these machines will be employed on the Gatun locks. After the concrete is mixed, it will be dumped into buckets set on flat cars, and the cars will be run to position under the great cableways spanning the locks' site, and from these cableways the buckets filled with concrete will be swung to position on the locks under construction.

The concrete-handling plants at Pedro Miguel and at Miraflores will be essentially different from the one at Gatun. It is desired to prosecute work simultaneously at all the locks, and therefore the great cableways and other plant at Gatun could not be used on the Pacific side. The plant at Gatun will be economical, because the three locks there are all continuous. It would not be economical to build other similar separate plants at both Pedro Miguel and Miraflores. In addition to this fact, the ground surrounding the locks at these two latter points is very unstable, and it would be unwise to place the great towers there. In their stead, therefore, there will be used a system of cantilever and berm cranes. These cranes will take the materials from storage and from cars and, after mixing, will deliver the concrete to place in the lock forms. It will be recalled that the materials at Gatun will be delivered by water, while at Pedro Miguel and Miraflores they will come by rail. As there is but one lock at the former point, the plant there will be taken, upon completion of the lock, to Miraflores, to assist in the work on the two locks at that point.

The cantilever cranes are set on towers, which rest on trucks running on tracks parallel to the lock walls. These cranes will travel the full length of the locks and, of course, parallel to them. They are situated outside of the locks. They will gather the material from the storage piles and, with the aid of grab buckets, drop it into the concrete-mixing machines situated in the towers. The inner arms of the cranes will then be used to transfer the concrete to the outside lock walls and to the smaller or berm cranes, which will in turn place it in position on the foundation and center wall between the locks, at points inaccessible to the cantilever cranes. The guaranteed



The spillway. The above photograph is taken looking through the completed spillway excavation, which will be lined with a heavy covering of concrete commenced and is now well under way.

in center of Gatun dam.



Between and running from right to left is the excavation for the locks, which will be 380 feet wide and 3,800 feet long. They will consist of a huge monolithic concrete structure. The concrete mixers in electrically-operated cars, picked up by the cableway, and deposited in place.

Steel towers for the construction cableways.

WORKS OF THE PANAMA CANAL.

capacity of the plant on the Miraflores locks is about 2,500 cubic yards of concrete per day. That of the cranes at Pedro Miguel is about one-half this, as the structure will be only half as large as the ones at Miraflores. All of the cranes, cableways, mixers, etc., will be electrically operated, and the power plants for furnishing the current are now about completed.

The forms for the concrete walls are to be of steel, and will all be interchangeable, which will allow them to be used on successive stages of the work. The circular forms for the water conduits, machinery chambers, etc., will all be of the rapid collapsible sheet-steel type.

FOODS AND DIGESTION.

The subject of food and its digestion is one of the most important with which the human family is concerned, and yet, strange to say, there is very little known about the comparative digestibility of foods by the average person.

To present certain facts relative to digestion, we have prepared an engraving which shows the relative digestibility of foods of various kinds. It will be seen that the baked apple and the raw egg are near the winning post, the egg being tied by the fish. Then follows venison, all these being digested within an hour. Then come milk, turkey, duck, and oysters. New bread and cheese follow in the same class with the above, the time required to digest them being about three hours. Then come turnips, potatoes, roast chicken, and cabbage. We are fast getting into the period of indigestibility, which is beautifully summed up in pork and veal, which require, under the most favorable conditions, five hours to digest. In the sixth hour and "beyond" class, we find jam, crabs, and alcoholic beverages of various descriptions. Certain other articles of food are about as bad as crabs and jam, notably eels, which are notoriously indigestible, requiring six hours, also stone fruits, which require the same period.

Food.	How Prepared.	Time.	
		Hours.	Minutes.
Fish (other than fat varieties)	Boiled	1	30
"	Fried	3	00
Fowls	Boiled	4	00
"	Roasted	4	00
Game (most kinds)	Roasted	4	15
Goose	Roasted	2	30
Hashed meat	Warmed	2	30
Liver (calves)	Fried or sauteed	2	30
" (ox)	"	3	00
Lamb	Grilled	2	30
Lentils	Boiled	2	31
Milk	Raw	2	15
"	Boiled	2	00
Mutton	Boiled & Broiled	3	00
" lean	Roasted	3	15
Nuts	"	5	00
Oysters	Raw	2	55
"	Stewed	3	30
Onions	Stewed	3	30
Peas	Boiled	2	30
Pig, sucking	Roasted	2	30
Pork, fat	Roasted	5	15
" salt	Boiled	3	15
Potatoes	Fried or baked	2	31
Rice	Boiled	1	00
Salad	Raw	3	15
Sausage	Grilled	3	30
"	Smoked	5	00
Suet	Boiled	5	30
Sago	Boiled	1	35
Soles	Fried	3	00
Spinach	Stewed	1	30
Salmon, fresh	Boiled	1	30
" smoked	Boiled	4	00
Stone Fruit	Raw	6	00
Tapioca	Boiled	2	00
Tripe	Boiled	1	00
Trout	Boiled	1	30
Turkey	Roasted	2	30
"	Boiled	2	15
Turnips	Boiled	3	30
Veal	Roast or Grilled	5	00
Venison	Grilled	1	00

Spontaneous Combustion of Textile Fibers.

Unspun and uncarded textile fibers collected in large masses have caused many conflagrations through

and a maximum of 10 per cent of cotton, showed elevations of temperature varying from zero to 18 deg. F. in three hours or more. The conclusion is that spontaneous combustion cannot occur in fibers containing less than 10 per cent of fatty matter, and that such fibers may safely be stowed in the hold of a ship.

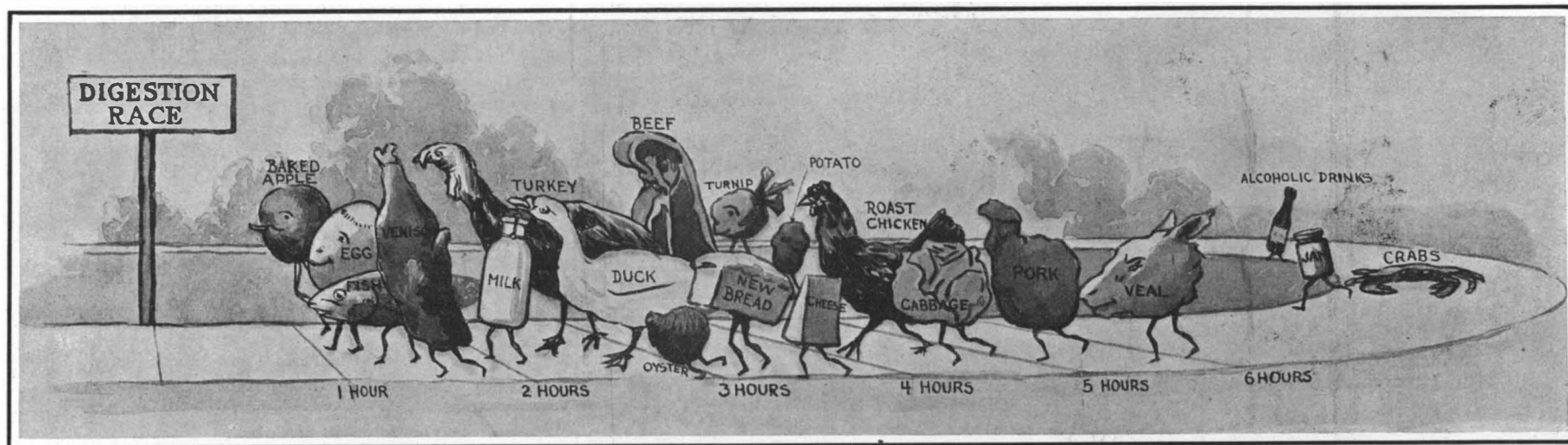
The Chemist in the Soap Factory.

In view of the lively competition which prevails in the soap industry it is necessary to exercise constant control, by chemical analysis, over everything, from the raw material to the finished soap and by-products. In the analysis of raw material great care should be taken to obtain fairly representative specimens. In analyzing animal fats it is only necessary to determine the proportions of water, ash, dirt (matter insoluble in ether), free fatty acids, and unsaponifiable matter. From these data the yield of glycerin and fatty acids can be calculated. In vegetable fats it is necessary to determine the proportions of water, dirt, unsaponifiable matter, the iodine ratio, and in some cases the saponification ratio and the amount of free fatty acids. It is often necessary, also, to apply iodine, saponification, titration, and color tests to the fatty acids after separation.

As the proportions of the different fatty acids in a mixture can be determined only approximately (to 5 or 10 per cent) by these methods, it would be very desirable to have all the constants, especially those of the most largely used fats and oils, accurately re-measured. Another desideratum is an agreement among soapmakers to employ similar methods, in order to prevent controversy in buying and selling.

The alkalis employed must be analyzed quantitatively for caustic and carbonated alkali and sometimes for the proportions of soda and potash. The purity of the acids and other chemicals used in bleaching and clarifying should also be tested.

The actual soapmaking should be left to the practical soapmaker, but the chemist should always deter-



THE RACE OF FOODS FOR FIRST PLACE IN THE DIGESTION RACE.

It will be seen by our engraving that, as a rule, cooking facilitates digestion, partly by softening the food, and partly by inducing chemical changes, which would otherwise have to be induced by functional activities. Fat retards digestion, as it has to undergo a long process of emulsifying before being absorbed. This accounts for the indigestibility of pork.

Under normal conditions it is well that the digestive process should not be prolonged beyond four and one-half hours. For invalids and others with weak stomachs, the time should be much less. As a result of repeated experiments, the following digestive time table will be found of considerable interest:

Food.	How Prepared.	Time.	
		Hours.	Minutes.
Apples, sweet	Raw	1	30
" green	Stewed	1	35
Asparagus	Boiled	1	30
Barley Soup	"	1	30
Barley	Boiled	2	00
Beans	Boiled	2	30
"	Puree	1	30
Beef, lean	Roasted	3	00
" tender	Stewed	2	45
Beefsteak	Grilled	3	00
Beef, fresh salted	Boiled	2	45
" old salted	Boiled	6	00
Beets	Boiled	3	45
Brams	Boiled	1	35
Bread, fresh	Baked	3	30
Butter	Melted	3	30
Bread and Butter (with coffee)	"	3	45
Cabbage	Pickled	4	30
Celery	Boiled	1	30
Chicken	"	2	00
"	Fricassee	2	45
"	Roast	4	00
Cheese, old	"	3	30
Custard	Boiled	2	45
Duck	Roasted	2	00
Eel	Roasted	6	00
Eggs, fresh	Raw	2	00
"	Soft boiled	3	00
"	Hard boiled	4	00
"	Whipped (raw)	1	30
"	Scrambled	3	00

spontaneous combustion. It appears to be established that clean fibers do not ignite spontaneously and that the combustion is due to the impurities, which consist chiefly of oils used in the preparation of the fibers and of the natural grease of unwashed or insufficiently washed wool. The refusal of a shipping company to transport shoddy in a ship's hold has led a German investigator to make comparative studies of the shoddy and the fibers which were accepted for shipment, in regard to the nature of their impurities and the degree of spontaneous heating to which they are subject. The admitted fibers included unwashed wool containing 6 to 21 per cent of grease, washed wool containing about 3 per cent of grease, wool cardings and combings containing 2 to 3 per cent of added oil, and raw cotton containing about 1/2 per cent of grease. The shoddy contained from 1 to 5 per cent of oil. The experiments were conducted by compressing with the hands about 2 ounces of the fiber into a ball, surrounding the bulb of a thermometer, placing the ball in a wool oven heated to 230 deg. F., and reading the thermometer at intervals until the temperature ceased to rise. The first series of experiments were made with cotton, with which increasing quantities of oil were incorporated in successive experiments. A curious and inexplicable fact was observed. The cotton to which no oil was added, and which contained only 1/6 per cent of fatty matter, showed at the end of two hours an elevation of temperature of 16 deg. F. above the constant temperature of the oven.

Very dirty unwashed wool, which lost 64 per cent of its weight in washing, showed a superheating of 21 1/2 deg. F. in five hours. Wool washed in three baths of boiling petroleum naphtha for three hours, superheated 11 deg. F. in three hours, and the same wool, after the addition of 10 per cent of olein, superheated 21 1/2 deg. F. in three hours. Five specimens of wool shoddy, containing a maximum of 5 per cent of olein

mine the excess of alkali or of fatty acid in the finished product, in order that the manufacturer may give guarantees of quality.

Finally, the residual liquors must be analyzed for glycerin, salt, impurities, and alkali.

Another extensive field of work is open to the chemist in devising and testing new processes and products, and improvements in manufacture.

The Beginning of Iron.

It is commonly believed that the use of iron commenced in either Africa or Asia, but Ridgeway, in his recently published work, "The Beginning of Iron," states that the latest investigations prove that iron was not worked in Egypt until the ninth century before the Christian era or in Libya until 450 B. C., that the Semites adopted its use still later, and that it has been known in Uganda only within the last five or six centuries. In China iron is first mentioned in 400 B. C. Bronze weapons were employed in China until 100 A. D., and in Japan until 700 A. D. According to Ridgeway, the metallurgy of iron must have originated in central Europe, especially in Noricum, which approximately represented modern Austria and Bavaria. Only at Hallstatt and in Bosnia and Transylvania, from which countries the Achaians and Dorians are supposed to have migrated to Greece, are found evidences of a gradual introduction of iron, at first as an ornament applied to the bronze which it ultimately displaced. Everywhere else, iron was introduced suddenly—a fact which implies a foreign origin. Of course, Ridgeway does not assert that iron was unknown outside of central Europe. On the contrary, he states that meteoric iron was known in Egypt in remote antiquity, but that it was worked as flints were worked, by cutting or chipping, and was not smelted. In other words, it was the metallurgy, not the knowledge, of iron that originated in central Europe.



HOW TO MAKE CONCRETE POTTERY.—III.

BY RALPH C. DAVISON.

(Continued from the issue of June 26th, 1909.)

The last two articles described the method of making individual pieces by means of modeling or building up on wire frames. This is perhaps the quickest and easiest way when there are but few pieces of a kind to be made; but when a number of duplicate pieces of one design are required, it is too slow a method to be used for commercial purposes. Therefore, when a number of duplicate pieces are wanted, it is best to make up a regular mold into which the concrete or Portland cement mortar is poured in a

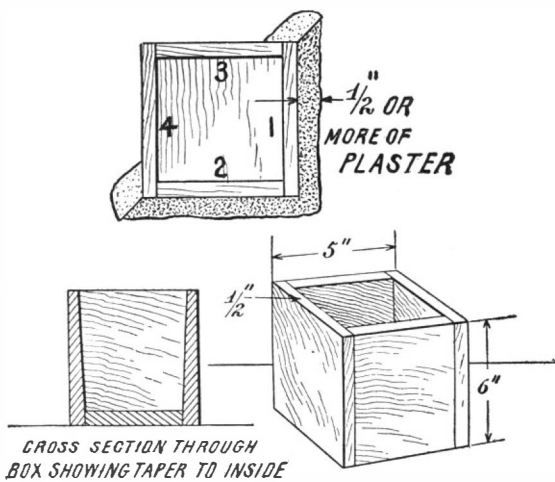


Fig. 8.—THE WOODEN MODEL AND PLAN VIEW SHOWING PLASTER APPLIED.

liquid or almost liquid state. These molds are usually made of plaster of Paris. The method of making them of course differs according to the design of the piece to be cast, but when one has mastered the method of making one or two designs, it is easy to make others, for the reason that the general principles are the same throughout.

In all mold work the first thing required is a pattern or model of the piece which is to be produced. If the design is an original one, having relief work, and is to be reproduced from a drawing, the first thing to be done is to model it in clay, and from this clay model the plaster mold is cast.

If the design is simply that of a square or round box devoid of all ornamentation or relief work, the model can be made of wood or any other material. In many instances, it is desired to reproduce articles of a more or less ornate design, which one has already in hand or which one can procure, such as metal or china ornaments, vases, jardinières, etc. In this case, the mold can be made directly from the piece which it is desired to reproduce.

A plaster mold of a simple piece, such as a square pot, can be made according to the following directions. The model for this can be made of wood. The dimensions indicated in Fig. 8 are used merely as an example; any other dimensions can be used, as the piece can be made as large or as small as desired, or it may be made oblong. When the wood model is put together, it should be well shellacked and oiled. Use fairly heavy oil or vaseline. This is

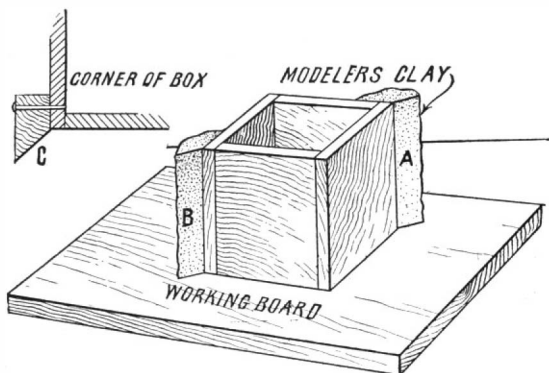


Fig. 9.—SHOWING THE CLAY PLACED AT CORNERS OF MODEL.

done to prevent the plaster from sticking. Now place the model on the working board, which should also be oiled, and then take two pieces of modeler's clay and place them on the model at opposite corners, as indicated at A and B in Fig. 9. If modeler's clay is not handy or easily obtainable, you can make two strips of wood shaped as indicated at C, and lightly tack these in position on the corners in place of the clay.

Shellac and oil the faces of these strips. The box is now ready to receive the plaster, which should be mixed as follows: Enamelled tin or iron ware makes the best thing to mix plaster in, as it is easily cleaned.

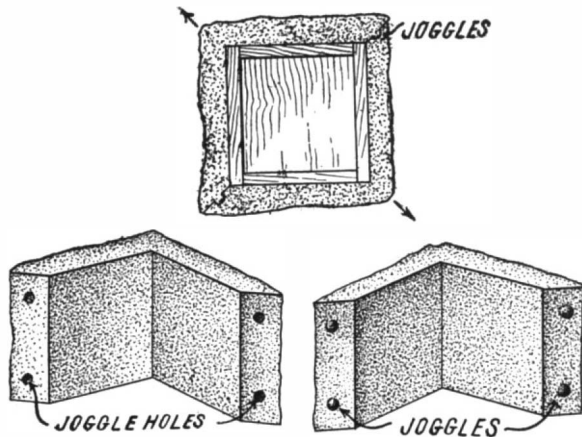


Fig. 10.—PLAN VIEW OF MODEL, ALSO TWO HALVES OF MOLD, SHOWING JOGGLES.

Place a handful of plaster in your tin, and add plenty of water to it; mix it up until it is of the consistency of a thin paste. Dip your hand into this and scoop the plaster up and throw it on the sides of the model. Cover the sides completely, and keep adding plaster until the sides of the model are covered with at least 3/4 inch of plaster; if thicker, no harm will be done. This operation will have to be done quickly, for if not the plaster will set or become hard in the tin before you can use all of it. When it has once set before it is used, it has to be thrown out and another mix made.

The piece will now appear as indicated in the plan view, Fig. 9. Let the plaster which has been deposited on the sides 1 and 2 set for about 10 or 15 minutes, and then remove the strips A and B. Cut holes about 1/4 of an inch deep into the plaster on the surfaces formed by the strips A and B. These are called joggle holes, and are provided so that the plaster mold when finished will fit together properly. Shellac and oil the faces of the plaster as well as the sides 3 and 4 of the wood model, and proceed to deposit the plaster on these as was done on the sides 1

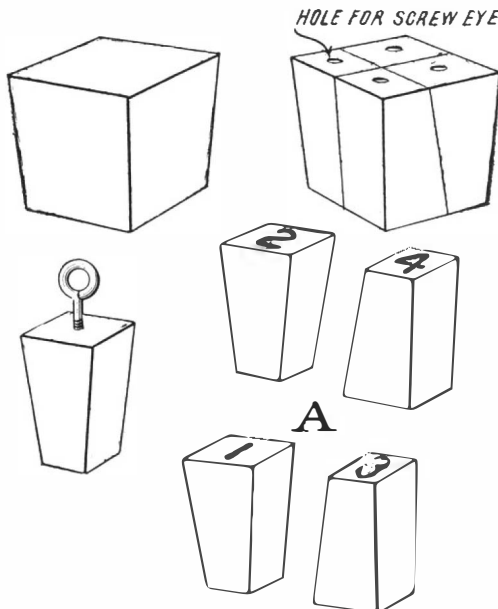


Fig. 11.—DETAILS OF THE PIECE CORE.

and 2. Care must be taken in all of the above operations not to move the model from its original position on the working board. The model and plaster sides should now look as shown in Fig. 10. Before removing the plaster sides level them off to the height of the model. Now lift the whole up from the working board. If care has been taken in oiling all sides of the model, a slight jar will loosen the plaster from it. Then pull apart, as indicated by the arrows, the two plaster sides of the mold.

Lay these aside, and then proceed to make the core or the part of the mold which forms the hole or the inner sides of the box. This is made as follows: It will be noticed that in the wood model of the box, which is shown in Fig. 8, a slight taper is given to the inside. This taper is provided so that the core will draw out more freely than if the sides were perfectly straight. Place your model on the working board. Shellac and grease well the inside of the box, and then mix the plaster as before, and pour it into the inside of the box. Level the top, and let the plaster set for 10 or 15 minutes. Now turn the box upside down and tap it gently. This will loosen the plaster core, and it will fall out. If the core should for any reason stick to the sides, the wood model should be opened a little, so that the core can be taken out without injuring it. The core will then be in one piece, as indicated in Fig. 11. It should now be smoothed up nicely, and all corners and edges should be made round. Where a marked taper has

been given to the core, it might be, if well oiled, used solid in the mold when casting the cement.

It is far better, however, to make what is known as a piece core, as this can be removed more readily, and is less liable to break the cement on removing than is the solid core. To make a piece core, cut the solid core shown in Fig. 12 into four parts as indicated at A. This can be done with an ordinary wood saw. If the saw binds or sticks, a little water applied to the blade will obviate the trouble. Mark the pieces thus cut 1, 2, 3, 4, as indicated, care being taken to get the proper numbers on the right pieces, as this is the rotation in which they are to be removed from the cast. Piece number 1, which is a decided wedge in shape, should be taken out first, and it is well to provide in the top of this piece, as well as in the other pieces, a straight round hole in which a screw eye of suitable size can be screwed. By passing a piece of wood through the eye of the screw, the piece can be easily pulled out from the mold.

After having cut the core and fitted it together nicely, as shown in Fig. 11, put it back into the wood model. If necessary, tie a string around the pieces to hold them in place. Also before putting the core into the model, place in the bottom of the model a thin strip of wood; about 1/8 of an inch thick will be thick enough. This will allow the core to project 1/8 of an inch above the sides of the model, as shown in

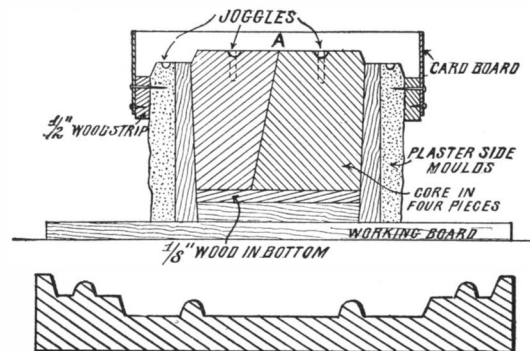


Fig. 12.—PARTS ASSEMBLED FOR CASTING THE PLASTER CASE, ALSO SECTION OF THE PLASTER CASE.

Fig. 12. Taper this 1/8-inch projection of the core as shown, and then place in position, on the outside of the model, the outside plaster molds which have already been made. Tie a string around these to hold them firmly in position.

Now secure by means of brads or fresh plaster strips of 1/2-inch wood around the outside mold, as indicated, about 1/4 of an inch from the top. Taper the edges of the plaster mold from the point where the wood is attached to the top as indicated. This can readily be done by cutting the plaster with a knife.

Joggles or holes should be made in the top of the outside plaster mold, as well as in the top of the pieces of the core as indicated. These will help greatly in holding together as well as in assembling the various pieces of the mold. Now secure to the strips by means of tacks a 1/2-inch strip of heavy cardboard around the entire outside mold. Shellac and oil well the entire inside of the inclosure thus made. Now mix your plaster as before, and pour it over the top of the core, the model, and the top of the outside plaster mold. The cardboard sides and wood strips already attached will prevent the plaster from running down the sides. Smooth the plaster off level

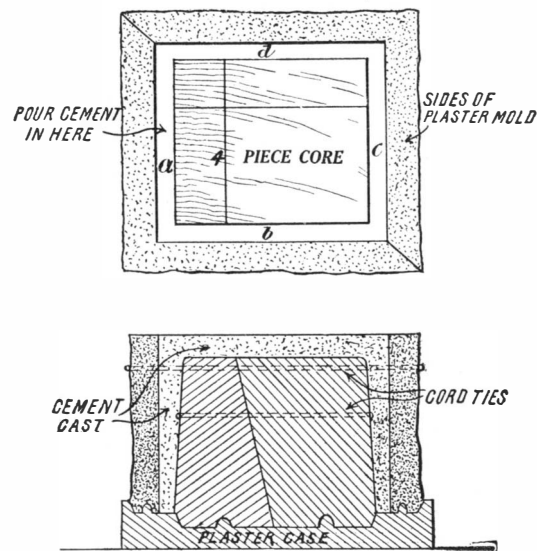


Fig. 13.—PLASTER MOLD SET UP FOR CASTING CEMENT.

with the top of the cardboard, and let it set or harden. When hard turn the whole upside down, and by gently jarring, the piece just cast will come off freely. This piece is called the case. It will have the form shown in section in Fig. 12, and is used as shown in Fig. 13, for setting up the core and outside plaster mold in which to cast the cement box. In fact, it forms part of the mold.

Before casting the cement box it will be well again

to shellac and oil all parts of the plaster mold which will come in contact with the cement. Then set up the mold as shown in Fig. 13, care being taken to bind the outside form firmly together by means of string. The mold is now ready to receive the cement mixture, which should be made as follows: Take 1 part of Portland cement and 2 parts of marble dust, if a fairly light color is desired; if not, 2 parts of any good clean fine sand will do. Mix these thoroughly together while dry, and then add enough water to allow the whole to be mixed to the consistency of a heavy cream. Let it be thin enough so that it will pour freely. Pour this mixture in the openings *a*, *b*, *c*, *d*, between the outer plaster mold and the core, until the mixture is flush with the bottom of the core. Lift the mold and gently jar it. This will tend to settle the cement, and will also force out any air that may be in the mold, and thus avoid the trouble of air bubbles or voids in the finished cast. The cement already deposited in the sides will settle, more or less, under this treatment. Now fill the remaining portion of the mold flush with the top of the outside plaster sides and jar the mold again. Repeat this operation until the cement will settle no more. Wipe off the top of the mold with a straight edge, thus removing any surplus cement, and giving to the bottom of the box a good even surface. Then place the mold in a level position, and allow it to stay there without moving for from 24 hours to 48 hours, the longer the better, as the longer it is allowed to remain, the harder the cement will set. After having set for the above-mentioned time, the piece can be removed from the mold. The method of doing this is as follows:

Turn the mold over into the position shown in Fig. 12; tap the case *A* around its edges; this will loosen the case, which is then removed. Now take the screw eye and insert it in the hole in the piece 1 of the core. Pull this out, and then repeat the operation in pieces 2, 3, and 4 of the core. Cut the string which binds the sides together, and then pull them off in the directions indicated by the arrows in Fig. 10.

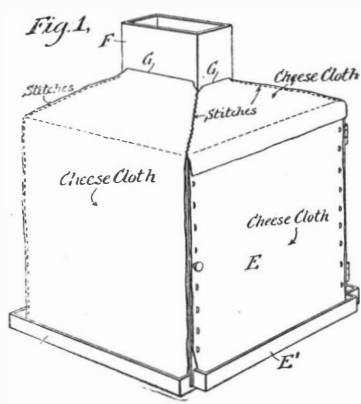
If care has been taken throughout all of the above operations, the result will be a perfect cast. The next step is the curing of the box. This is a simple operation. All that is necessary is to soak it well with water. This can be done by placing the cast directly in water, and letting it stay there for one or two days, or it can be sprinkled or dashed with water three or four times a day for two or three days in succession or longer; the longer the process is kept up, the better the result. By the application of plenty of water, the product produced will become as hard or harder than stone.

(To be continued.)

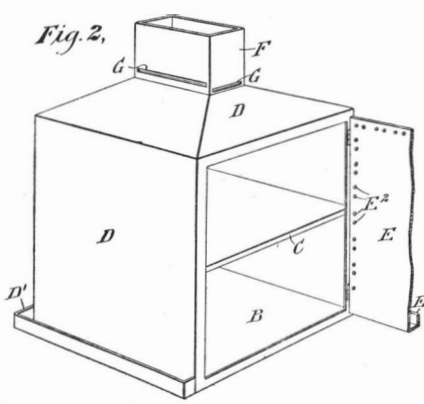
ICELESS REFRIGERATION.

BY EDWARD THORPE.

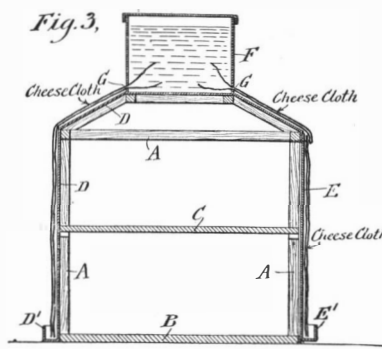
While the mad race for supremacy between the mercury and price of ice continues, much comfort can be taken in the fact that there are other methods of



REFRIGERATOR COMPLETE WITH TANK UNCOVERED.



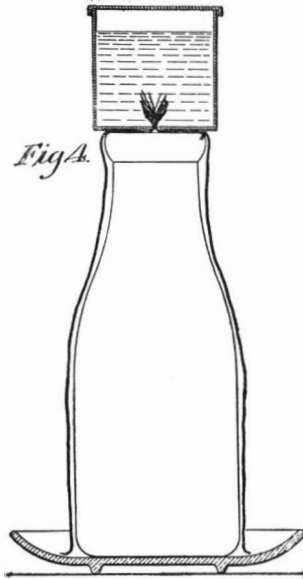
CLOTH REMOVED TO SHOW THE ZINC BOX.



CROSS-SECTIONAL VIEW OF REFRIGERATOR.

keeping victuals cool besides that of melting ice in an ice box. If in changing from the solid to the liquid state water absorbs sufficient heat to keep an ice box cool, it is equally true that a change from the liquid to the gaseous state will result in refrigeration, provided, of course, the rate of vaporization keeps pace with the heat which enters the ice box from the outside atmosphere. Under proper conditions it is possible by this method to maintain a sufficiently low temperature in the ice box to preserve food from rapid decay. A simple method of making such an iceless refrigerator is illustrated in Fig. 1. In this illustration the cover of the water tank is removed. The box comprises a frame *A*, which is built upon a wooden floor *B*. The frame *A* serves as a support for a zinc box *D*, which is fastened thereto. The water tank *F* is soldered to the top of the box, while at the bottom is a trough *D'*. The door *E* at the front of the box has its own trough section *E'*. Slots *G* are cut in the four sides of the tank *F* to receive the ends of a cloth cover for the box. The cover is preferably made up of several thicknesses of cheesecloth stitched

together at the corners, and the ends are jammed tightly through the slots into the water tank *F*. The door *E* is provided with its own section of cheesecloth, as indicated in the illustration. In operation the water from the tank soaks into the cheesecloth and by capillary attraction and gravity passes on down to the bottom of the cloth, where any excess of water is caught in the trough. The flow of water through



HOW TO KEEP A MILK BOTTLE COOL.

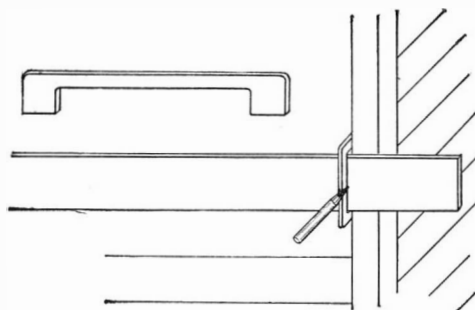
and over the cloth should be very slow, and may be regulated to a large extent by the tightness with which the cloth is stuffed into the slots *G*. The box is placed on a suitable shelf supported by brackets just outside of the open window on the breeziest side of the house and out of the direct rays of the sun. It is advisable to make the box a couple of inches narrower than the window opening, so that the currents of air passing in and out of the window may have free passage all around the moist cheesecloth. As the water in the cheesecloth is evaporated it absorbs a large amount of heat, much of which is taken from the zinc box, tending to keep the food in the box cool. A modification of this idea is shown in Fig. 4. Here the construction is adapted to cool an individual milk bottle. The cloth covering is placed directly over the bottle, and at its upper end is jammed into a slot in the bottom of the small reservoir. The milk bottle is placed in a saucer, which serves as a trough to catch the excess of water. Instead of the cheesecloth covering, the leg of a sock can be used, as this is already of cylindrical form and is well adapted to hold the moisture. In case the water from the tank does not moisten the cover sufficiently, the trough may be also filled, and the water will be drawn up therefrom by capillary attraction.

A WEATHERBOARD GAGE.

BY L. G. BAYLEY.

It is customary, when cutting off weatherboarding to fit up against the corner strips of a frame house, to use the long square or carpenter's rule. The square is sometimes held along the edge of the weatherboard, or down the side of the corner strip. Either method necessitates carrying the square along, or fetching it from where it was laid down.

One-quarter the time can be saved, saying nothing of the convenience, by making a little gage as illus-



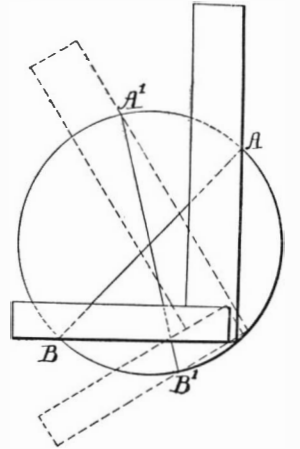
A WEATHERBOARD GAGE.

and held firm against the "Star" Foot and Power Saw Cutting board as it is held against the wall. The gage is made a little inside the pencil mark.

QUICK MEANS FOR FINDING THE CENTER OF SHAFTS.

BY ALBERT PRATHER.

In the illustration the circle represents a section of a shaft, the center of which it is desired to find. The corner of a square is placed on any point of the circumference. The points *A* and *B* are the intersections of the outer sides of the square with the circumference. Draw a line from *A* to *B*. Now shift the square a little, as represented by the dotted square, and with the corner on any other point mark the intersections *A'* and *B'*, then connect *A'* and *B'*, and the intersection of *AB* and *A'B'* will be the required center. It is necessarily the center, for it is the intersection of two diameters.

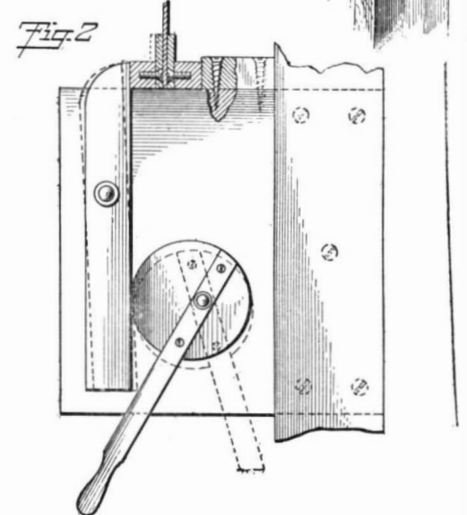
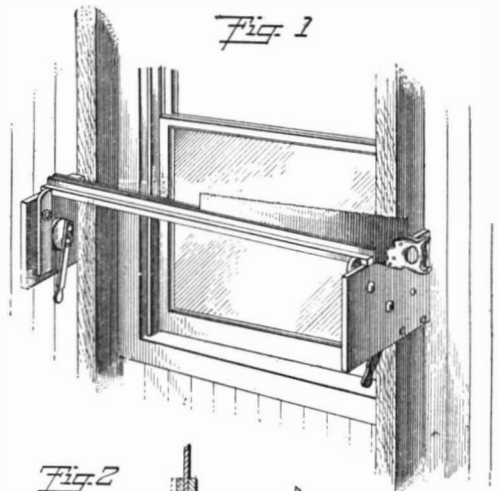


METHOD OF FINDING CENTER OF A CIRCLE.

A HOME-MADE SAW VISE.

BY JAMES G. NEWLAND.

Desiring a saw-filing vise that would allow an ordinary saw to be filed or set from end to end without change and without chattering, to hold the saw rigidly and yet so that it could be instantly released, the writer made a device as follows: In the barn loft there was a south window with a good light. To the 2 x 4 studding at each side of the window and at right angles to it, at a convenient height two pieces of wood 1 x 12 x 12 inches were firmly nailed, thus forming two brackets. Two pieces of straight 2 x 1/4-inch flat iron, long enough to go across these brackets, were found, also two straight pieces of 1 x 1-inch iron (discarded square-bed carriage axles with stubs off). The latter pieces were faced with the flat iron by means of a couple of countersunk-head stove bolts. Two pieces of 2 x 2-inch angle iron would have done as well. These made the two jaws of the vise, and they were



A HOME-MADE SAW VISE.

placed across brackets in front of the window, with a wooden strip between the inside jaw and the studding to take the file thrust. On the inner side of each bracket a lever of 1 1/4-inch square hardwood was pivoted with its upper end bearing against the outer jaw. Two circles of wood were cut and mounted on bolts in the brackets, but an inch off center, so that they could be used as cams to press against the lower ends of the lever and force the upper ends firmly against the outer jaw, thus clamping the saw firmly in place. A handle was secured to each cam, with which to tighten and release the vise.

M. YEOMANS, N. Y. In this case the object of the inventor is to provide a new and improved hair ribbon pin, more especially designed for use on women's hair to securely hold a hair ribbon, to display the bow thereof to the greatest advantage, and to give the pin a buckle appearance.

Electrical Devices.

PROCESS FOR OXIDIZING ATMOSPHERIC NITROGEN BY ELECTRICITY.—D. HELBIG, Rome, Italy. This invention consists in employing an electric high-pressure flame arc blown in a special manner by means of air for the purpose of oxidizing atmospheric nitrogen. The quantity of energy which becomes effective every moment, remains practically constant.

TELEGRAPH-REPEATER.—E. LONGORIA, Monterey, Mexico. When one side of the repeater is working, vibrations are not produced on the reverse side, because the repeating contacts are arranged in such a manner that long before the first one opens the second is closed. Its work is safe and precise, as the closing of contacts are made through the use of independent springs for each of them, and they have a uniform tension. It works with less local battery than any system, as the force produced by this latter is not used to close the contacts, and to open them the pressure of the natural weight of the arm of the repeater is almost sufficient, and thus the sound is clear and sonorous.

ELECTRICALLY-OPERATED PRICE-CARD.—P. L. DIRKING, Spokane, Wash. The invention relates to signs, the more particular object being to produce an electrically-operated price card of simple construction. The effect upon the eye is simply that one legend, together with the light for exhibiting it, disappears, and that the other legend, accompanied by the light for exhibiting it, makes its appearance, the legend thus being presented alternately to the gaze of the observer.

Of Interest to Farmers.

CULTIVATOR.—A. HELMLINGER, Hanover, Kan. This invention relates more particularly to a form of disk cultivator. The patentee has provided a very simple and light construction of frame and cultivator supporting members which afford a very wide range of various adjustments to position the cultivators to adapt the implement to the particular work in hand.

STACKER.—W. T. MCCALL and D. L. OREN-DORFF, Manhattan, Kan. The device is for use in the field for elevating and piling up hay or grain into stacks, and primarily for the purpose of stacking grain which has been cut by a header, in which the heads of grain with a small proportion of the straw are received into a box-like receptacle and is elevated to pile the same in suitable stacks.

Of General Interest.

LUNCH-BOX.—P. J. BIRD, New York, N. Y. The invention refers to improvements more particularly to that type of portable lunch boxes in which separate food drawers or compartments and a separate liquid receptacle are provided, together with means for heating the liquid receptacle, and, if desired, certain of said food compartments.

FOLDING BOX.—C. E. WRENSHALL, Owen Sound, Ontario, Canada. In the present patent, the invention is an improvement in folding or knock-down boxes whose sides and ends are hinged together or otherwise so connected as to lie parallel when folded. The box is well adapted for various uses and may be constructed in any size required.

REVOLVING SIGN.—M. HEIM, New York, N. Y. This device may be set and kept in motion by very light currents of air. The bearings are constructed to develop no appreciable friction either at first or after the sign has been in use and exposed to the weather for an extended period. The tendency of the sign to revolve is increased by providing each of its heads, or its opposite ends, with outwardly-extending vanes which incidentally add to the ornamental appearance of the sign.

SOUVENIR.—E. C. RICHMOND, Tacoma, Wash. The souvenir consists of a body having the opposite side faces inclining inwardly from each end toward the transverse center and having the edges scored to simulate a package of shingles, the representation being further perfected by placing cross-bars at opposite sides of the contracted central portion of the body, joining the adjacent ends of the bars by metallic straps and nailing the overlapping ends of the straps and bars to the body.

NON-REFILLABLE BOTTLE.—T. W. LEONARD, Richmond, Va. The construction preserves the appearance of the bottle and strengthens the bottle neck where desired. The bottle can be easily filled and sealed and while the dispensing of the contents can be readily accomplished, the sealing devices being adapted to move from sealing to unsealed position for such purpose.

SAFETY WATCH-GUARD.—L. FREEDMAN, New York, N. Y. The invention relates to certain improvements in that type of devices adapted for securing a watch chain or fob to

a watch, and at the same time fastening the watch to the edge of a pocket or other portion of a garment, so that the watch cannot accidentally fall out or be surreptitiously extracted.

Hardware.

CLAMP.—T. NEWTON and H. JOURDAN, Camden, N. J. The clamp is for leather and other goods, in which a member is provided with a flange at one end and arms to which are pivoted a movable member having a flange which is adapted to engage the flange on the first-named member, there being shoulders on the pivoted member against which a spring presses to hold the pivoted member firmly in an open or closed position, the spring being secured to the first-named member.

HINGE.—H. E. HOKE, Hanover, Pa. The inventor's object is to provide a hinge more especially designed for use on either the right or left shutter, and arranged to permit convenient hanging of the shutter; to prevent the shutter from falling off on an upward pull when closing the shutter; and to hold it against accidental closing when in an open position.

LOCK FOR SLIDING DOORS.—J. A. BENEDICT, New York, N. Y. The invention comprehends a plate mounted upon a movable door and sunken thereinto, the plate being provided with a pivotally mounted bolt for engaging the plate by entering the recess thereof, the arrangement of the parts being such that the swinging plate may be swung back into a normal position of inactivity or may be temporarily secured relatively to the plate in the movable door member.

Heating and Lighting.

OIL-BURNER.—W. S. ROBINSON, Fresno, Cal. The invention relates to oil burners adapted for use in cooking stoves, heating stoves, or for any or all other purposes where oil is used as a fuel for generating heat. The special object is to provide means for vaporizing the oil and means for controlling the draft of air to the burner.

Household Utilities.

WINDOW-FIXTURE.—A. F. GIROUARD, Leominster, and F. A. PERRON, Fitchburg, Mass. The object of the invention is to provide a fixture combining means for supporting or holding a curtain pole, shade roller and blind, the fixture being easily applied to the window casing without the use of nails, screws, or other similar fastening devices.

BOILER-STAND.—S. S. STAHL, Connellsville, Pa. The object in this case is to provide an adjustable stand, which may be varied to receive boilers of different diameters, and also varied in height so as to support such boilers at a proper distance from the floor in order to make connections with the heating apparatus.

COMBINED TABLE AND LAMP-STAND.—M. F. KOCH and M. KOCH, New York, N. Y. This invention has in view a combined table and lamp stand such as may be easily moved from place to place and support articles accessible from a bed, chair, or other convenient position, the lamp being adjustable over the table to direct the light to any required point.

CONVERTIBLE BED AND MATTRESS THEREFOR.—L. B. JEFFCOTT, New York, N. Y. The object here is to provide a bed and mattress, arranged to permit of conveniently converting the bed to form a davenport, a single bed, a double bed, or a couch, the mattress conforming to the changes, thus requiring no separate mattress for the different forms in which the bed is used.

FOLDING BED.—L. B. JEFFCOTT, New York, N. Y. The inventor provides a two-unit folding bed or couch, arranged to permit of collapsing one bed unit and passing it under the other bed unit, in such a manner that the mattress, blankets, bed clothes, pillows, and other bedding of the collapsed bed unit remain undisturbed and are accommodated in the space between the extended and the collapsed bed unit.

FOLDING BED.—J. RANKO, New York, N. Y. The invention includes a special form of support for the mattress, the support being resiliently carried by the frame. An object is to provide a folding bed frame which when extended forms a comfortable couch or cot, and which can be folded into compact form so that it can be easily moved from place to place, shipped or stored.

Machines and Mechanical Devices.

MOTOR.—A. P. BARNES and O. SCHMITT, Bolckow, Mo. The aim in this invention is to provide a motor with twin escapement wheels which are engaged by pallets mounted on pallet arms, the arms being pivoted to a rocking head, and being adapted to rest against the peripheries of the escapement wheels so that the pallets will be lifted from recesses in the escapement wheels periodically during the operation of the motor by the contact of the arms with the wheels at increasing distances from the pallets.

SOUND-REPRODUCER.—R. B. SMITH, New York, N. Y. Of the many purposes of this invention, one is the provision of means to increase the sensitiveness of the stylus lever as regards its movement toward and from the general position occupied by the diaphragm;

another is to provide means to enable the stylus lever to be played with various records having different types of sound grooves by merely throwing one jewel or record point out of service and another into service, both jewels being permanently carried by the stylus lever.

FILTERING-MACHINE.—R. T. WILDER, El Paso, Texas. The invention relates more particularly to such machines as operate centrifugally to force the substance to be filtered through the filtering media. An object is to provide a machine having a rotatable casing and a helical screw adapted to centrifugally separate the solid matter from the liquids in which it is held in mechanical suspension.

TYPE-BAR.—E. E. TALIAFERRO, Colorado Springs, Colo. The invention relates more particularly to type bars used in connection with writing machines and the like. One of the objects is to provide a type bar for producing a plurality of original, duplicate impressions by a single movement of the bar.

ANIMAL-TRAP.—J. SNOW, Falun, Minn. This trap has an open bottom permitting an animal to put its foot clean through the trap, so that the trap will become fastened well above the foot. The trap will throw its jaws up the leg of the animal some distance, making it impossible for the animal to escape by chewing away its foot, which is often the case with the old style trap.

STAND FOR GRINDING-WHEELS.—G. E. SOFER, Kankakee, Ill. The purpose here is to provide details of construction for a machine which will enable the instant arrest of motion of its grinding wheels, and a resumption of rapid rotary motion therefor as may be desired, the improvement dispensing with the employment of a countershaft and change wheels, as well as shifting gear therefor, usually provided for each machine.

PIPE-REAMER.—W. F. PORTER, Duke Center, Pa. This improvement is in the nature of a novel construction of pipe reamer for reaming out the ends of pipes or tubing such, for instance, as oil well tubing, and it consists in the novel construction and arrangement of parts whereby a reamer is provided which is adapted to ream out tubes or pipes of varying diameters.

POWER-SCOOP.—E. P. LORCH, New York, N. Y. An object of this invention is to provide improvements whereby if the scoop in advancing should meet an obstruction, such as a projecting manhole cover or the like, it may slide backward and in doing so reach a higher level and pass over the obstruction, the scoop being immediately returned to its original position by means of a compressed elastic medium or member.

ABSORPTION REFRIGERATING-MACHINE.—T. J. KIRN, Louisville, Ky. The device while freeing the ammonia gas from the moisture contained therein and returning the latter to the generator, acts at the same time as an economizer of heat by preheating the aqua ammonia, before it is returned to the generator, so that the latter is raised to a considerable temperature and therefore does not require the same amount of heat to drive off its ammonia that it otherwise would.

Railways and Their Accessories.

WAY-BILL.—F. H. CRUMP, Los Angeles, Cal. One purpose of the invention is to provide an interline way-bill having coupons similar to a passage ticket, which furnishes each road over which the freight passes with sufficient information to enable it to provide the proper revenue accruing from the service performed.

TORPEDO.—E. P. S. ANDREWS, West Windham, N. H. The invention comprises a plate which forms a saddle or seat upon the head of the rail to which there is attached a receptacle for an explosive. This receptacle is in the form of a flattened tube, and the object is to arrange the latter so that the pressure of the wheel which discharges the torpedo will hold the ends of the tube closed. In this way the bursting of the receptacle by the force of the explosion is insured, and also a loud report.

RAILROAD-TIE.—J. A. MCCORMICK and E. E. THRASHER, Cumberland, Md. The improvement pertains to railroad ties, and more particularly to ties each comprising a body, and pivoted end sections arranged to swing into longitudinal alinement with the body, and, like the latter, having lips adapted to engage rail bases to clamp the rails in position.

BOX-FREIGHT CAR DOOR.—G. W. LOHMAN, Berwick, Pa. The object here is to provide box-freight cars, also barns, carriage houses, and other inclosures with an improved door adapted to slide parallel to the side of the car or other structure and to swing into the doorway thereof so as to lie flush with the adjoining sides of the same and to be locked thereto.

NUT-LOCK.—E. M. LOVELL, Stanberry, Mo. This invention of this patentee is the result of an effort to practically improve the nut lock devices intended mainly for preventing the loosening of nuts in railroad joints. The patent discloses a plurality of washers of special construction, the inner one of which receives the nut and is locked with the outer washer, the latter in turn being so disposed in relation to the fish plate and rail that the whole is held against turning until purposely released.

CAR-FENDER.—H. FAJANS and A. M. CHAMBERS, New York, N. Y. The fender con-

sists of a fender frame, an upright frame, arms adjustably and pivotally supported at their inner ends from the car and at their outer ends pivotally supporting the fender frame intermediate its length and having a sliding connection therewith, a slide carried by the upright frame, a net connected to the forward part of the fender frame and to the slide, means to hold the outer end above the ground, and swing to the ground when it strikes an object received in the net, and means to automatically lock the inner portion of the fender frame in its upper position.

MINE-CAR.—T. W. WEAVER and C. B. WEAVER, Tunnelton, W. Va. The aim in this case is to provide a device which will securely lock the end gate of a car, and which will be automatically released when the car has reached a predetermined point, so that the contents of the car will be easily discharged.

Pertaining to Recreation.

PLEASURE-RAILWAY.—W. F. MANGELS, New York, N. Y. This railway is for use in pleasure resorts and the like, and is arranged to enable the passengers of a vehicle to assist in propelling the power-driven vehicle, thus providing an exhilarating and healthy ride, and permitting several vehicles driven uniformly by power to race, the hand power supplied by the passengers being the determining factor of the race.

AQUATIC MERRY-GO-ROUND.—H. E. RIEHL, New York, N. Y. The object of the inventor is to provide a merry-go-round arranged to afford an exceedingly novel and highly interesting ride. The passengers in a car undergo several movements, that is, are carried bodily around with the platform, are moved up and down and turn alternately with the car around in opposite directions.

Pertaining to Vehicles.

TIRE-PATCH.—J. A. WHEELER, Onaway, Mich. An object of this invention is to provide a device by which the worn outer surface of a rubber tire may be protected and which may be readily applied without the necessity of special tools. A further object is to provide an emergency patch which may be cheaply made from old tires which have been discarded.

DRAFT-EQUALIZER.—E. COOK, Portland, Maine. The equalizer is adapted to be detachably connected to vehicles, plows, etc., and having a double tree adapted to roek on a block, with which it engages at opposite sides when thrown to reverse angular positions, and at the center when moved to an equalized position; the block and tree further having V-shaped or other engaging stop portions at the rear of the block, and the block having a rearwardly extending hook for detachably applying it to certain forms of appliances.

DESIGN FOR A CUT-GLASS DISH.—R. H. PITTMAN, Honesdale, Pa. In this ornamental design for a cut-glass dish the form of the dish is circular, and the ornamentation simply comprises a cluster of three flowers and their leaves in the center or base of the plate, and the same type of flower running around the rim.

BICYCLE.—I. DI FABIO, Philadelphia, Pa. Mr. Fabio, the inventor, shows a very interesting form of actuating device and structural features of a bicycle, the improvements more practically relating to means for mounting the cranks and the arrangement of clutches cooperating with the cranks to control the actuating sprocket wheel.

TIRE.—J. C. RAYMOND, New York, N. Y. The object of the present invention is to provide a tire arranged to permit of quickly disconnecting the tire from the rim of the wheel, for repairs or other purposes, and replacing the tire and securely locking it in place on the rim. It relates to tires, such as shown and described in Letters Patent of the U. S., formerly granted to Mr. Raymond.

HITCHING DEVICE.—H. A. WETTSTEIN, Hazleton, Pa. The invention relates to hitching devices for use in connection with horses. One object of the invention is to provide an improved device for supporting and releasing a hitching weight, and for connecting the same to a bit or reins of a horse. It provides means for engaging the hitching rein or rope, to prevent tension so as not to induce backing up.

ATTACHMENT FOR DOUBLETREES.—J. L. ALTER, Remington, Ind., and C. A. EINERT, Clarksville, Ark. The purpose of this invention is to enable the double tree for applying draft force to a load, to be positioned at a proper distance from its longitudinal center in engagement with the load, and thus by the leverage afforded at one end of the double tree, even the load to be drawn, if a strong horse or team is hitched to the shorter arm of the double tree and a weaker horse or team is connected with the longer arm thereof.

Designs.

DESIGN FOR A BADGE.—A. E. PARKER, Brooklyn, N. Y. The design in this case represents a badge comprising an ornamental and symmetrical arrangement of a horseshoe, three clover leaves, and a swastika.

NOTE.—Copies of any of these patents will be furnished by Munn & Co. for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper.

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Kindly write queries on separate sheets when writing about other matters, such as patents, subscriptions, books, etc. This will facilitate answering your questions. Be sure and give full name and address on every sheet.

Full hints to correspondents were printed at the head of this column in the issue of March 13th or will be sent by mail on request.

(12111) C. B. says: Will you kindly inform me as to the principle of the "electrolytic detector" used in wireless telegraphy? A. If an electrolytic detector has a small electro-motive force applied to it by a shunted cell of battery, the electrodes become polarized, and the current is reduced practically to zero. When oscillations are sent through the cell in this condition, they destroy the polarization of the small electrode, and the current suddenly increases, but it returns to its former small value when the oscillations cease. This explanation, with a full discussion of the subject, you may find in Fleming's "Elementary Radio-telegraphy and Radio-telephony," which we send for \$2.

(12112) T. F. Van W. says: Can you tell me if the specific gravity of the moon is known, and if so, how it compares with that of the earth? A. The density of the moon is 0.61 that of the earth. One of the best determinations of the density of the earth is 5.527, reached by Boys in 1894. This would make the specific gravity of the moon to be 3.37.

(12113) C. S. says: 1. If we take two jars of equal inside diameter, and fill both with equal quantities of alcohol and leave one jar open, but close the other with a cover, with only a small opening through which the vapor can escape, will the alcohol evaporate in the same time from both jars, all other conditions being equal? A. The evaporation of any liquid takes place more slowly out of a bottle with a small mouth than out of one with a large mouth. 2. Does reflected sunlight differ in any way from direct sunlight? That is, will a plant grow as well if exposed to reflected as to direct sunlight, and will reflected light kill certain bacteria, as well and quickly as direct sunlight? A. Ordinarily reflected light differs in no respect from the same light before reflection. The spectrum of moonlight is simply a fainter spectrum of sunlight. Any effect which direct light can produce will be produced by reflected light, except for the loss in brightness by reflection. 3. Does sunlight lose in intensity if reflected by a clear mirror? A. There is no perfect reflector. Light is lost by reflecting it from any mirror whatever. A metal mirror will reflect about 6/10 of the light which strikes it perpendicularly, and a mercury mirror about 75/100. The loss is larger if the light strikes the mirror obliquely.

(12114) R. J. T. asks: On April 22nd the A-Z's, a club of six young men, held a spirited meeting at the home of one of its members. The topic under discussion was "Resolved that, if a tree falls in the forest and there is no animate being present, there is no sound." After the discussion, the judges awarded their decision to the negative, merely on the merits of the debate, however, not on the merits of the question. Not being satisfied on the merits of the question, however, as brought out in the material presented, the club would like to ask that you answer it in your paper. A. The answer to your question depends upon the definition of the word "sound" applied to the argument. In most dictionaries two definitions are given: 1. A sensation produced through the organs of hearing. In this sense if there are no human or animal brains present to receive this sensation through the organs of hearing, there is no sound. 2. The physical causes of such sensation: waves of alternate compression and rarefaction passing through any substance, solid, liquid, or gaseous, but especially through the atmosphere. The sound waves are produced by the fall of the tree, whether or not there are organs of hearing present to receive them, and consequently in this sense sound is made though unheard.

(12115) J. R. D. says: May I ask your opinion re the following? What is the correct size and length of stove pipe to give a strong draft to a stove of the following dimensions? Diameter 6 feet, height to top of stove 3 feet, beyond that height a sloping dome about 4 feet, terminating in a stove pipe. At present I have a 10-inch stove pipe about 12 feet long. Draft below is supplied by leaving open the irregularities in the ground. The stove is intended to aid in burning out stumps, the idea being to bore and light the stump in the usual way and then place the stove over it to give a strong draft and suction, so that the roots as well as the stump would burn clean out. At present, with the stove pipe as mentioned it does not appear to make much difference nor make the bored stump burn any longer than without it. Is the stove pipe too small for such dimensions? If properly proportioned, even if not successful in burning out the roots, it should make a very fierce

fire by the draft and suction, which is not the case. A. We should not say that the dimensions of your stove pipe could be usefully increased, or that combustion of the stumps would be more complete if the draft were increased. If we correctly understand your method of burning the stumps, a stage must be reached at which combustion can only be from the inside outward, especially when nearing the roots, after which the flame would have to travel against the draft, and the latter would be unlikely to help it. Such a method of destroying stumps must be slow at the best, as a block of solid wood would soon be covered with ash and consumed material, leaving no inflammable surface exposed to the flames.

NEW BOOKS, ETC.

FISH STORIES. By Charles F. Holder and David Starr Jordan. New York: Henry Holt & Co., 1909. 336 pages. Price, \$1.75 net.

Prof. C. F. Holder is one of the oldest contributors to the SCIENTIFIC AMERICAN and he is well known to our readers. Prof. David Starr Jordan is president of Stanford University and is a well-known ichthyologist. The authors are perhaps two of the most prominent amateur and professional students of fish in the country, and this volume tells their unusual fish exploits and their best fish stories. It is a delightful miscellany, telling about the strangest kind of fish with a strictly scientific description which melts almost imperceptibly into accounts of personal adventure. Unlike most fish stories they have a strong foundation in fact. It is a book which we can commend to the general reader as well as those who are slaves of the rod.

CHARACTERS AND EVENTS OF ROMAN HISTORY FROM CAESAR TO NERO. By Guglielmo Ferrero. New York: G. P. Putnam's Sons, 1909. 8vo.; 275 pages. Price, \$2.50 net.

The present work, which is very handsomely printed and bound, consists of a series of studies of the great men and great women of ancient Rome, and critical moments and events in Roman history. Among the people and subjects treated are "Corruption" in Roman History, the Legend of Antony and Cleopatra, Nero, the Relation of the Conquest of Gaul to the Development of Modern France, Julia and Tiberius, Wine in Roman History, and Roman History and Modern Education. Interesting, entertaining, picturesque, full of pregnant ideas, this volume of Prof. Ferrero's is sure to find an absorbed audience that will be richly rewarded for the close attention they will give it.

BIRDS OF THE WORLD. A Popular Account. By Frank H. Knowlton, Ph.D. With a chapter on the Anatomy of Birds by Prof. Frederick A. Lucas. The whole edited by Root Ridgway. New York: Henry Holt & Co., 1909. Quarto; 872 pages; 16 colored plates, 236 illustrations. Price, \$7.

There has been a great popular awakening in recent years in relation to our birds. It is only necessary to pay a visit to the American Museum of Natural History in New York to see evidences of the growth of this movement. The magnificent exhibits which are to be found in this building have done much to awaken interest in birds, as has also the work of the Audubon society. The widespread nature teaching in our schools is also responsible for the increased interest in ornithology. Few of those who turn to the country either for recreation or for permanent residence have an inclination or desire to become professional ornithologists, but they have wished to know at least the names and facts in the life history of the birds that they see constantly about them. To supply this demand for popular information a large number of works have been written, and their extensive circulation proves that they have filled a real want; but most of these are more or less local in their scope, only a few treating of the birds of the whole world, so that the time seems ripe for a work of moderate size in a single volume which would set forth in non-technical language the salient facts regarding the birds of the world. The author has attempted to prepare such a work, and he has succeeded admirably in his task. The illustrations are excellent and numerous. The colored plates are well executed. It is a book which should be in every library, as well as in every school library. The book is a portly one, and is handsomely bound.

MENDELISM. By R. C. Punnett. American Edition with Preface by Gaylord Wilshire. New York: Wilshire Book Company, 1909.

This is the second edition of a popular work on Mendelism which has won for itself a deservedly high place in current popular scientific literature. Why Mr. Wilshire should have burdened the book with a Socialistic Preface is more than we can understand. It is a far cry from Mendelism to Socialism.

LES PLANÈTES ET LEUR ORIGINE. By Ch. André. Paris: Gauthier-Villars, 1909. 285 pp. Price, 8 francs.

M. André's book is divided into three parts, in which the planets, satellites, and the formation of the planetary system respectively are described. Among the striking features of the

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CRUDE RUBBER AND COMPOUNDING INGREDIENTS. A Text-Book of Rubber Manufacture. By Henry C. Pearson, Editor of The India Rubber World. Second Edition. New York: The India Rubber Publishing Company, 1909.

This is the second edition of a book which appeared ten years ago and which may be regarded as a standard work on the subject in English. Since the appearance of the first edition the rubber industry has made rapid strides. New sources of rubber have been opened up and progress has been made in reclaiming waste rubber. In this revised edition the improvements in the art have all been conscientiously noted. The many new compounding ingredients, substitutes, and processes find a place in its pages. As it stands the book is a dictionary of compounding facts, and an encyclopedia of rubber factory practice, intended primarily for factory use.

ATLAS UND LEHRBUCH DER HYGIENE. Mit besonderer Berücksichtigung der Städte-Hygiene. Herausgegeben von Professor Dr. W. Prausnitz, Vorstand des hygienischen Instituts der Universität Graz. München: J. F. Lehmann's Verlag, 1909.

The science of hygiene is concerned with the preservation of the health of human beings. Its study is based upon an accurate knowledge of the human organism and the effect of environment upon that organism. Hygiene is either scientific or practical. Scientific hygiene endeavors to ascertain everything that may have an effect upon health, and to determine the conditions which are most favorable for the development of mankind. Practical hygiene has for its object to apply the principles which have thus been scientifically discovered, so as to reduce the dangers to human health. In order to attain this object, practical hygiene requires innumerable technical installations, which include not only the construction of a dwelling, but everything that pertains to a dwelling. Unfortunately, this ideal has not as yet been reached, because the engineer and the physician have not worked in perfect accord, and also because the landholder is only too frequently prompted to build his structures as cheaply as possible. It is the purpose of the work before us to set forth these principles of hygiene simply and clearly and yet accurately, so that the public will acquire a broader knowledge of the development of a new and important science. The book is intended not only to help the architect who draws the plans of the house, and the builder upon whom devolves the duty of construction, but it will serve the purpose of indicating to the factory or house owner what he owes his employees or the inmates of his house. The book will also aid the client of the sanitary engineer to point out definitely just what he wants. Hitherto he has been able to talk only vaguely, because he had no concrete example to which he could point.

UNSERE HONIGBIENE. Von Prof. K. Sajó. Stuttgart: Kosmos Gesellschaft der Naturfreunde. Price, 50 cents.

Prof. Sajó is a well-known contributor on natural and scientific topics, not only to Kosmos, but to other periodicals as well. In this little book he has given a very clear and comprehensive description of the bee as a biological species and also as a useful insect.

THE ART OF THE NETHERLAND GALLERIES. By David C. Preyer. Boston: L. C. Page & Co., 1908. 12mo.; 380 pp. Price, \$2.

This attractive volume is one of the series of the Art Galleries of Europe, of which seven have already been published prior to the present volume, which is the history of the Dutch School, illuminated and demonstrated by critical descriptions of great paintings in the many galleries. The wonderful and unique art of the Dutch School of the seventeenth century can nowhere be studied so completely as in the Netherland galleries. Any work which tends to bring these masterpieces into closer touch with the visitor should be warmly welcomed. The present volume is a painstaking appreciation of the art of the great masters of Holland. The book is exceedingly well written, and the illustrations reproduced in sepia tints are very much better than in the average work. The paper is particularly light in weight, and the book will be found a most enjoyable one for those who are fortunate enough to be able to visit the galleries in person, while to those who stay at home the book will prove of genuine interest. It is most attractively bound.

THE RESUSCITATION OF PERSONS SHOCKED BY ELECTRICITY. By Edw. Anthony Spitzka, M.D., Professor of General Anatomy, Jefferson Medical College, Philadelphia. 1909. Reprint from the Journal of the Medical Society of New Jersey.

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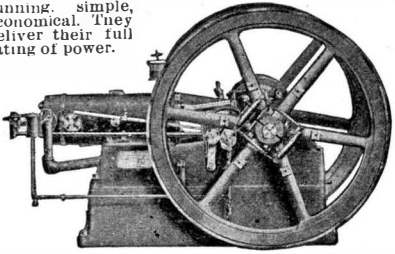
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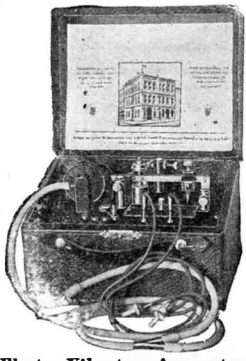
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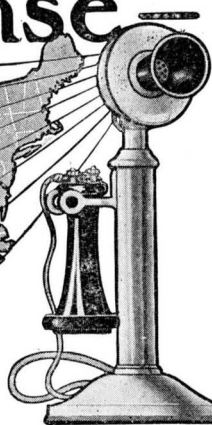
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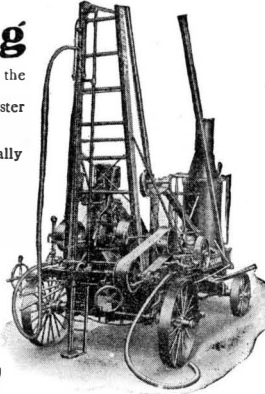
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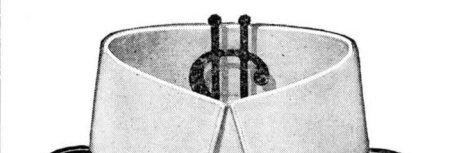
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