CONCURRENT ELECTRIC REPORTS OF RACES.

The illustration and diagram on this page show the method of working of an electrical system by means of which new electro-mechanical results are obtained which are novel and interesting from the electrician's standpoint. This system has been worked out by Mr. S. D. Mott, of Passaic, N. J., whose system of bulletining baseball games was described in the SCIENTIFIC AMERICAN of January 24, 1891.

The dial of this instrument may represent anything in the nature of a race. In this case a horse race is shown. Referring to Fig. 2, the transmitting part of the apparatus is shown at A, which consists of a positive and negative key, the operator's index and a battery. In the line at the receiver is the neutral relay, *n*, and the polarized relay, *n'*, one giving a uniform step by step motion to hand cylinders or disks controlled by ratchets, *rr'*, actuated by magnets, *mm'*, etc. The other relay selects the magnet in the instrument to show, in this case that of a horse race, the number of the races, as at *a*, to start horses and at the same time tap a bell, as at *b*, to show the winners in colors marked on bristol board disks, as at *c*, or acting to accelerate by magnets, *dd*, etc., or to retard, by means of a neutralizing coil on *mm'*, etc., any contestant selected by the operator at A, through the medium of the selector, C, and polar magnet, *n'*. This diagram for convenience shows only two contestants, with their respective magnets, but it will be readily understood that more may be added in the full line circuit, *e*, and that they may be placed in series as shown, or in parallel. The resistance, *t*, will equal the sum of the resistance of all the actuating magnets less one. This equalizes the magnetizing and demagnetizing current from the battery, neutralizing its effect on *m* for instance when the current is split at *s*. There is no need of synchronism as ordinarily understood; the fact that the contestants all come together and stop on the scratch after each event insures indentity of action in all instruments for all practical purposes.

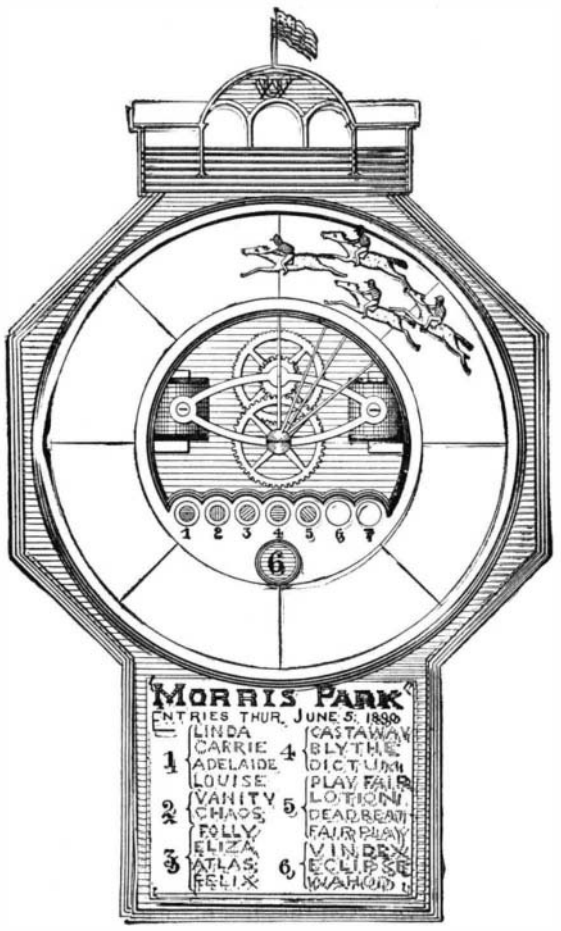


Fig. 1.—THE DIAL.

Fig. 1 is an ornamental dial showing the relative positions of the horses in a race from start to finish. A bulletin is supplied with the day's entries, and when so supplied will play any race when connected electrically with the track or course.

The horses' names are generally printed in colors to correspond with dummies on dial; upon the entry card may also appear any information, such as sweepstake or handicap, the purses, the ages, best records, names of jockeys, etc. The dummiesare also colored so that in each race the identification of the dummy is complete. At the opening in the dial above the figure 6, which is the number of the race being run, are disks indicating the winners. When the race starts, a bell is tapped or a music box may be set playing to attract attention. The horses all come in in the proper order, ready for the next race. The dial is now exhibiting a race taking place at Morris Park, Thursday, June 5, 1890. The winner of the first race was Linda, 2d Chaos, 3d Atlas, 4th Castaway, 5th Fairplay; the sixth is just ending with Vindex the winner and Eclipse 2d. It will be apparent that the dummy horses may be replaced by colored arrow heads or even letters or figures for other races, such as yacht, boat or foot races. The advantages of this system from an economic standpoint, and quite apart from its popular and attractive aspect, are that no receiving operator is necessary; the dials name and publish the event at one and the same operation, one operator taking the place of 100 operators when a game or race is being reported from the grounds to 100 different localities. In comparison with the stock ticker, it is much cheaper to make, simpler in mechanism, and by no means as liable to derangement or error in working. It can be operated over single line circuits to greater distance than any ticker, needing no attention, such as supplying with tape, winding, etc., only an occasional inspection by those having them in charge. An important point in connection with this invention is its capacity of being relayed or operated over long lines, operated from New York to Chicago for instance. Instruments used at Cleveland could be actuated by relays interpolated in the line. The same is true for other intermediate points. Signals are wholly unintelligible if the line is tapped.

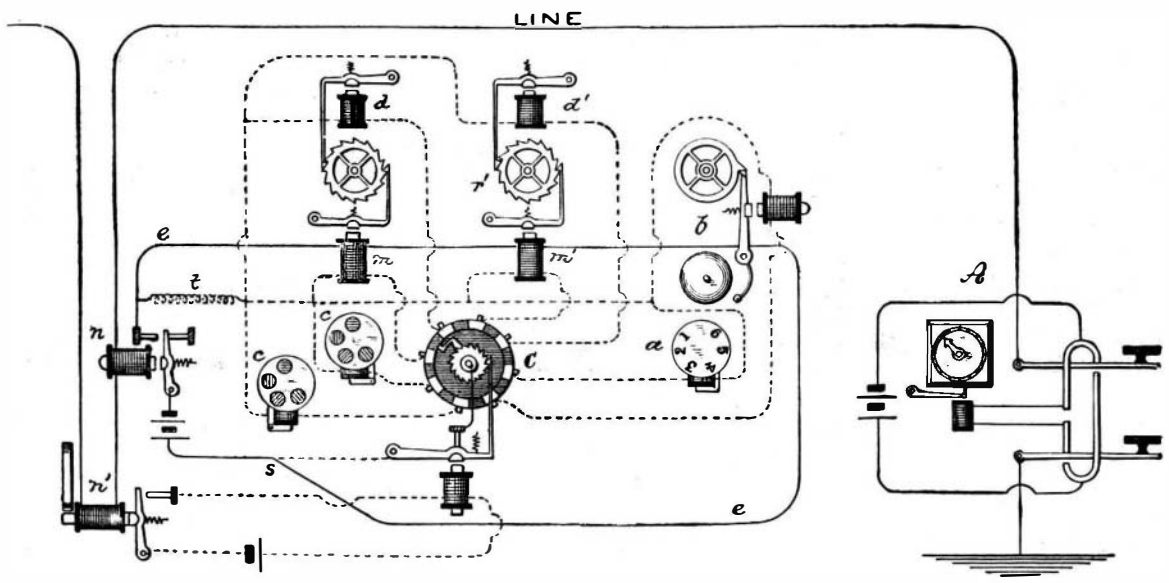
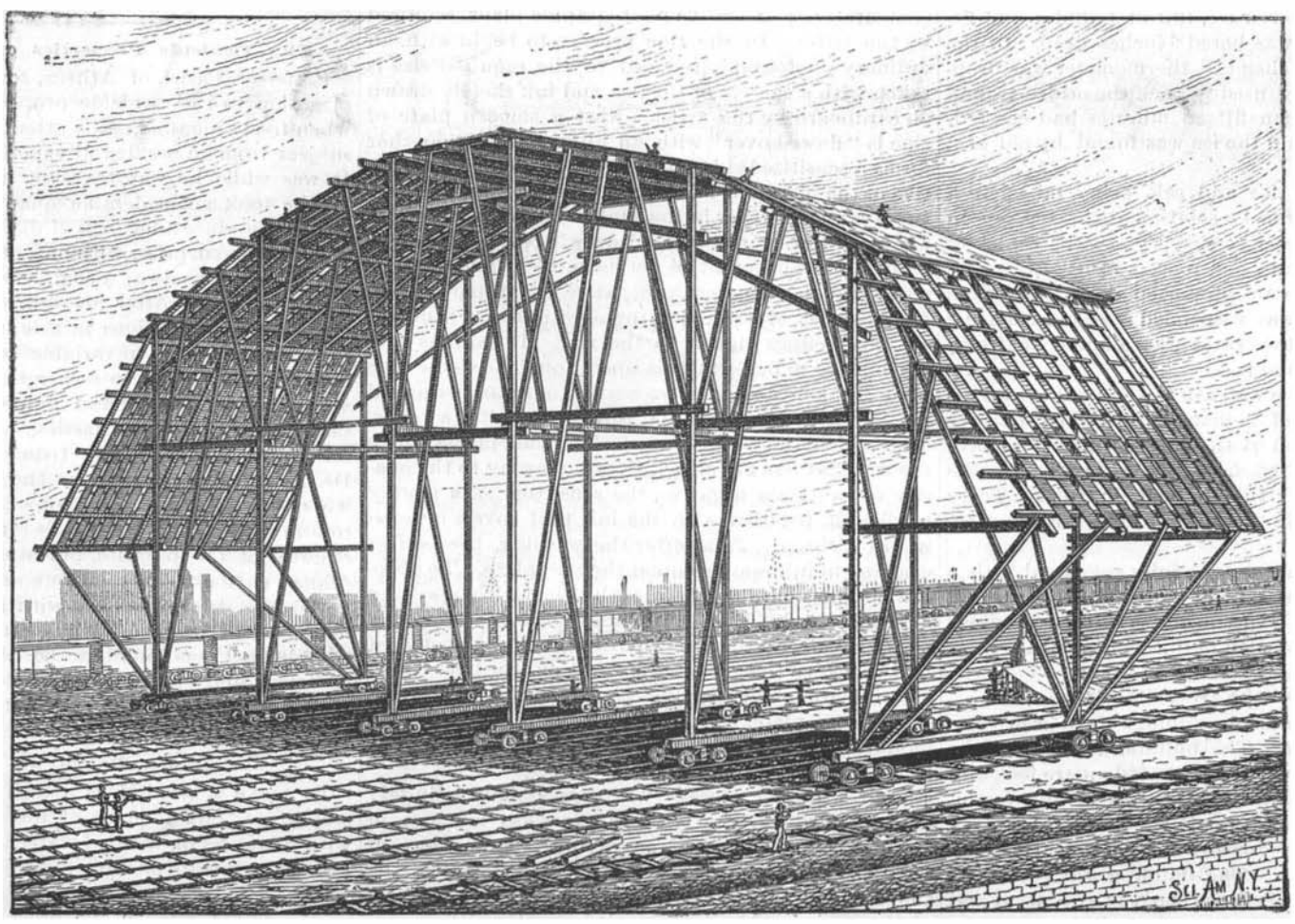


Fig. 2.—CONCURRENT ELECTRIC REPORT OF RACES.

NEW DEPOT OF THE PENNSYLVANIA RAILROAD.

Very few people appreciate the great work of reconstruction that has been begun at the eastern terminus of the Pennsylvania Railroad system at New York and Jersey City. The present accommodation for trains and for passengers has been found to be inadequate, and active operations have been begun for remedying the evils of the old system. Among these evils are the delay and dangers attendant upon the running trains through the streets of Jersey City on the road level. This is to be altered, and the tracks all through the city are being elevated upon the most substantial sort of substructure, one that can carry the heaviest express trains at full speed. The saving in time will be considerable, besides relieving the railroad company from many suits for loss of life and limb. The necessity for this is apparent. Jersey City has become too important a municipality to endure any more the ceaseless passage of trains through her streets and across her thoroughfares. The Pennsylvania Railroad is the largest road entering the city limits, and the city will be greatly benefited by this disposal of its trains. The Pennsylvania Railroad will reap the benefit of an exclusive track free of all crossings, upon which trains can freely run at high speed directly into the terminal station.

This elevated viaduct will operate in perfect harmony with the double deck ferryboat system which is soon to be put into active operation on the lines across the Hudson River, connecting Jersey City and New York. The passengers will be transferred directly from the platform of the depot to the upper deck of the ferryboat, while the local traffic will be confined to the lower deck of the boat. This relieves the ferryboats from the great overcrowding which formerly took place during the busy portions of the day. A ferry house with a double landing will also be provided at the New York shore, and the passengers on the two decks will disembark on separate platforms of the ferry house. The upper platform on the New York side connects with a bridge extending across West Street, which enables passengers to reach the foot of Cortlandt Street without having to wade through the mud which is almost always to be found in these overcrowded thoroughfares. The



TRAVELING SCAFFOLD USED IN ERECTING THE TRUSSES OF THE PENNSYLVANIA R.R. DEPOT IN JERSEY CITY, N. J.

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bridge is now in course of erection, and will be found of great convenience to passengers.

The terminus of the railroad proper is in Jersey City, N. J. The company are there engaged in the construction of an immense passenger depot, which when completed, it is claimed, will be the largest structure of the kind in the country. Up to the present time but a very small portion has been erected. A high level area for the floor has been established by filling in, the sides being laid up with old sleepers in crib-work. Brick foundations for the great frames are completed, and the bases of many of the frames are in place.

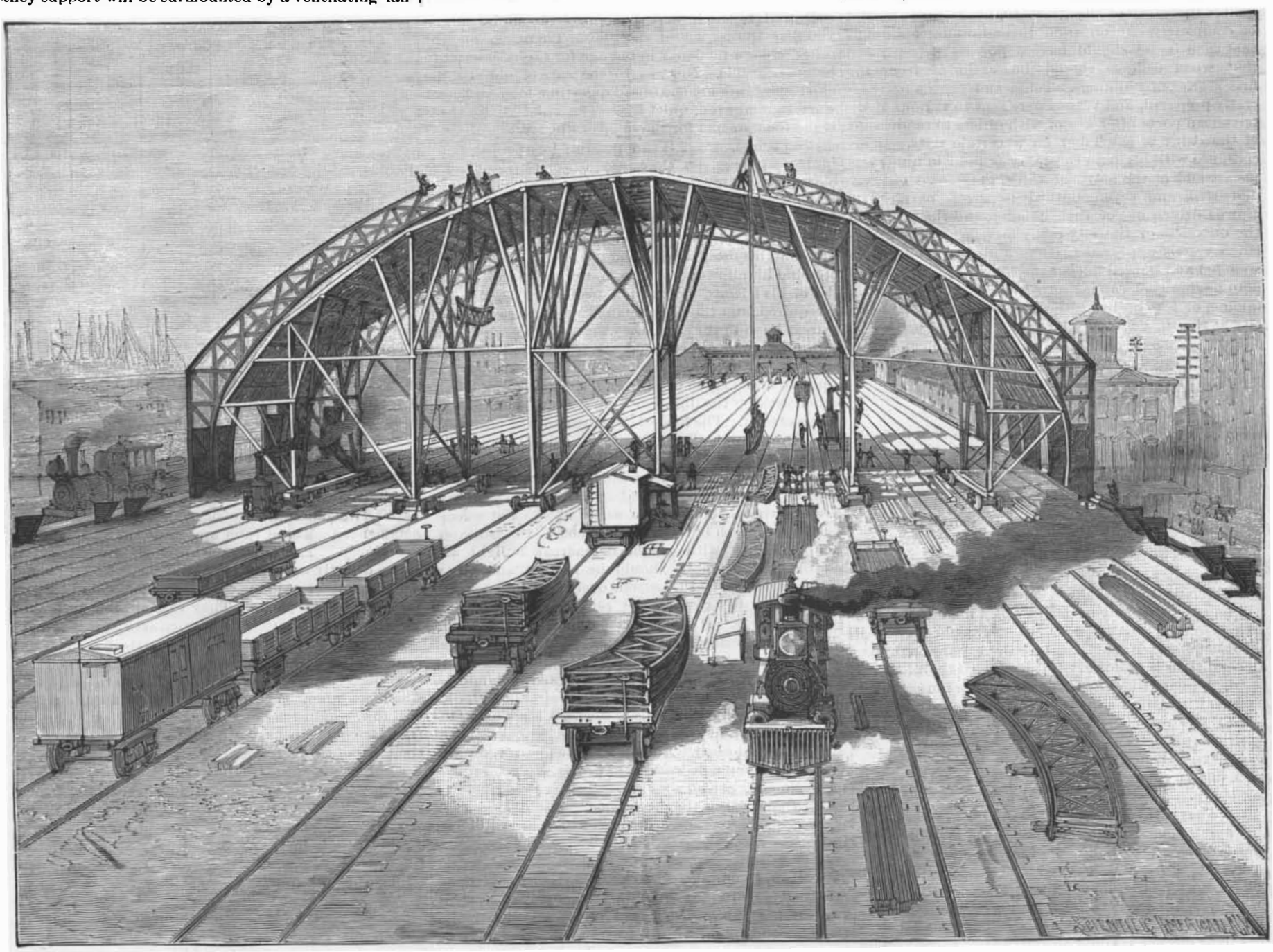
The general plan of the depot involves the roofing of a clear area of 256 by 600 feet with metal and glass, carried by twenty-two arched trusses. These are arranged in pairs, the members of each pair being 14 feet 6 inches apart, and 43 feet 6 inches intervening between each pair. This gives a total of 58 feet from the center line of one pair of trusses to the center line of the next pair. These trusses, with a clear span of over 250 feet, will rise 90 feet from the ground level, and the structure they support will be surmounted by a ventilating lantern or clear story 26 feet high. The bases of the trusses rest on eight steel rollers at each end, and these bases are connected by a tie rod or extension member made of 12 inch I-beams, spliced end to end. These extend clear across the depot, under the level of the tracks.

The depot will provide eight outbound and four inbound tracks, with wide passenger platforms between.

For erecting the arched trusses a traveling scaffold has been constructed, which is illustrated in the cuts. It is carried by twelve railroad car trucks, running upon six tracks. A 12 by 14 inch beam, 60 feet long, is carried by each pair of trucks, running on the same track. An iron plate resting on the truck bolster receives the end of the beam, which is prevented from shifting, if it had such a disposition, by dowels. Into the end of each of these stringpieces a vertical member, 12 by 14 inches, and a diagonal member of similar size are mortised. There are no intermediate supports. Upon the twelve upright and twelve diagonal members thus provided the arched or hip roof top of the scaffold rests. The general construction is shown clearly in the cuts. The timbers are bolted together and braced diagonally, with an entire absence of tie rods. Ladders are fixed for ascending to the first hip of the roof. At a number of places going up the slopes of the roof, cross slats are nailed to act as ladders. Two inch planking is distributed over the roof, so as to provide a good working platform. Small cranes are set up on the hips and ridge to raise the pieces of the trusses. The hoisting is done by portable hoisting engines standing on the ground.

The scaffold is 234 feet wide, 60 feet deep, and 84 feet high. Thus it is deep enough to include three trusses. When these have been set up, the hoisting cranes are taken down and the scaffold is shifted a distance of 58 feet, bringing it into position for the erection of three more trusses. It is moved by the hoisting engines. It is found that it moves very quietly, without oscillation, and without much strain. In one case, when the wheels were unskidded, the great structure moved a couple of feet under the influence of the wind alone.

The timbers are generally 12 by 14 inches and 12 by 12 inches, of Oregon pine. Some of them are 80 feet long. There is only one spliced timber in the whole structure. There are about 120,000 feet of timber in it, costing $40 per thousand. The whole cost is put at $8,000. The total weight is in the neighborhood of 400,000 pounds. The work is being executed by the Pennsylvania Railroad. It is under the superintendence of Mr. A. Brann.



ERECTING THE GREAT TRUSSES FOR THE DEPOT OF THE PENNSYLVANIA RAILROAD, AT JERSEY CITY.

As a standard of comparison, the great train room of the Grand Central Depot in New York may be taken. This is 652 feet long by 199 feet 2 inches wide, and 94 feet high, and is similar to the Pennsylvania Railroad depot, being covered by a roof carried on arched trusses.

The Schiseophone.

London *Iron*, noting that the importance, both in mechanical and civil engineering construction, of having metal free from internal flaws has always been recognized, and the difficulty of detecting them as well, records an approach to a solution of this difficulty by means of the schiseophone, which is the invention of Captain De Place, of Paris. "This apparatus consists of a small pneumatic tapper worked by the hand, and with which the piece of steel or iron to be tested is tapped all over. Connected with the tapper is a telephone with a microphone interposed in the circuit. Two operators are required, one to apply the tapper and the other to listen through the telephone to the sounds produced. These operators, who are in electrical communication, are in separate apartments, so that the direct sounds of the taps may not disturb the listener, whose province it is to detect flaws. In applying the system one operator places the telephone to his ear, and so long as the sounds produced by the taps are normal, he does nothing. Directly a false sound—which is very distinct from the normal sound—is heard, he instantly signals for the spot to be marked. By this means he is able not only to detect a flaw, but to localize it."

Mortality from Snakes and Wild Beasts in India.

The latest official statistics on the subject show that in 1882, 22,970 persons were killed in India by snakes and wild beasts, as well as 76,271 cattle. Of the former number, 20,571 deaths were due to snake bites, 975 to tigers, 184 to leopards, 139 to wolves, 110 to bears, 57 to elephants, and the remainder to other animals (scorpions, dogs, foxes, crocodiles, lizards, wild boars, etc.). The curious feature of the figures is that, in spite of all the efforts made to destroy snakes and other animals, and the sums paid as rewards for this purpose, the mortality both of persons and cattle is increasing. It is suggested that the most effective method will be to destroy the cover for snakes near the villages, and district officers are accordingly ordered to see that this is done, while the local governments are left to decide for themselves whether the reward system is to be continued or not. The provinces most seriously affected are Bengal, Oudh, and the Northwestern Provinces.

The Distances of the Stars.

It is quite a familiar illustration to represent the distance of the stars in terms of the *light-year*, but it has not been noticed that the same figures which express in years the time light occupies in reaching the earth from a star will also express in miles the distance of the star upon a scale of the radius vector of the terrestrial orbit to the inch. The illustration appears useful, as it gives, perhaps, a more distinct idea of the isolation of the solar system in space than can be otherwise obtained, and does not introduce the question of time into the measurement of distance. Thus if the annual parallax of 61 Cygni is assumed to be 0".434, which is probably very nearly correct, it will take 7½ (7·464) years for its light to reach the earth, and 7½ (7·499) miles will represent the distance of this star on a scale that gives one inch to the distance of the sun from the earth.—*John I. Plummer*, *Nature*.

THE United States has a mile of railway for each 400 of population and each 22 miles of area, while the balance of the world has a mile for each 7,500 of population and 227 miles of area.

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The Great Fire in Rome, A. D. 64.

It has for centuries been commonly understood that Rome was set on fire and burned by the Emperor Nero, in the year 64, either through brutal malice or drunken incapacity and indifference. Another account of the matter has lately been given, as the result of the recent investigations of Lanciani, an Italian author, as follows:

Nero desired to make many changes in the streets of Rome by increasing their width and making many of them more direct, and also to introduce many improvements by reconstructing public buildings. His efforts in this direction were met by an opposition from property owners, and were also embarrassed by the fact that the city abounded in temples, altars and shrines which were inviolate.

The emperor directed two architects, Severus and Celar, to prepare plans for the rearrangement of streets in certain parts of the city, making them as near to straight lines and right angles as the hilly configuration would render feasible. Numerous public squares were laid out, and a system of sewers planned. Regulations for buildings were prepared, in which it was provided that the height of houses should not exceed double the width of the street, that each house should be completely cut off from the adjoining buildings, that each house should have a portico in front, and that wood ceilings should be excluded from the first stories of buildings. Tents and booths were secretly prepared, and vessels were sent to various Mediterranean ports after grain, with orders to rendezvous at the delta of the Tiber on a certain date. In accordance with his plan the city was fired in numerous places, and of the fourteen wards, three were entirely destroyed and seven burned in great part. The crowds driven out of their homes found the booths in the outskirts of the city ready for them. The grain-laden vessels appeared in time, and the townspeople were fed and housed during the rebuilding; the whole plan having been carried into effect without exposure, famine, or loss of life, although the population of the city at the time was very large.

Something about Thermometers.

The aperture in the tube of a thermometer is smaller than the finest hair. And though it appears to be round, it is not, for if it were, the mercury could not be easily seen. It is, therefore, made flat, and then the glass magnifies it so that it seems to be quite large. To bring it out still more distinctly, a maker of Boston recently conceived the idea of backing the tube with a thin film of white sizing. This device is now generally adopted by the foreign makers.

Mercury is generally used in thermometers because it is more regular in its contraction and expansion. It is indeed impossible to make a spirit thermometer that will be as trustworthy as one in which mercury is used. In a mercurial thermometer the degree marks are all the same distance apart, because the expansion under all conditions is uniform. But in a spirit thermometer the degrees are wider apart at the top, because the expansion increases at a greater ratio after a certain temperature is reached. Though not so trustworthy, spirit thermometers are necessary, as mercury freezes at 40 degrees below zero. Spirits of wine is generally used, and is colored red, so that it will be more visible to the eye.

In a correct thermometer, the scale is graduated to the requirements of the tube to which it is fitted, so that every correct thermometer must have a special scale of its own. That is to say, it wouldn't do to put the tube of one thermometer in the frame of another. Of course, in the very cheap grades of thermometers such accurate adjustments are not made, and therefore their records are only approximately correct. The best thermometer tube made will cost about $5; but a thermometer may be made to cost almost any price, according to the way in which it is mounted.

As every one knows, the Fahrenheit scale is that most commonly used in this country. Fahrenheit arbitrarily assumed a limit of cold which he termed zero. This makes the freezing point 32 degrees above zero and the boiling point 212 degrees above zero. As a matter of fact, however, in northern latitudes the temperature in winter frequently falls below the zero point, so that there is no scientific reason why the zero point in the Fahrenheit scale should be where it is. A much more scientific scale is that known as the centigrade, which marks the point at which water freezes as zero, and divides the space between that and the point at which water boils into one hundred degrees. In the Reaumur scale zero marks the freezing point, and eighty above zero the boiling point. Many self-registering thermometers are now used. These instruments mark the highest or lowest temperature reached, as the case may be, so that one may return at night feeling assured that the weather can play no pranks without his learning of them.

IN the stables of the Adams Express Company, Boston, a five horse electric motor operates two machines for grooming horses. With the new machines two men can groom a horse in five minutes.

The Science of Old Age.

Old age has its special dangers and its special safety with regard to disease. For instance, whereas in a child the temperature goes up on the slightest provocation, in old age it can hardly be moved at all. The aged body is not, as a rule, prone to any acute disease. If a person passes eighty, it is rare for him to be seized with any special malady. In injuries such as fractures, though from the lightness and brittleness of the bones they are easily met with, they are repaired solidly and quickly, even in centenarians. Slight shocks cause severe depression, but greater injuries are surmounted, and surprising recoveries made from severe maladies. Wounds and ulcers often heal quicker than in the young; the aged recover from attacks of congestion, paralysis, apoplexy, pneumonia, erysipelas, and other affections in a surprising way. Diseases, as we have said, often pass them by. A man may live to one hundred in a house in which he had typhoid fever himself, and in which many of his children and grandchildren have since died from it. It is probable these favorable results are due to the long time the organs have worked unitedly and helped each other, like old soldiers who pull well together and bear reverses under which younger troops would succumb. There is, on the other hand, a tendency in old age for slight diseases to become chronic. Now, as to the care of old age, the chief points are moderate and digestible food, sufficient warmth, and even, quiet life. The chief of the three is the food, or fuel for the lamp of life. While all fixed dieting is bad, where it can possibly be avoided, a few hints can be given that may prove of value. The older a person is after fifty, the less food he requires. Luigi Cornaro, who lived to one hundred, though of a feeble constitution, took 12 ounces of solid food and 14 ounces of fluid daily during the latter part of his life; and his most severe illness was caused by his increasing his allowance, through the continual entreaties of his friends. Very little proteid or animal food is required, and though in many respects false teeth are a great boon to the aged, they may lead to too great a consumption of animal food. It is not the amount of coals we put in a grate that warms the room, but the amount that can be burnt; and the great point is to avoid choking the digestive and excretory organs with excess of food. The food of the nursery is the best in old age. Bread and milk and honey is a capital diet. Milk agrees with nearly all. Hot milk with a little Mellin's food forms an admirable drink at night, and can be kept warm in a hot water jug covered with a cozy. Fruit is wholesome if ripe or well cooked. Fat is good, as cream or fresh butter. Warm food is very suitable. Soup enriched with cream or marrow is light and nourishing. All meals should be regular, and all excesses avoided. Of 800 persons over eighty, 60 per cent were moderate eaters, 30 per cent small, and only 10 per cent large. If weight is being gained, the diet should be decreased. In addition to the after-dinner nap as years creep on, a doze after breakfast and before dinner is often helpful. As to clothing, it should be both warm and light. Fur is an admirable material. The underclothing should be of wool. A sealskin waistcoat is useful, and the feet and hands should be well and warmly clothed. And eider down quilt on the bed, which should be warmed in winter, is a good covering. No aged person should be suffered to get cold in bed. Two A. M. is the hour when most deaths take place, when the temperature of the body is lowest and its powers feeblest. All habits of old people should be respected, and not lightly altered. Whatever excites exhaustion should be forbidden. Early rising is therefore bad. Drinking hard water is not good, as it tends to hasten the calcareous changes in the body. Certain common errors in the care of the aged may be here pointed out; some we have already touched on.

1. That the aged require rich and very nourishing diet.
2. That early rising is good for them.
3. That cold baths invigorate them; whereas they are fraught with imminent danger, and are often fatal.
4. That continual medicines and dinner pills are needed to digest the food; whereas, instead, less should be eaten.
5. That the rooms should be hot; whereas they should be cool, but not cold—65 degrees to 70 degrees.
6. That a fixed diet should be rigidly adhered to; whereas variety is often essential.

Old age is of two sorts: that which is natural, and that which is prematurely acquired in youth; and it need hardly be observed that it is only of the former variety we now speak. Self-denial often requires to be practiced by the aged in many ways, though not arbitrarily. All known weak points in the constitution should be jealously watched. No care as a rule surrounds the aged such as guards the young, because they are not in many ways the same objects of interest. But this is not as it should be, nor is it consistent with the Christian profession. In animals, death when it comes is, as a rule, swift. There is, with the vast majority, no old age and debility suffered among them. No long wasting or disease or slow tumors embitter their lives; they are killed by their fellows when their powers fail, and are thus delivered from all these slow tortures by one sharp stroke. This apparent cruelty of nature is thus a merciful provision for those beings who know not the meaning of sympathy. In early ages and in savage life it was the same with man. The skulls found in the gravel beds are all full of teeth, as of those who died early. Now, in advanced civilization, love and care prolong life to a great age. This is not an unmixed good. Almost the very existence of slow decay and long disease has been brought about by the love and care that distinguish humanity. Hence it is a peculiarly noble and Christian work to lessen the sufferings that in a sense our own care has made possible; and, as far as we are able, to make old age a period of serene sunshine and an unmixed blessing.—*Leisure Hour.*

Preparing for the World's Fair at Chicago.

A ground plan for the World's Fair buildings has been adopted provisionally, according to which the main structures, twelve in number, will cover 74 acres. The numerous annexes will, it is thought, occupy about 37 acres more. The distribution of space is as follows:

Department.	Main structures. Acres.	Additional area. Acres.	Total acres.
Agriculture	9½	10	19½
Horticulture	8½	..	8½
Fisheries	3	..	3
Mines	6	.	6
Machinery	11½	7	18½
Transportation	7	10¾	17¾
Manufactures, Liberal arts, Ethnology	22½	9	31½
Electricity	6	.	6
Totals	74	36¾	110¾

The live stock exhibit is to be placed at the south end of the park, where 94 acres are reserved for it. In addition to this, twenty acres are devoted to the government. At the north end of the park 90 to 100 acres more are available for State headquarters and numerous purposes not yet defined.

Progress of the American Tin Plate Industry.

We have received from Messrs. Norton & Bros. a specimen of their tin cans made of American tin plates, the manufacture of which they have lately commenced. These cans are made and soldered by machinery. The ornamental labels are printed in colors directly upon the tin and baked upon the same. This firm alone paid over one million of dollars in 1890 for English tin plates. They expect soon to discontinue the importation of the foreign article, as they have nearly finished a complete Siemens steel furnace and rolling mill at Maywood, and will soon make their own steel plates entirely from domestic material and with American labor. The addition of a furnace and rolling mill to the industries of Maywood will greatly benefit the place. There has been an advance in England of the price of tin plates, and the cost here is now $5 50 per box, whereas in July last the English prices were $4.50 per box. Messrs. Norton, however, believe these prices cannot long be maintained in the face of the active progress that is being made in this country to establish tin industries. In fact, they are now offering tin cans at $2 per hundred which last summer were selling at $3 per hundred in Baltimore.

The Home of Influenza.

Professor Tessier, of the medical faculty of Lyons, has returned from Russia, whither he was sent last March to take evidence upon the course of influenza there, and the various conditions of its evolution. He found, according to the *Medical Record*, that influenza is a growth of Russian soil, and, when not a raging malady, is a smouldering one. The way the people live in winter, locked up in heated houses; the flatness of the soil, its consequent bad drainage, and universally sodden condition when the April thaw begins; the filthiness of the farm yards, the village streets, and the rivers, which become suddenly swollen, and on falling leave a putrid mud behind—all conduce to make influenza endemic. Its microbe is, in fact, to be found in this mud. Dr. Tessier calls it a strepto bacillus. What is peculiar in this disease is the alliance with this bacillus of pneumococcus, which also lives in Russian marshes, river mud, and village pools.

Bering, not Behring.

When the czar Peter the Great determined to send out an exploring expedition to ascertain whether Asia and America were united by land, he selected to lead this expedition Captain Commander Ivan Ivanovich Bering. Bering was the son of Jonas Svendsen by his second wife, Anne Pedersdatter Bering, and was born at Horsens, in Jutland, in the summer of 1681. All the Russian and Danish records agree as to the spelling of the family name; both in Danish and in Russian it is Bering. His autograph is always written Bering.

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A New British War Ship.

The Pique, recently launched, is one of the protected second-class twin-screw cruisers provided for by the Naval Defense Act of last year, and is the first of three of the same class that Palmer & Co. are at present building for her Majesty's government. Her dimensions are as follows: Length between perpendiculars, 300 feet; breadth extreme, 43 feet 8 inches; depth moulded, 22 feet 9 inches; displacement, 3,600 tons on a mean draught of 17 feet 6 inches; I. H. P., 9,000; speed, 20 knots. The vessel has two funnels and two pole masts, with a light fore and aft rig. The hull throughout is built of steel, and the bottom of the ship is sheathed with teak 3½ inches in thickness to 2 feet above the water line. The stem, sternpost, rudder, and shaft brackets are of phosphor bronze. There is a steel protective deck, which extends the whole length of the vessel. The transverse section of this deck is in the form of a flat arch, the crown of which rises 1 foot above the water line at center of vessel, and slopes down toward the sides to a point 4 feet below the load line. The thickness on the sloping part is 2 inches, and 1 inch on the crown, where are placed under the protective deck the engines and boilers, magazines, steering gear, and other vital parts of the ship. Vertical engines are adopted in the Pique, and, in order to insure protection to the cylinders which project above the projective deck, a belt of armor of solid steel 5 inches in thickness, with 7 inches of teak backing, is fitted round the engine hatchways, between the protective and upper decks. The vessel is divided into a large number of water-tight compartments, and has a double bottom the full extent of engine and boiler space, the continuity of which is carried forward and aft by the water-tight flats forming the magazines, shell rooms, and store rooms of the ship. The bunkers are placed alongside the engines and boilers, and extend to the upper deck. There are two separate engine and boiler rooms.

The armament consists of two 6 inch breech-loading guns, one mounted on the poop and the other on the forecastle, both placed on the middle line; six 4·7 inch quick-firing guns, three on each broadside; eight six-pounder quick-firing guns, one three-pounder gun, and four five-barrel Nordenfelt guns mounted on suitable stations along the sides of the vessel. A nine-pounder gun for boat and field purposes is also secured on deck. In addition to this, four torpodo tubes are fitted—one forward, one aft, and one on each broadside. For controlling the ship in action a conning tower of steel 3 inches thick is fitted on the aft end of the forecastle, inside of which the various telegraph instruments, steering wheel, voice pipes, etc., are placed.

A complete installation of electric light is fitted, including three powerful search lights. The crew numbers 250 hands all told. The propelling machinery consists of two sets of vertical triple expansion engines, having cylinders 33½ inch, 49 inch, 74 inch, and 39 inch stroke. The boilers are five in number. The close stoke hole system of forced draught is introduced, each stoke hole being fitted with two powerful fans worked by separate engines for the supply of air. The coal supply on 17 feet 6 inches draught is 400 tons.

The solid old ironclad Thunderer, which has just been fitted by Messrs. Maudslay, Sons & Field, of Lambeth, with new triple expansion engines of 7,000 horse power, and is now on the eve of undergoing her trials, has received the first four specimens of a gun from which great things are expected.

The new guns, two of which are mounted in each turret—and the turrets are clothed with 14 inch armor plates, which, though only of old fashioned wrought iron, would stand a great deal of hammering—are of 10 inches caliber and 29 tons weight. The total length is 26 feet 10 inches, the projectile weighs 500 pounds, and the full charge of powder is, as is now usual, just half that weight. At a range of 1,000 yards it is calculated to pierce 21 inches of wrought iron plate, while the 12 inch 45 ton gun is only credited with power to perforate a plate thinner by four-tenths of an inch. Besides the Thunderer, the Devastation and the two new second-class battleships, Barfleur and Centurion, are all to be armed with a quartet each of these weapons. They are the heaviest guns yet constructed to be worked by hand power, and it is probable that in their case the extreme limit of size and weight has been reached in this direction. They are mounted on ordinary Vavasseur slides with hydraulic buffers for taking the recoil. The trunnions are accurately balanced on knife edge bearings, but an arrangement is fitted whereby the shock of the gun on the trunnions—should it be fired with sufficient elevation to cause a downward thrust on the excessively delicate knife edge bearings—is transferred to the broad main bearings themselves. This plan facilitates elevating or depressing the gun. The training is done by causing the turrets to revolve, a double set of racks or toothed wheels being fitted round the base of each turret, into which a vertical shaft with pinion is geared. This shaft is worked by a steam engine well down below out of the reach of shot. The turret is also capable of being revolved by hand gear in the event of the turret-turning engine being disabled, but the operation would naturally be slow.

INVENTION IN 1889 A. D. VS. INVENTION B. C.

At the railway stations, ferry houses, and even upon the street corners, there may be found in almost every city and village in the United States automatic vending machines, which, for a nickel, or more or less, will deliver the various goods which they are adapted to sell. The purchaser may procure a newspaper and a cigar to smoke, or, if averse to the use of the weed, he may secure a tablet of chewing gum or a package of sweets. If entertainment is desired, it may be found in the "nickel in the slot" phonograph.

In Europe and America, machines of this class are provided for dealing out potable liquors; bouquets are also furnished in a similar way; and if you desire to know how much you have increased in weight since yesterday, all that need be done is to mount the platform of the nickel in the slot scales, and drop in your coin, and the thing is done. One of the latest achievements in this line is the automatic photographic apparatus, which takes your picture for a nickel, while you wait.

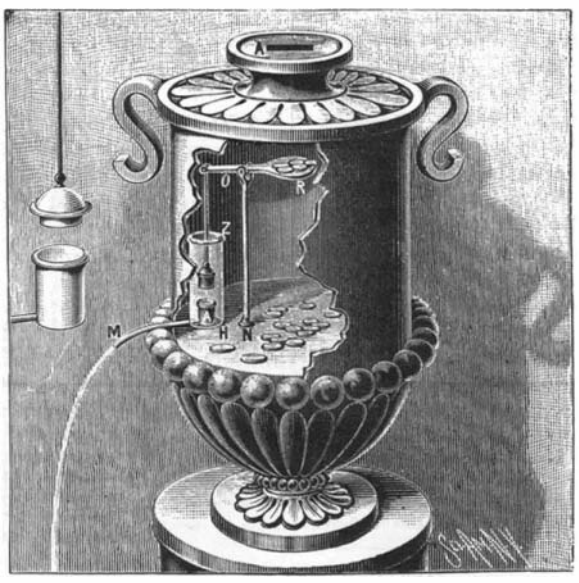

Fig. 1.—LUSTRAL WATER VASE DESCRIBED BY HERON. ABOUT 100 B.C.

Fig. 2.—NOBLE'S AUTOMATIC PERFUME DISTRIBUTOR. PATENTED IN 1889.

The craze has even gone so far as to apply the principle to the distribution of perfumery. In the railway stations and ferry houses may be found machines which, for a penny, will dole out a drop or two of liquid which passes for perfumery, and which, in many cases, serves as a thin mask for bodily uncleanliness.

These various devices, and many others which we might mention, are regarded as very clever inventions, and have certainly proved successful in many cases in a pecuniary sense.

The last automatic vending machine alluded to is shown in Fig. 2. The perfume reservoir is located in the upper portion of the vase; the tube communicating with the lower part of the reservoir extends through the side of the vase, and is closed at its upper end by a valve attached to one end of the lever, O. The other end of the lever, O, is connected by a rod with the lever, E, the longer arm of this lever being provided with a pan, R, for receiving coin, while the shorter arm of the lever is furnished with a weight for counterbalancing the pan and closing the valve. A curved piece of metal is arranged concentric with the path of the pan, R, and serves to retain the coin dropped into it through the slot in the top of the vase until the pan, R, is carried down beyond the end of the curved plate, when the coin is discharged into the lower part of the vase; the counterweight on the short arm of the lever then returns the lever to the point of starting, and closes the valve, thus stopping the flow of the perfume.

This very clever device was patented by Mr. Lewis C. Noble, of Boston, Mass., on November 19, 1889. Our illustration is prepared directly from the patent drawings. This and other machines for analogous purposes are regarded as the peculiar product of our inventive age, but in turning back the pages of history we find that in Egypt, something more than two thousand years ago, when a worshiper was about to enter the temple, he sprinkled himself with lustral water, taken from a vase near the entrance. The priests made the distribution of holy water a source of revenue by the employment of the automatic vending machine which is illustrated in Fig. 1. This apparatus would not release a single drop of the purifying liquid until coin to the amount required had been deposited in the vase.

A comparison of the ancient lustral water vase and the modern perfumery vending machine will show that they are substantially alike. The ancient machine has a lever, O, fulcrumed in the standard, N, and connected with the valve in the reservoir, H. The lever is furnished with the pan, R, for receiving the coins dropped through the slot, A, at the top of the vase. An enlarged view of the valve belonging to the vase is shown at the left of the engraving.

The mechanism is almost identical with that shown in the modern device, illustrated in Fig. 2; in fact, this ancient vase described by Heron, more than two thousand years ago, is the prototype of all modern automatic vending machines, and simply serves as another proof of the truth of the saying "There is nothing new under the sun."

It is a curious fact that this ancient invention escaped the notice of the Patent Office until long after patents were granted for the earlier automatic vending machines. It was only a comparatively short time ago that the Patent Office began to cite the vase of Heron as a reference. It was discovered in an ancient work on natural philosophy, and it is a matter of considerable interest to us now to know that this device was well known to the Patent Office during the middle of this century. The vase of Heron is illustrated and described in a work on hydraulics and mechanics published in 1850, by Thomas Ewbank, who was at that time Commissioner of Patents.

Identity by the Thumb.

At a recent meeting of the Anthropological Institute, Mr. Francis Galton, F.R.S., exhibited a large number of impressions of the bulbs of the thumb and fingers of human hands, showing the curves of the capillary ridges on the skin. These impressions are an unfailing mark of the identity of a person, since they do not vary from youth to age, and are different in different individuals. There is a statement that the Chinese—who seem to be credited with every new discovery—had used thumb impressions as proofs of identity for a long time, but Mr. Galton pronounced it to be an egregious error. Impressions of the thumb formed, indeed, a kind of oath or signature among the Chinese, but nothing more. Sir W. J. Herschell, however, when in the Civil Service of India, introduced the practice of imprinting finger marks as a check on personation. Mr. Galton's impressions were taken from over 2,000 persons by spreading a thin film of printers' ink on a plate of glass, then pressing the thumb or finger carefully on the plate to ink the papillary ridges, and afterward printing the latter on a sheet of white paper. Typical forms can be discerned and traced, of which the individual forms are mere varieties. Wide departures from the typical form are very rare.

Our Navy to Aid the Exposition.

Several army and navy officers who have been detailed as special commissioners to carry invitations from the government of the United States to the other American republics and the West Indian colonies have left for their destinations. It will be part of their duties, *Bradstreet's* says, to explain the plan and scope of the exhibition, to secure the appointment of commissioners by the several governments, to give information regarding the regulations for foreign exhibitors and for the admission of goods through the custom house, and to secure characteristic exhibits. The commissioners are particularly instructed to secure exhibits for a commercial section of the Latin-American Department, for the information and instruction of the merchants and manufacturers of the United States, showing the various classes of merchandise consumed and desired by the people of the countries to which they are assigned; the patterns and designs most preferred; the best methods of preparing and packing them; practical illustrations of the obstacles in the way of extending trade, and the advantages that are secured and enjoyed by European merchants in competition with those of the United States.

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