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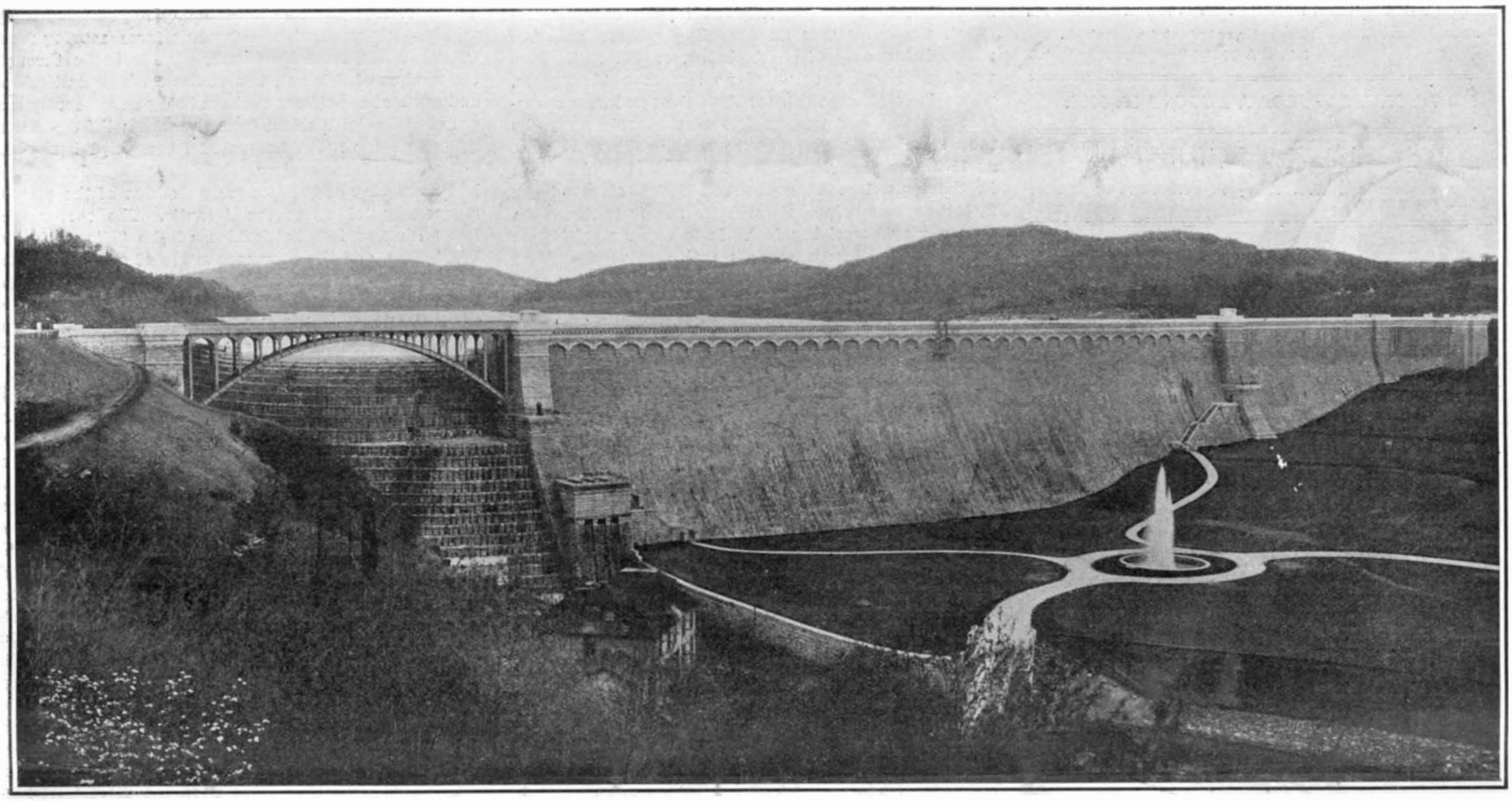
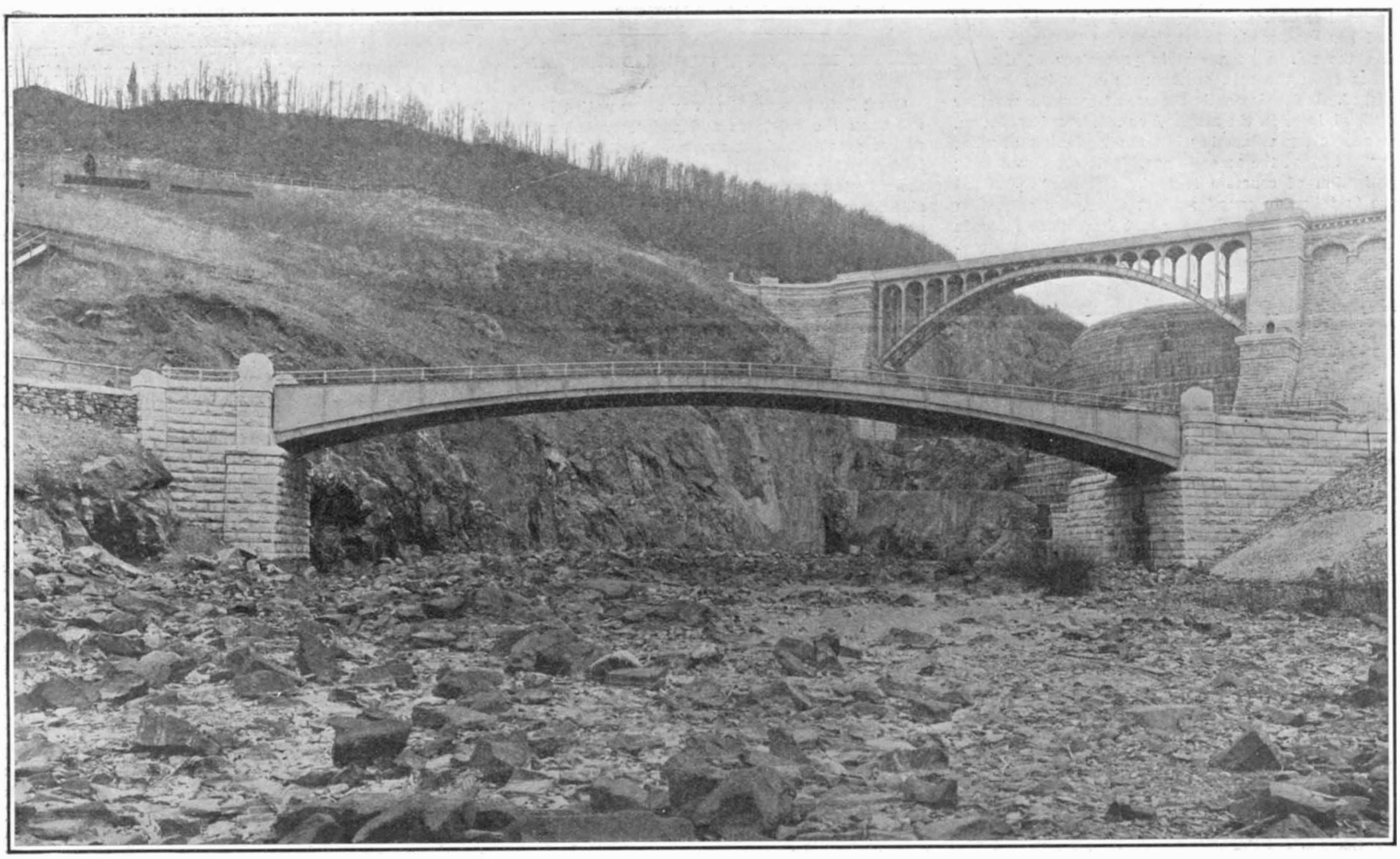


Total length dam and spillway, 2,168 feet. Height, foundation to crest, 297 feet. Width at base of foundations, 216 feet. Depth of foundations, 140 feet. Storage capacity, 30,000,000,000 gallons. Cost, $7,631,189.

The New Croton Dam, Showing the Fine Architectural and Landscape Effect.



The upper bridge is 200 feet and the lower bridge 150 feet in length.

View of North End of Dam Looking Up Bed of New Channel, Formed to Take Surplus Water That May Pass Over Spillway.

FINISHING TOUCHES TO THE NEW CROTON RESERVOIR.—[See page 133.]

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MUNN & CO., 361 Broadway, New York.

NEW YORK, SATURDAY, AUGUST 25, 1906.

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.

CONCRETE AND CRUSHED ROCK.

Evidence of the rapid increase in the use of concrete in engineering and architectural work is to be found in the great demand for, and increasing value of, what used to be known as "broken stone" and is now known as "crushed rock." There was a time, and not so very long ago, when the hand hammer or the portable crushing machine of moderate capacity were equal to supplying the demand; but of late years the call for this material has been so extensive as to warrant the construction of large plants equipped with machinery of special design and large power, capable of turning out several hundred tons of crushed rock per hour from each machine. In fact, it is likely that the production of crushed rock will become a specialized industry, with plants located conveniently to suitable quarries, and within reach of rail or water transportation.

The important effect which the growing use of concrete is having upon certain allied interests is shown by the fact that the sanitary district of Chicago has been negotiating for the sale of the enormous quantities of rock which were excavated during the construction of the Chicago drainage canal. This rock at present lies in huge banks, which extend for many miles parallel with the canal between Lockport and Lemont, Ill. The estimated amount of material suitable for crushed rock now lying in these spoil banks is 22,000,000 cubic yards, and the whole of it, of course, lies conveniently for transportation through the canal to Chicago. An offer of 10½ cents per cubic yard has been made for the rock as it lies in place, with the return of a certain percentage of the net profits from the sale of the rock after it has been crushed. Extensive as is the use of concrete, whether in the plain or in the armored or reinforced condition, we are to-day witnessing but the beginning of what may be termed the concrete age. This ever-broadening application of concrete is to be welcomed, provided care is taken to guard against careless construction or the introduction of cheap and fraudulent methods of work. If the day ever comes when concrete construction is carried on in the shoddy manner which characterizes much brick and stone construction of the present day, we shall be leaving a heritage of trouble and disaster to posterity, the measure of which it would be hard to foretell.

ELEVATION OF OUTER RAIL ON CURVES.

The elevation or, as railroad engineers call it, the super-elevation of the outside rail on curves is more important and demands more careful thought and attention than the maintenance-of-way engineer, the roadmaster, and the section boss are in the habit of giving to it. The danger of derailment due to the centrifugal force exerted by a train against the outer rail on curves may be greatly reduced by elevating the outer above the inner rail. Indeed, there is a degree of super-elevation corresponding to a given rate of speed which will theoretically relieve the outer rail of any side thrust, and cause the engine and cars to travel round the curve without any tendency to bear more heavily upon one rail than the other. If all trains were run at the same speed over a given track, it would be possible to put in this theoretical amount of super-elevation. As a matter of fact some trains would run slower than those for which the track was adjusted, and the slower trains would bear heavily against the inner rail. It is for this reason that engineers are in the habit of adopting a compromise super-elevation, too low for the fast train and too high for the slow train. We believe, however, that it would be better to put in the full super-elevation required for the fast trains, and this for the reason that the risk of derailment on the inside of a curve is a remote one, as is proved by the rarity of an accident of this kind.

On some of the roads of this country, where a fast schedule has to be maintained over tortuous track, the outer rail on some curves is super-elevated as much as 8 inches, and the riding on such track is wonderfully smooth and comfortable. It is, in fact, impossible to tell by the sensations of the body whether the train is running on tangents or on curves. On the majority of our roads, however, the track is not sufficiently adjusted to the higher speeds at which our fast trains are run, and we believe that to this cause, largely, are to be attributed the many derailments which occur. In this connection it is interesting to note the conditions on the curve at Salisbury, England, on which so many Americans recently lost their lives. According to information given at the coroner's inquest, the curve was an exceedingly sharp one, the radius being only of eight chains, or 528 feet. This would represent a curve of no less than 11 degrees, which is one degree greater than the maximum curvature which twenty years ago was considered to be the extreme limit even on our western railroads. That an 11-degree curve should have been allowed to remain in the main line of a road on which some of the fastest expresses in the world are run is to American eyes a very surprising fact. It is also surprising to learn that, although express trains were permitted to run without stopping, though at supposedly reduced speed, through Salisbury station and over this curve, the super-elevation of the outer rail was only 3 1-3 inches. It is not sufficient to urge as an excuse that the curve commenced at the station platform, and that a greater super-elevation was impossible. What was needed, and what is needed to-day at this point, is such a relocation of the line as will eliminate the curve, or at least reduce it to safe proportions.

The evidence of the guard and other employees shows that the train ran from Wilton, a few miles away, to Salisbury at a speed of 68.5 miles per hour, and there is no clear evidence to show that the speed was much reduced through the station. In fact, the guard stated that when the disaster occurred he was doing his best to attract the attention of the engineer. With a 50-ton engine running at that speed on an 11-degree curve, the centrifugal force was equivalent to about 25 tons applied at the center of gravity of the engine, which was about 5 feet above the rail. As the half width of the track was only 2 feet 4¼ inches, it is evident that the resultant of gravity and centrifugal force must have passed just about through the point where the wheel flanges bore upon the corner of the outside rail. The instant this resultant passed outside the rail, which might easily occur when the engine lurched against the rail, there would be nothing to prevent the whole mass from turning bodily over; and this was probably what occurred.

BRITISH MERCHANT MARINE AND THE COMMERCE DESTROYER.

Great Britain more than any other nation is dependent upon the existence and uninterrupted movement of her great merchant marine. In itself, and as the indispensable medium for carrying her vast commerce, the shipping fleet of the island empire is its most valuable asset. Therefore, it has been generally regarded as the most vulnerable point upon which to concentrate attack in time of war. So largely does Great Britain depend upon her over-sea commerce for food stuffs, that there would be no surer way of bringing that proud empire to its knees as a supplicant for peace than to capture, destroy, or drive from the high seas the ships that carry her food stuffs and the raw materials and finished products of her factories.

The recent naval maneuvers, in which practically the whole strength of the British navy was concerned, were planned with a view to determine just how great this peril might be, and to this end an "enemy's fleet" was organized which, though not large in numbers, was mainly distinguished by its combination of great gun power and high speed. Among the battleships were included the five new vessels of the "King Edward VII." class, and among the cruisers was the Atlantic squadron, which, under the command of Prince Louis of Battenberg, visited this country in the fall of last year. Although the commerce destroyer, as represented by our own "Minneapolis" and "Columbia," has ceased to be built, its place has been taken by the modern armored cruiser, which has all the speed of the commerce destroyer, in addition to good armor protection and a heavy battery of long-range guns. The Atlantic cruiser squadron, for instance, consists of ships, the slowest of which is of 23 knots maximum speed, while the fastest, the "Drake," made 24 to 25 knots for short distances when in chase of the enemy.

The "defending fleet" included twenty battleships of the Channel and Mediterranean fleets, besides several squadrons of cruisers, and the plan of the maneuvers was to dispatch a large number of merchant ships across the zone of war under convoy, the vessels being sent off in groups along one of several routes between Falmouth or Milford Haven and Gibraltar. The ships, whether their course lay northward or southward, converged off Cape Finisterre, which, of course, became the central point of defense. The method of defense was for the fleet to move in sections respectively to the south and to the north, each preceded by a wide screen of scouts and cruisers, the widely-separated ships of each screen being kept in touch by wireless telegraphy.

The nine battleships and cruisers of the enemy rendezvoused off Cape St. Vincent, where the vessels were formed in three great lines reaching east and west, with 30 miles between the individual ships of each line. The battleships formed the center line, while a line of cruisers was placed 120 miles to the north, and another line 120 miles to the south, the whole of this great network being kept in touch by wireless telegraph. The defending force, moving from Gibraltar and from Falmouth, quickly broke through the meshes of this net, two of the enemy's battleships and some of his slower cruisers being subsequently put out of action by the fleet from the south; the defending fleet from the north accounted for a third battleship and another large cruiser, while the "Magnificent," the last remaining of the slower battleships of the enemy, escaped by taking to the Atlantic. The enemy was left with five fast battleships of the "King Edward VII." class, and the enormous value of a homogeneous squadron of uniform high speed was shown by the fact that these vessels were able to break through the theoretically overwhelming force of the enemy, and steam up the channel with the defending fleet in hopeless pursuit.

The enemy's cruisers, forming the southern edge of the net, fought an important engagement with the defending cruisers off St. Vincent, in which all of the ships on both sides were severely handled and some vessels were practically destroyed. It is significant that most of the engagement took place at 6,000 yards range, at which the 6-inch gun is practically ineffective, and that the maneuvering was carried out at the high speed of 21 knots an hour. The value of speed in armored cruisers was shown when the enemy's squadron sighted the outer fringe of 25-knot scouts (a new type recently built) and gave chase. In this case the flagship "Drake" was able to raise her speed to 24.8 knots, with the result that she ultimately brought the destroyers within range, and they were ruled out of action. It is claimed, and very justly so, that the maneuvers have emphasized the value of an efficient engineering staff and have proved, once more, that upon the efficiency of the staff, and not upon the mere trial records of the ships, depends their final value when put to the supreme test of war.

On the other hand, too much importance must not be placed upon the escape of the attacking fleet and its ability to raid the maritime cities along the coast, and capture and destroy merchant vessels. Such damage would be local and temporary. Only by meeting and defeating the defending fleet in a pitched battle, a feat of which the enemy was quite incapable, could any decisive result have been achieved. Although the swift cruisers of the raiding fleet succeeded in doing considerable damage to the country's commerce, they were driven from the trade route which was selected for attack, and as a fleet were badly damaged and widely scattered. Altogether, the contention of the leading naval authorities that Great Britain's commerce can never be so absolutely crippled as to decisively affect the issues of war, would seem to be strengthened by the events of this summer's maneuvers.

THE EFFECT OF THE SEA UPON CLIMATE.

The enormous area of the sea has a great effect upon climate, but not so much in the direct way formerly believed. While a mass of warm or cold water off a coast must to some extent modify temperature, a greater direct cause is the winds, which, however, are in many parts the effect of the distribution of warm and cold water in the ocean perhaps thousands of miles away. Take the United Kingdom, notoriously warm and damp for its position in latitude. This is due mainly to the prevalence of westerly winds. These winds, again, are part of cyclonic systems principally engendered off the coasts of eastern North America and Newfoundland, where hot and cold sea currents, impinging on one another, give rise to great variations of temperature and movements of the atmosphere which start cyclonic systems traveling eastward.

The center of the majority of these systems passes north of Great Britain. Hence the warm and damp parts of them strike the country with westerly winds which have also pushed the warm water left by the dying-out current of the Gulf Stream off Newfoundland across the Atlantic, and raise the temperature of the sea off Britain.

When the cyclonic systems pass south of England, as they occasionally do, cold northeast and north winds are the result, chilling the country despite the warm water surrounding the islands.

It requires only a rearrangement of the direction of the main Atlantic currents wholly to change the climate of western Europe. Such an arrangement would be effected by the submergence of the Isthmus of Panama and adjacent country, allowing the equatorial current to pass into the Pacific. The gale factor of the western Atlantic would then be greatly reduced.

The area south of the Cape of Good Hope is another birthplace of great cyclonic systems, the warm Agulhas Current meeting colder water moving up from the Polar regions; but in the Southern Ocean the conditions of the distribution of land are different, and these systems sweep round and round the world, only catching and affecting the south part of Tasmania, New Zealand, and Patagonia.

WANTED: BRAINS TO DISSECT.

BY CHARLES STIRRUP.

It may not be generally known that all over the civilized world there is a strong demand for brains that are a little above the average in quality; not intelligence, or intellect, or genius, but, literally, that part of the human organism which is contained within the skull and is known as the brain.

Scientists who devote themselves to the study of comparative anatomy have for the most part nothing better to dissect than the brains of paupers and lunatics. These, however, leave much to be desired, and it is to the interest of the human family that the brains of cultured and learned people should be placed at the disposal of those patient and laborious men who are engaged in the vastly important work of unraveling the secrets of the working of the mind.

But it must not be supposed that a certain number of such brains are not forthcoming. Comparatively speaking, they are few, but, still, more numerous than most people imagine. In the great majority of cases they are bequeathed by their respective owners. On one occasion Sir William Fowler, the famous authority on comparative anatomy, in addressing an audience of cultured men and women, spoke of the difficulties he and his fellow workers had to contend with in having little else than the brains of people of low intellect to dissect, and went so far as to appeal to the audience to help science in this matter in the only possible way. On the conclusion of his address several members of the audience, including a few ladies, promised to bequeath their brains to him; and, it is said, proved as good as their word. More than one man of great eminence has regarded it as something in the nature of a duty to do this in the interest of science. Prof. Goldwin Smith, for instance, some time ago formally willed his brain to Cornell University.

Some remarkable brains have been sold, not given. An Englishman who calls himself Datas has disposed of his to an American university for $10,000. He is a man of little education, and for many years worked as a coal miner. But he has a marvelous memory, especially for dates, and is now earning a handsome income on the music-hall stage. Any member of the audience may ask him the date of some occurrence, and is answered instantly. It is considered that his brain must show some very unusual development, and there was not a little bidding to secure it after death.

It stands to reason that the brain of a man of intellect offers a much richer field for observation than the brain of a pauper or some other human derelict. The brains of great men vary very much; more, in fact, than do those of nonentities. It is found that men of encyclopedic mind have large and heavy brains —Gladstone had to wear a very big hat—with an enormous bed of gray matter and numerous convolutions; on the other hand, men whose genius is concentrated upon one line of thought are of small brain and, consequently, have a small head. Newton, Byron, and Cromwell belonged to this class, and each had a small head. Yet many people imagine that this is a sign of small mental capacity. A visitor who was shown the skull of Cromwell was so disappointed at its size, that the caretaker of the relic endeavored to console him by saying that this was the skull of the great Roundhead when he was a boy. Prof. Symes-Thompson told this anecdote in a recent lecture, and he also mentioned that Newton was so small when born that he could be put inside a quart pot.

A SEVERE EARTHQUAKE IN SOUTH AMERICA.

Shortly after 7 o'clock, on the evening of August 16, the city of Valparaiso, Chile, was demolished by an earthquake as severe as that which destroyed San Francisco April 18. The earthquake shocks, of which there were several, were recorded by seismographs in Washington, D. C., Florence, Italy, and at Newport, Isle of Wight. The record made at the last-named place was recorded by the instruments of Prof. Milne, the well-known seismologist, and they show an earthquake of long duration, lasting more than five hours. The first record of the earthquake by Prof. Milne's instruments was at 12:24 A. M., August 17, by Greenwich time. This corresponded to 7:15 P. M. of August 16 at Valparaiso. On developing the photographic films on which the subsequent record was made Prof. Milne found that his first record was entirely confirmed, and he was able to determine, from the interval of time between the preliminary tremors (which come through the earth) and the large waves (which travel around its surface) that the earthquake occurred some 6,000 miles away, probably on the coast of South America. Although telegrams indicate that the greatest disturbance was at Valparaiso, Prof. Milne believes that the shock was equally great along the coast, some distance north of that city, which is a classical spot so far as earthquakes are concerned. In 1835 a thousand or more miles of coast line were permanently raised a considerable number of feet, while in 1868 Iquique was destroyed, chiefly by large waves which not only damaged property but which also carried the American warship "Wateree" about half a mile inland. In 1877 another inundation resulting from an earthquake carried the same vessel nearly two miles further inland. During the last ten years, according to Prof. Milne, the southwest coast of South America has remained quiescent, and there have been many more disturbances upon the western coast of North America than in this region. These disturbances culminated in the great earthquake of April 18, which destroyed San Francisco. The present earthquake, from all indications, was quite as severe as that experienced in California. It did not occur, however, altogether without warning, as early in the present year there were a number of earthquake shocks felt throughout the republic. On March 27 the town of Raucagua experienced thirty slight shocks in a single night, and on April 24 several severe shocks were felt at Valdina. These did little damage, but greatly alarmed the people. On May 5, at Arica, a maritime town through which the trade of Chile is carried on with Bolivia, a violent shock occurred. Communication with Valparaiso is practically cut off save by one or two lines of cable extending up the western coast of South America. All the telegraph wires across the South American continent have been shaken down by the disturbance, which seems to have been general throughout Chile, and which was felt even in some parts of the Argentine Republic. A repetition of the San Francisco disaster occurred when the ruins of the city caught fire. Nearly all of the business houses and many of the residences on the hills at the back of the city were either shaken down or burned. The loss of life, at the present writing, has not been determined.

A curious fact in connection with the earthquake is that the seismograph on Mt. Hamilton, at the Lick Observatory, Cal., shows no record of any earthquake shock. This instrument is located in the so-called earthquake belt extending down the western coast of North and South America and around the Pacific Ocean where it takes in Singapore, Japan, and the Aleutian Islands. The seismograph located in this belt would be expected to receive distinct vibrations. The seismograph at Washington recorded both east-and-west and north-and-south vibrations of considerable extent. That at the Johns Hopkins University had the needle thrown off the recording cylinder, so violent was the shock, while the seismograph at Victoria, B. C., also recorded a shock not so severe as that felt at San Francisco last April, but which was, nevertheless, quite prolonged. The Chilean earthquake doubtless is the result of changes in elevation of the earth's crust due to changing conditions within, and in all probability these changes are the outcome of those earlier ones which produced the California earthquake.

THE NICKEL ORE MINES OF CANADA.

The mining of nickel ore in America has its center in the vicinity of Sudbury, Ontario, where the annual output has increased very rapidly within the last two or three years, owing to the extensive development of the deposits. While the existence of the ore has been known for over fifty years, only recently has this resource been exploited on an extensive scale. The annual product at present aggregates about 5,000 tons. Up to the present time, however, not over 50,000 tons have been taken from the mines, which gives an idea of the small quantity of this metal produced in comparison with iron, copper, and tin.

Ores of nickel are more evenly and abundantly distributed over the world than is generally supposed, but only in a very few countries are the deposits of such dimensions as to warrant their development as working mines, and at the present time the mines of Sudbury and New Caledonia produce about the whole supply of nickel. Canada is the largest producer in the world. The Sudbury nickel field has long been known as the most important source of that metal in America, if not in the world; but the work of the last three years has brought out more and more strikingly the unique character of this mining region. It has been proved that all the ore deposits of any economic importance are at or near the outer margin of a huge laccolithic sheet of eruptive rock a mile and a quarter thick, 36 miles long, and 17 miles wide. This sheet is now in the form of a boat-shaped syncline, with its pointed end to the southwest and its square end to the northeast. The rock composing the sheet is norite at the outer and lower edge, merging into granite or granodiorite at the inner (upper) edge. The ore bodies are round the margin of the norite, or along dike-like offsets from it, and have evidently segregated from the rock while still molten, though they may have undergone later rearrangement.

Nickel was first discovered at the Wallace mine, Sudbury, in 1846. In 1856 attention was again drawn to the subject by the finding of nickel and copper six miles north of Whitefish Lake, and less than half a mile southwest of the main pit of the Creighton mine, probably the largest deposit of nickeliferous pyrrhotite in the world. The discovery evidently was not deemed of much importance, as it was soon lost sight of. But the construction of the Canadian Pacific Railway through that region aroused such interest, that in less than ten years from the opening of the road all the mines which are now operated were located.

The industry was at a standstill for about a year, when the Canadian Copper Company, which has expended a large amount in the development of the Sudbury deposits, was organized with a capital of $2,500,000. This company opened Stobie, the Copper Cliff, and Evans mine, while investigations were made which proved the existence of very extensive veins. The Creighton mine was opened in July, 1900. It is undoubtedly the largest in the district, and from the very beginning of operations has produced large quantities of almost pure sulphides, with little or no rocky admixture. It is especially valuable as carrying a large percentage of nickel, with a very much smaller percentage of copper. The mine is situated about six miles in a straight line west of Copper Cliff station. The ore when mined is carried over the Manitoulin & North Shore Railway to Clara Bell Junction, where connection is made with the railway owned by the Canadian Copper Company.

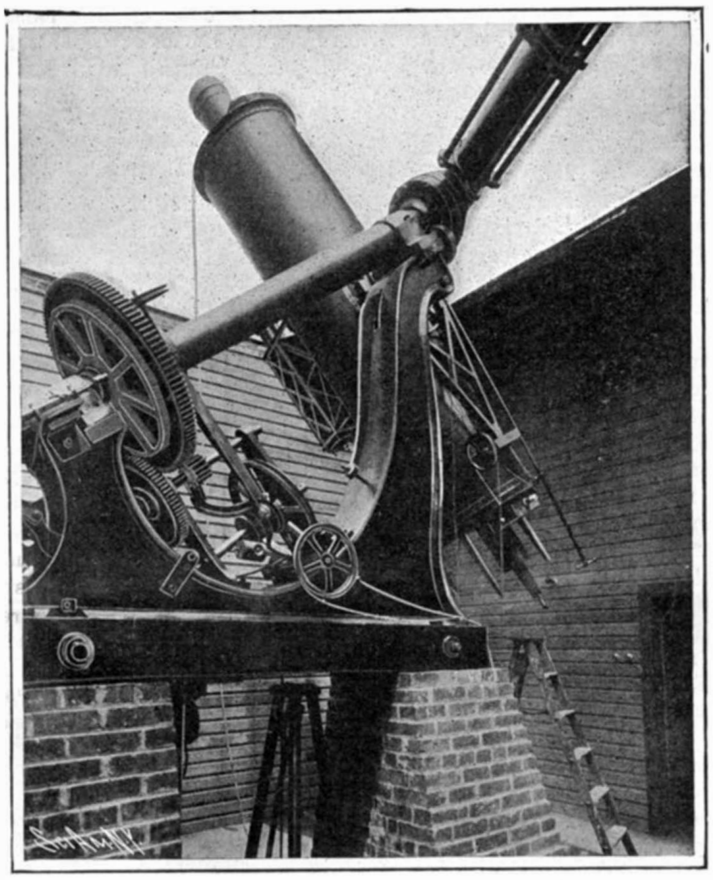
The Creighton mine is at present the main source of supply, and with its equipment allows for a production of between 500 and 600 tons of ore per day. The old or original Copper Cliff supplies about 1,000 tons of ore per month, obtained mainly from the thirteenth and fourteenth levels, the latter workings being 1,052 feet below the surface, but even at this depth the ore body shows no serious diminution either in size or richness. No. 2 mine and the Frood (No. 3) complete the list of mines from which at present the supply of ore is drawn. The mines of the company not in use at present must not all be considered as having been permanently abandoned, but the openings now utilized produce an ample supply of the sulphide material of the various grades suitable for smelting.

The remarkable increase in the production of this metal in the Canadian district is largely due to the improved processes which have been invented for reducing the ore. At the smelters in the United States and Canada electrical apparatus has been employed, by which the metal can be secured at a much smaller cost than in the past, consequently it can be placed on the market at a much lower price, and is being utilized in various industries, where in the past its sale has been confined to a very limited market.

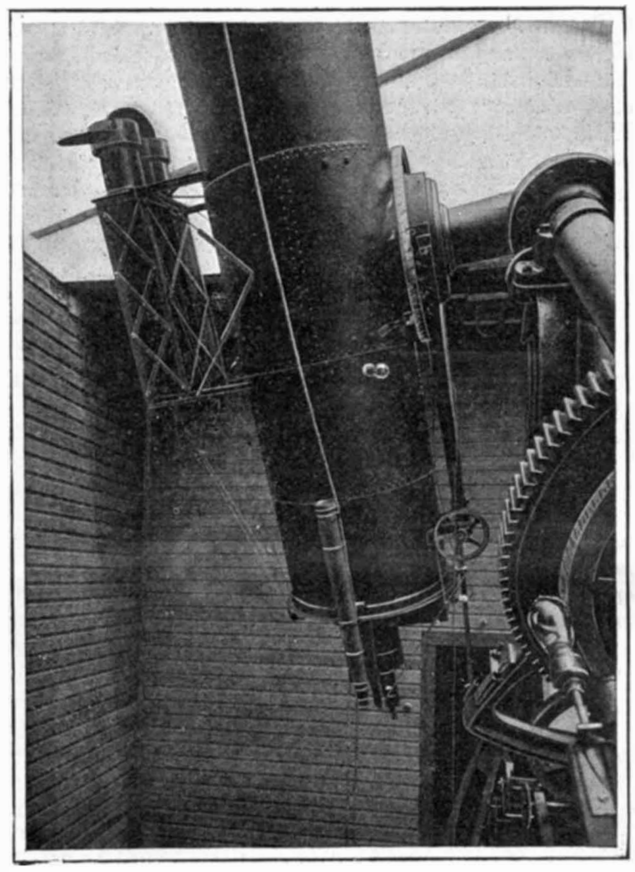
In a paper read before the Académie des Sciences, Messrs. D'Arsonval and Bordas show the advantages of using low temperatures in chemical work. The use of low temperatures is of great value for the separation of different bodies, either by solidification or by vaporizing. We need only to choose the right difference between the temperature, according to the nature of the bodies to be separated. Without going into details, we may mention an easy method by which in a few minutes many operations can be carried out, such as distillation of alcoholic liquids, drying of easily-attacked substances, collection of volatile products, etc. A primitive alembic is formed by connecting two glass vessels of the desired form and volume by a T-tube provided with a stop-cock. One of the vessels forms the boiler or dryer and contains the mixture to be separated, while the second vessel serves as the cooling or condensing chamber. We first make a vacuum in the chambers by the mercury pump, and after this the boiler is heated by placing it in water at 15 deg. C., for instance. The cooling chamber is plunged into liquid air, or simply into solid carbonic acid mixed with acetone. In the analysis of wines, for instance, we obtain at the same time the alcoholic products on the one hand and the extractive matter corresponding to the vacuum extract. In the drying of flour, albumenoids, fats, etc., we have the dry product and also collect all the moisture which can be weighed. Thus we have in a few minutes and without danger of destroying the substances, a series of analyses which might require days and even weeks by the usual methods. By regulating the temperature of heating the boiler, we also control the nature of the distilled product. Thus, when keeping the boiler at —80 deg. C. and the cooler at —191 degrees, we were able to take a volatile product from gasoline which has a remarkable resistance to cold and does not freeze at —200 deg.

NEW ASTEROID CAMERA AT THE NAVAL OBSERVATORY.

BY C. H. CLAUDY.



Mounting of New Asteroid Telescopic Camera. A Camera May Be Seen Outside of the Tube.



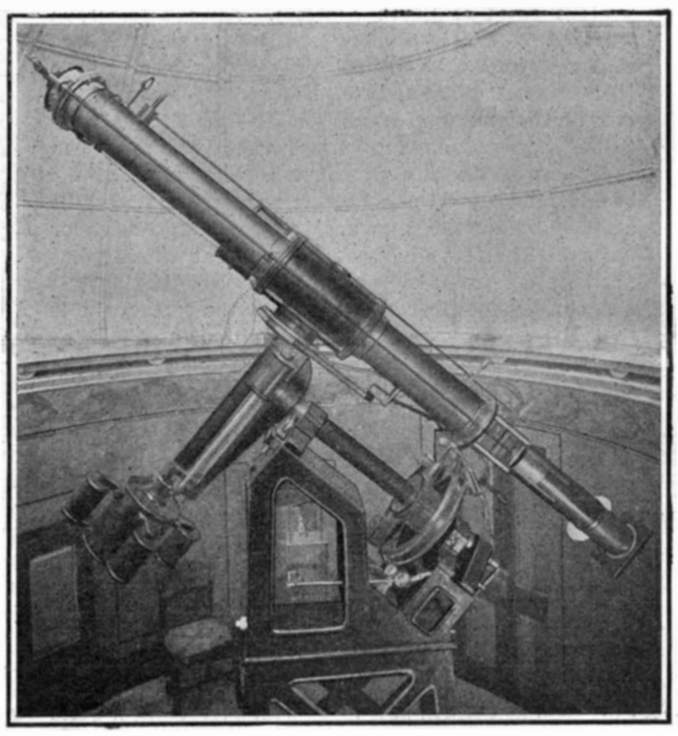
Eyepiece of Telescope, Showing a Camera.

There has just been placed in commission at the United States Naval Observatory at Washington, D. C., a new instrument for photographing asteroids. It replaces the single camera heretofore mounted upon the great 26-inch telescope at that place. The single camera mentioned did good service, but it had two fatal defects for serious asteroid work—it could only expose one plate at a time, and its use put the magnificent equatorial out of commission for other important work.

The new instrument is a triumph of ingenuity, in that it has utilized existing material, cost but a tenth as much as an instrument of similar capacity would have, if made by any of the big instrument makers, and is fully as capable and just as satisfactory for the work it has to perform as any machine which could be made for the purpose.

The mounting, that is the axes and the machinery which drives the polar axis, is the same once used for the 26-inch instrument, before the new (present) Warner & Swazey mounting was obtained. The asteroid mounting is the historic apparatus which first turned the big glasses on the moons of Mars, when they were discovered by Prof. Hall. When the 26-inch glass was placed in the new mounting, the old mounting went to the scrap heap, to lie dormant for half a score of years. Then Mr. W. W. Dinwiddie of the observatory staff raked it out of the dirt, fitted it together, made new parts to replace those lost or rusted, erected the whole on a pier, built around the pier a house of his own design, with a sliding roof, and would have had the cameras in commission long ago had it not been that the solar eclipse of last year took his time and attention. Now, however, the instrument is completed and in use.

Only the central section of the tube of the old telescope mounting has been retained. Within this tube is placed a visual telescope with an achromatic lens of 14 feet 4½ inches focus and clear aperture of 9.62 inches. It is an old lens, albeit a very fine one, by Merz & Mahler, of Munich. The cameras, the essential part of the instrument, are two in number and mounted on the outside of the old telescope central section. They have objectives 40 inches in focal length and 6 inches clear aperture, giving a working aperture of F. 6.6. These lenses are used on plates 4 by 5 inches, giving a photographic field of approximately 5 by 6½ degrees. The shutters are wire frames covered with black velvet, arranged to open and close by the operation of a pair of cords.

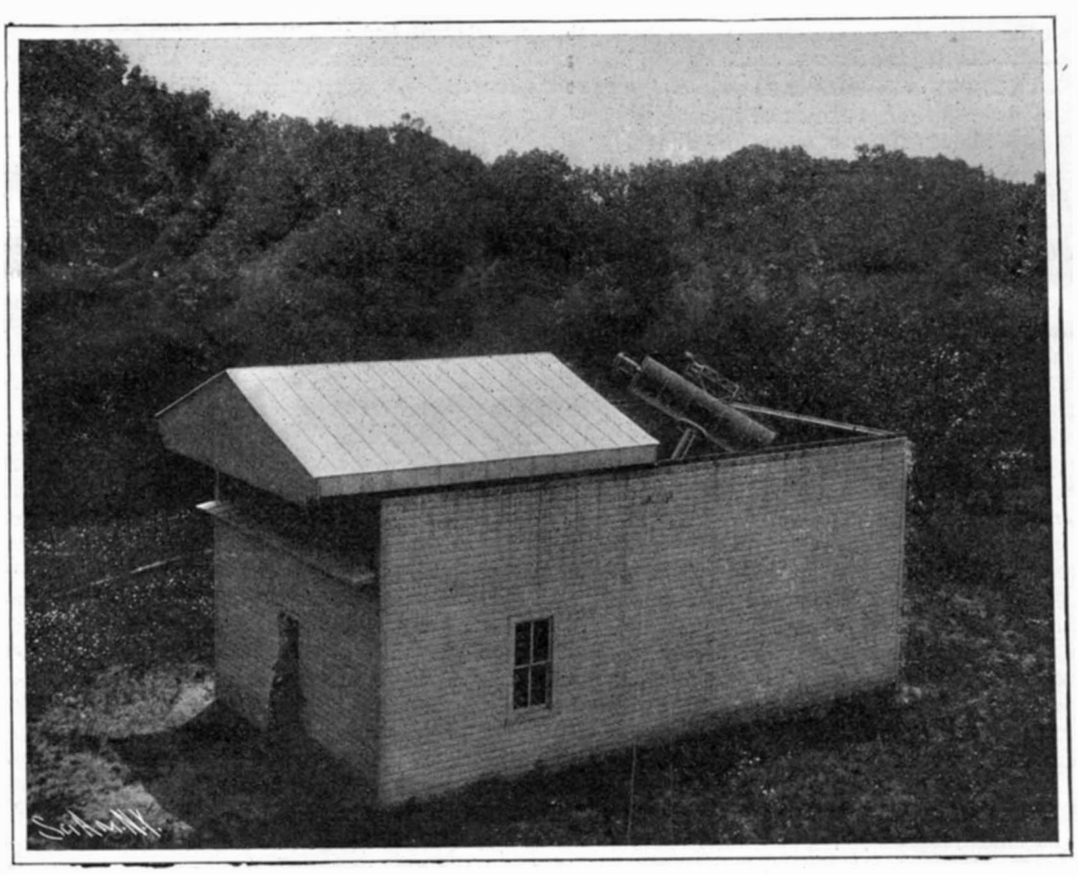


Double Equatorial Telescope.

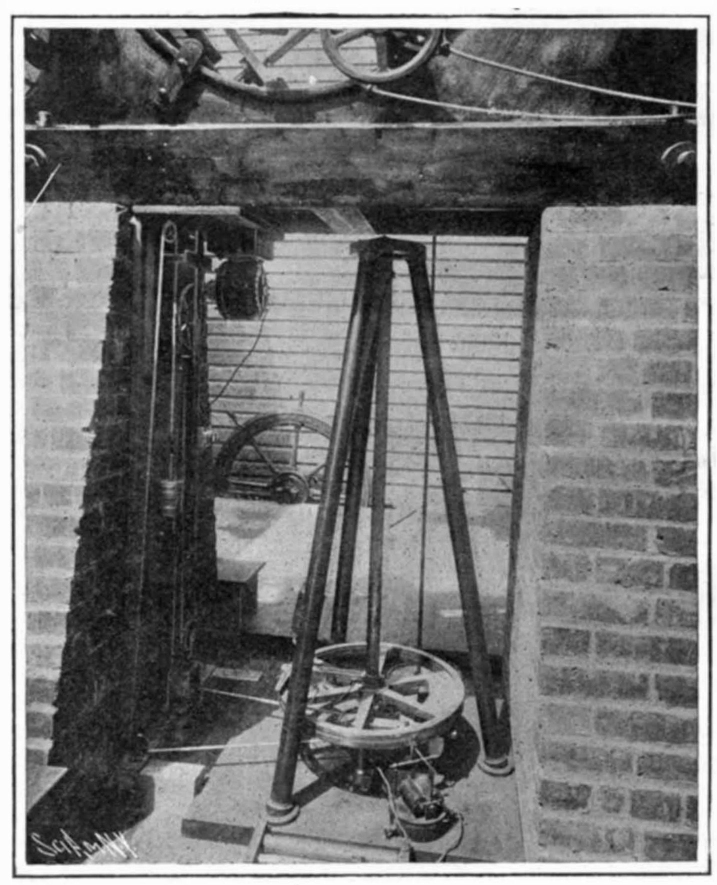
Two exposures are made at once in photographing the heavens. The reason is found in the almost microscopic images which stars and asteroids produce. Any little flaw in the plate, any small particle of dust or error in development, may produce a mark which can be easily mistaken for a star or asteroid. For the same flaw to occur on two plates in the same place is an unthinkable coincidence, however, and so the two plates are made and compared, and if both show the same phenomena in the same place, it is proof positive that the origin is heavenly and not earthly.

The driving mechanism of this asteroid camera is particularly interesting. For the benefit of the uninitiated let it be said that the fixed axis of the telescope is parallel to the axis of the earth, and that a delicate clock is employed to turn the axis of the telescope in the reverse direction to that of the rotation of the earth. The result is that a star once caught on the cross hairs of the visual telescope remains so when the clock is set in motion.

"Clock" it is, but no layman would ever designate the mechanism by any such name. And yet it is simple enough. Within a tripod of brass



Asteroid Telescopic Camera House With Sliding Roof.



Driving Clock for New Asteroid Photographic Telescope, Showing Huygens's Loop.

NEW ASTEROID CAMERA AT THE NAVAL OBSERVATORY.

rods is a perpendicular shaft, and hung at an angle from the top of this shaft is a heavy brass pendulum. At the base of the shaft is a wheel. Obviously, if the shaft is made to revolve, the pendulum will fly outward, from the force of its rotation—centrifugal force; but when the pendulum flies out too far, an electric connection is made between its end and an electrode on the edge of the wheel. This applies an electrical brake to the edge of the wheel, and the clock slows down. But this is not all. So delicate an adjustment is necessary to take care of variations of friction in the ponderous machinery above; for the telescope tube will bear more heavily on a given bearing in one position than in another. But because this electrical brake is so delicate, a further adjustment of the clock is necessary to take care of variations in the applied power. Probably the ideal power for any driving clock is a weight, but that means a deep pit and considerable complications. So here an electric motor supplies the power. Now, an electric motor is subject to too many fluctuations of speed with a varying load to do accurate service as an astronomical clock driver, so, while here it actually supplies the power, that power is used to wind up a weight.

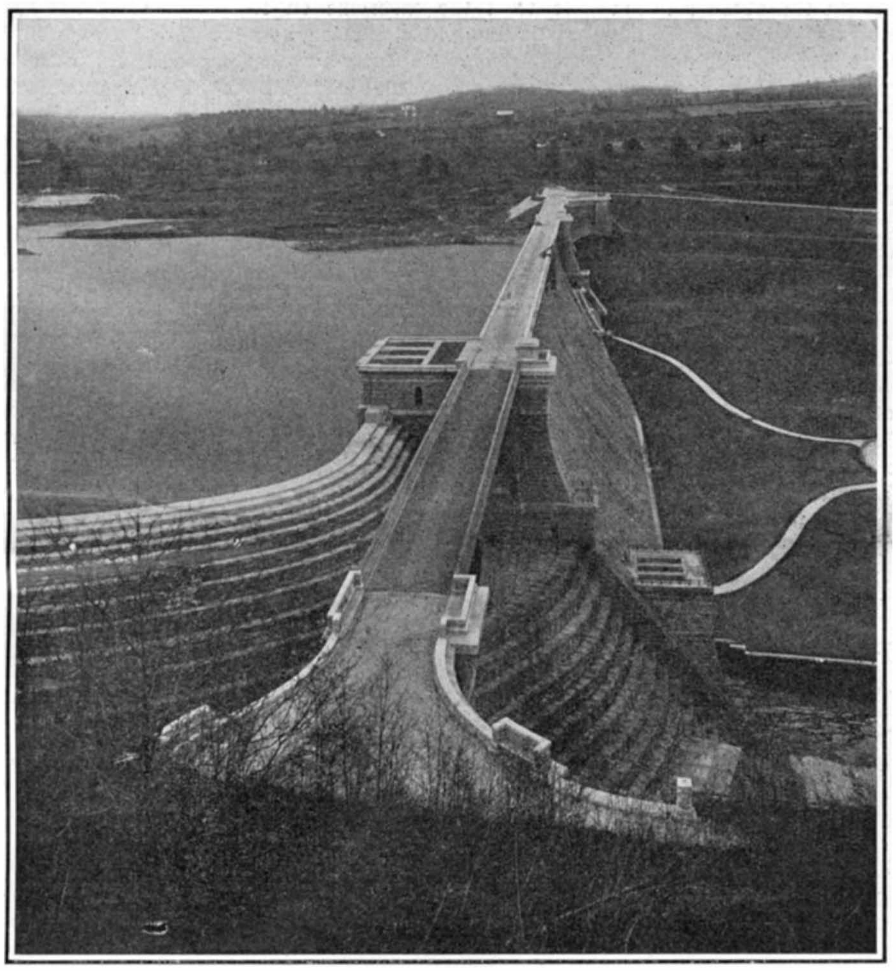
This weight is balanced by a lighter weight, and connected thereto with that curious arrangement of cords and pulleys known as Huygens's loop, by which the source of power winds up a weight which runs down as fast as it comes up, and so is stationary. Stationary within limits, however; for an increase in the speed of the motor pulls the weight up and a decrease lets it down a bit, and this motion has been here utilized to make and break the circuit which supplies the motor. And so the uneven electric motor has been made to deliver an even supply of power, and the clock pendulum regulates the speed for differences of friction, and the whole turns the axis of the telescope with its cameras so accurately as to allow exposures of an hour and more to be made and still record the star images as points. But it must not be imagined that the machine does this unaided. The motion of the earth around its axis is absolutely even, with no breaks or jumps or alterations in speed whatever. No man-made machinery, no matter how sensitive, can accomplish this, even the best and most accurate of astronomical clocks, for recording time, losing or gaining steadily, which loss or gain is known as the "rate of the clock." And this clock of the telescope has not only to take care of its own motion, but of that of a heavy mass of metal and glass. So, no matter how perfect a clock a telescope may have, it must be supplemented with the eye and hand of the observer at the eyepiece. He fixes the cross hairs in the eyepiece upon some one star in the field he is photographing, and then, when the instrument varies a little in its even movement, he screws it back into position by means of the slow-motion handle which connects with the polar axis. The observer, of course, does not have to keep his eye continually glued to the eyepiece, but looks through it at stated intervals of a minute or so, and corrects any slight variation in position which the clock has not taken care of.

The exposures average an hour. The plates are developed for strength with a dilute developer to avoid fog, and the result is a piece of clear glass spotted all over with little black dots. And if an asteroid is present, it is in the form of a little trail. For the telescope follows the apparent motion of the stars, but the asteroid moves through the stars and so leaves a line—in an hour's time—where the star records a point.

The telescope and its cameras are housed in a wooden structure with a sliding roof, which can be hauled on and off at will by means of the ship's steering wheel seen through the clock in the picture of the mechanism. The view of the house itself shows the roof off, and the instrument projecting above the roof line, ready for business. This construction enables the cameras to be pointed below the pole, if necessary, although photographing in such low altitudes is rarely resorted to.

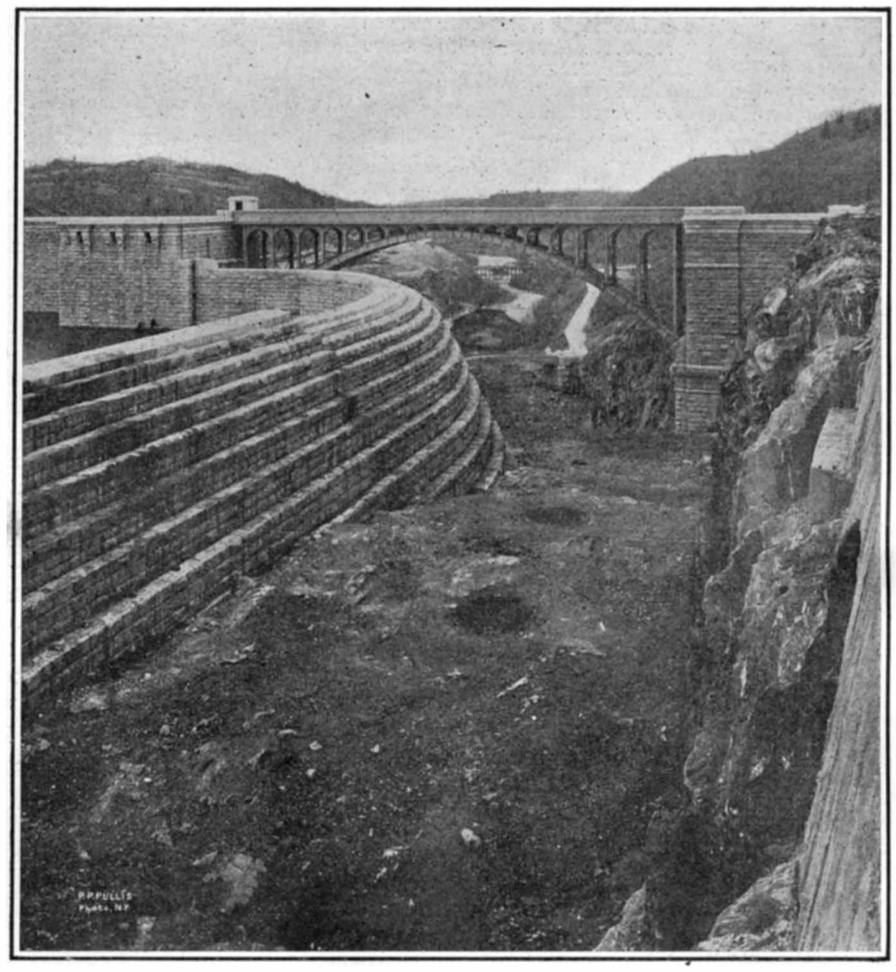
The house is 38 by 20 feet inside, of which 20 by 20 is the telescope room, the rest of the edifice being devoted to photographic dark rooms.

In this new instrument, just placed in commission, the observatory has a tool which should prove of great value. The asteroid work is by no means the least important done at the observatory heretofore, and now, with an instrument to be devoted entirely to the work, both it and the field of activities of the big telescope should be largely increased. The entire credit of the achievement, both for conception and execution, belongs to Mr. Dinwiddie.



In the foreground is the 200-foot bridge which carries the roadway from the abutment to the main dam.

View of Roadway Along Crest of the Dam.



The water is about 30 feet below crest of spillway.

Looking Down the Spillway Channel and Old Bed of Croton River.

FINISHING TOUCHES TO THE NEW CROTON RESERVOIR.

FINISHING TOUCHES TO THE NEW CROTON RESERVOIR.

The work of the landscape artist is rarely seen to better effect than in the disposition which he has made of the various banks of excavated rock and sand and the huge amount of general debris, which disfigured the otherwise picturesque valley of the Croton River below the new dam, during the years that the work of building was in progress. These banks of excavated material were necessarily of large proportions, as will be understood when we state that before the masonry of the dam could be built in place, it was necessary to excavate 1,750,000 cubic yards of earth and 425,000 cubic yards of rock. The greater part of this material was carried down the valley and dumped into large spoil banks, which extended in some cases for thousands of feet. Although, after the masonry of the dam had been carried up above the original level of the bed of the river, a large amount of the excavated material was used for filling in the excavated trench and restoring the original bed of the valley, there yet remained a vast amount of debris below the reservoir.

The finishing touches to the Croton Dam consisted mainly in the erection of a 200-foot steel-arch bridge across the spillway, the laying of the roadbed of the 18-foot driveway across this bridge and over the crest of the dam from one side of the valley to the other, and the formation of an ornamental park on the downstream side of the structure. The last-named work involved the grading down and forming into terraces of the debris, the construction of a central fountain, and the laying out of a series of driveways and footpaths, of which latter two lead from the fountain to the foot of the steps, by which the ascent may be made at two different points to the crest of the dam, while a driveway leads to a 150-foot steel bridge across the bed of the Croton River, whence it extends to a connection with the main road leading down to Croton Landing station on the New York Central Railroad. The 18-foot driveway along the crest of the dam forms a connecting link between two macadamized roads, which follow the shore of the new Croton Lake, and form a continuous ride over forty miles in extent. This road crosses the various arms of the lake by handsome steel bridges carried on granite piers, and it is destined ultimately to form one of the most picturesque drives in the vicinity of Greater New York.

The views which we publish in this issue showing the completed dam serve to illustrate the simplicity and general architectural impressiveness of the structure. At the same time they are deceptive, in that they fail to convey an adequate impression of the mammoth proportions of this structure. Thus, in looking at the view taken from below the dam, showing its whole length from side to side of the valley, anyone who is not familiar with the dimensions of the structure would not imagine that the height from the ground level to the crest of the dam was 160 feet; or that the fountain in the foreground was playing to a height of 60 to 70 feet. Moreover, the portion of the dam seen above ground represents only about one-third of the actual mass of masonry in the structure, which extends almost as far below the ground as it does above it, the total height of masonry from the foundation to the crest being just under 300 feet, or to be exact 297 feet. At the foundations of the dam in the center of the valley the masonry is 200 feet in thickness, and it narrows symmetrically to a thickness of 18 feet at the crest. The total length of the dam from the southerly abutment to the bridge is 1,168 feet, and the length of the spillway from the bridge to its terminus up the valley is 1,000 feet, making a total length of masonry of 2,168 feet. The 1,000 feet of spillway provides complete security against damage by sudden floods. As the waters flow over the spillway they enter a wide channel blasted out of the rocky side of the hill, and they are led beneath the steel arch bridge down to a new artificial channel, which ultimately directs them into the old bed of the Croton River.

For over sixteen months now, or ever since the gates in the dam were shut down, no water has flowed in the bed of the Croton River below the dam, and it is possible that it will forever remain dry, except at such times as the blow-off gates are opened for the purpose of cleaning the reservoir. The rapid increase in the daily consumption of water by New York city has brought the demand up to about 320,000,000 gallons per day. This represents an outflow from the dam which is constant. On the other hand, the inflow is very variable, and falls at times during the dry months of the summer far below the consumption. Hence the only time of the year when the water may possibly rise to the level of the spillway is in February, March, or April when there may come a conjunction of rapid thaw and severe rainfall after a winter of heavy snowfall. Such a contingency occurred in March of last year, when in a single day of the thaw there was an inflow into the reservoir of 1,500,000,000 gallons of water, and this amount constituted the average from March 25 to March 27, during which period the level of the water rose 14.48 feet.

In further explanation of the fact that the water will seldom rise in the reservoir to the level of the crest of the spillway, it must be remembered that the water which is available for filling the Croton dam represents the overflow which has come over the spillways of above a dozen dams located farther up the Croton watershed on the various tributaries of the Croton River. The Croton dam, when full, is estimated to hold 30,000,000,000 gallons of water; but before this amount can be stored, the river must fill up the reservoirs, given in the accompanying table, whose total capacity is about 44,000,000,000 gallons.

RESERVOIRS IN CROTON WATERSHED.

	Gallons.
Croton dam	30,000,000,000
Amawalk dam	6,692,000,000
Carmel dam	10,070,000,000
Boyd Corners	2,727,000,000
Middle Branch	4,005,000,000
Sodom	5,243,000,000
Bog Brook	4,400,000,000
Titicus	7,167,000,000
Old Croton	2,000,000,000
Smaller dams	1,588,000,000
Total	73,892,000,000
Bronx and Byram dams	4,141,000,000
Total now available	78,033,000,000
Under construction in Croton watershed:	Gallons.
Cross River dam	9,000,000,000
Croton Falls dam	14,169,000,000
Diverting basin	891,000,000
Total ultimate supply	102,093,000,000

Many important changes were made in the plans for the Croton dam subsequently to the starting of the work in August, 1892. Originally, it was intended to build that portion of the dam, which extends from the massive buttress at the right-hand stairway to the hillside, of earth with a central core wall. As the progress of the work revealed a rather poor underlying rock at this point, it was determined to change the plans, and build that portion of the dam of the same materials and thickness as the main masonry structure. This was a change for the better; for the dam is undoubtedly more solid and more securely founded upon the underlying rock than an earthen structure could ever have been. Unfortunately, the ornamental line of arches, which extends across the central portion of the dam just below the parapet, was not continued throughout this altered portion of the dam, and we think that the structure loses considerably in architectural appearance because of this omission. Moreover, the original plans called for a masonry arch across the 200-foot gap of the spillway. Here, also, from motives of economy, it was decided to build the arch of steel; and although the design is graceful in itself, it forms a break in the masonry structure which destroys the harmonious effect provided for in the original design. Had the bridge been built in masonry and divided into panels corresponding in width to the arches of the main dam, the latter feature could have been carried clear across the dam and bridge from abutment to abutment with fine architectural effect. These, however, are minor defects, and do not prevent the Croton dam from ranking not only as one of the largest, but also as one of the most handsome of this class of structure in the world. The dam has taken thirteen years to build, and has cost $7,631,189. It has served its purpose of carrying the city of New York through the critical period which must intervene before the new source of water supply in the Catskill region can be made available.

Wellman's Polar Project Abandoned.

A dispatch received in London states that Mr. Walter Wellman has decided to abandon the project of reaching the North Pole by means of his dirigible airship, because of the lateness of the season. It is likely that an attempt will be made in 1907.

The Death of James Dredge.

James Dredge, editor of Engineering, of London, died on August 15. In 1893 he was royal commissioner to the World's Fair in Chicago and in 1876 to the Centennial Exposition at Philadelphia.

The Ozobrome Print.

Mr. Thomas Manly, the originator of the Ozotype, an improved gum print, has now invented an improved method of converting a bromide print into a gum print, called "Ozobrome," produced by chemical reactions. The developed and fixed bromide print is "bleached" by a mixture of potassium bromide and potassium ferricyanide, as in the well-known Blake-Smith process, when potassium bichromate and gelatine are also present.

The materials required, besides the bromide print, which it is proposed to convert into a carbon print, are merely a piece of carbon tissue, the customary dishes and squeegee, and the patented pigmenting solution. The method being fully protected (Br. Pat. No. 17,007, 1905), it can only be worked on the conditions to be decided by the patentee, who will doubtless keep the manufacture of the pigmenting solution under his control. Its composition, however, as set forth in the specifications, is as follows:

Potassium bichromate	4 parts.
Potassium ferricyanide	4 "
Potassium bromide	4 "
Alum	2 "
Citric acid	3-5 part.
Water to make	600 parts.

Other bichromates, ferricyanides, and bromides, may be used, and the quantities are given in each case as "about." No other apparatus or material is needed.

Taking the piece of carbon tissue, which must be, of course, insensitive, it is placed in the above solution until it becomes limp or saturated with it. In the meantime, the bromide print has been soaked in water. The tissue is laid face upward on a glass plate, the bromide print put film downward on it, the two are squeegeed together, and left half an hour in that condition, lying on a sheet or two of blotting paper.

Let us consider what takes place while they are in this condition. Our solution contains potassium bromide and ferricyanide, and when a gelatine film full of it comes in contact with the silver image of the bromide print, it is easy to see that it will bleach that image just as if the liquid itself were applied to the print. The by-products of this reaction act in their turn upon the bichromate, and the product of this reaction makes the gelatine of the tissue, with which it is in contact, insoluble. So that where there is the silver image in the bromide print, there the patented solution acts on it, forming products which act on the bichromate, which in turn affects the carbon tissue, making it insoluble, just as it might have been made by light in the printing frame. So that we have a "carbon" image in contact with the bromide image. It only remains to develop that carbon image with warm water in the usual way.

Leaving, then, the theory of the method, let us get back to the print which we left lying on blotting paper half an hour, to give time for these processes to take place, and have their full effect. There is a choice of methods before us. Let us take the most direct. The print and tissue are together immersed in warm water, say 105 deg. to 110 deg. F., and after the lapse of a few moments, the back of the tissue can be pulled off and the picture developed with warm water. The black of the silver image will have become a faint brown in the operation, just as would have happened had we bleached the print prior to toning it with sodium sulphide. If there is any black deposit of silver visible under the shadows of the print, it may be removed with the ferricyanide and hypo reducer, after which the print is washed for a quarter of an hour, and is finished.

An alternative method is to put bromide print and adhering tissue in cold water for a minute, at the end of which time it will be found possible to separate the two by a steady pull from one corner. The pigmented tissue is placed in a dish of clean cold water face downward, and a piece of single transfer paper is slid underneath it, face upward. After the lapse of half a minute, they are withdrawn in contact, squeegeed together, and put aside for a quarter of an hour. The print is then treated precisely as a carbon print would be treated, but is, of course, not reversed, as would be the case were it in single carbon.

The bromide print is restored to its original condition when stripped off the carbon tissue, and will be found to bear only a faint image. It is washed in cold water for half an hour, and is then put into an ordinary developer for bromide paper, in the light, when the image will soon come back to its original condition again. It is then once more washed, but not fixed, and may be used as the basis of a fresh ozobrome print in precisely the same way as before. "In fact," says Mr. Manly in the ozobrome instructions, "with care, as many carbon prints can be made from one bromide print as the strength and substance of the original bromide paper will allow."

Mr. Manly, in his patent specifications, points out that negatives may be intensified, and lantern slides colored, by employing the first method. By soaking a collotype plate in the solution, and squeegeeing a bromide print into contact, the collotype plate can have the image transferred to it ready for printing.

An application of more interest to amateurs is the combination of ozobrome and gum printing. A mixture of gum, pigment, and a concentrated form of the solution described above may be spread on a bromide print with a brush, and then developed in one of the many methods dear to gummists.

What the precise outcome of this most remarkable invention will be, it is not easy to foresee. The more so that at the moment of writing, the ozobrome materials are not ready for the market, so that those who are anxious to try it must curb their impatience. The formula given above for the sensitizing solution is presumably only a typical one, and it is probably to experiments to get the best proportions and the most perfect solution that the delay is due. The backward-and-forward nature of the reactions in the two films in contact would lead us to expect a certain loss of fine definition, and we shall be curious to see how sharply defined a picture can be obtained by the process. Any slight diffusion is not likely to be noticeable enough to cause any trouble in the purposes for which ozobrome is most suitable. Another point which will arouse attention is the effect of the process on the strength and gradation of the picture, how far a soft ozobrome can be obtained from a strong bromide print, or *vice versa*. Then, again, it will be interesting to note how far it is possible to get effective pictures by redeveloping the bromide image underneath, so as to strengthen the ozobrome. It might be possible, too, to treat the ozobrome on its bromide basis with a sodium sulphide solution, so as to get a toned bromide with a "carbon" image on the top of it. But all these are surmises, and hypothetical in character. The notes above contain all that, so far, is to be learned of the process, apart from its theoretical bases, to deal with which this is hardly the place.—Photography.

The Current Supplement.

Because industrial alcohol will soon be extensively used in this country for manufacturing purposes, the opening article in the current Supplement, No. 1599, will be of interest, inasmuch as it gives a very comprehensive review of the methods employed in France for the denaturization of alcohol. The presidential address delivered to the British Association for the Advancement of Science by Prof. E. Ray Lankester bears for its title "The Increase of Knowledge in the Several Branches of Science." The first installment of the address is published in the current Supplement, and is devoted to an historical sketch of radium and modern theories of radio-activity. In a paper on the stability of submarines the well-known British naval architect, Sir William H. White, places on record the results of calculations made to determine the conditions of stability of submarine vessels in varying circumstances which may occur in service. Myron L. Fuller contributes an article on carbon dioxide, in which he tells of the sources of the gas and of its industrial use. The second and concluding installment of Mr. F. W. Fitzpatrick's critique on the effects of the San Francisco fire is published. A very good article is that on sand-lime brick, explaining as it does the chemical composition of the brick and how it is manufactured. Edouard Salles writes clearly and instructively on ions and ionization. A third installment of the excellent paper on tinning is published.

A New Transcontinental Automobile Record.

A remarkable transcontinental automobile record was completed on August 17, by the arrival in New York city at 11:10 P. M. of L. L. Whitman and C. S. Carris in a Franklin, air-cooled, 6-cylinder, touring runabout of 36 horse-power. The start was made from San Francisco August 2, at 6 P. M. (9 P. M. Eastern time), so that the total elapsed time was 15 days, 2 hours, and 10 minutes for the journey of nearly 4,000 miles. The car would have reached New York fully a day sooner had it not met with an accident at Conneaut, Ohio, where Carris ditched it during the night while speeding. The new record more than halves the previous one of 33 days made by Whitman in 1904 on a 10 horse-power Franklin car. A notable feat performed by the car during the trip was the climbing of the Sierra Nevada Mountains to an elevation of 7,260 feet in almost the same time as that made by the "Overland Limited," the fast transcontinental train. The 600 miles across the Nevada Desert to Ogden, through hitherto impassable sand, were covered at an average speed of 11 miles an hour. Ogden was reached in four days, as against ten in 1904. From Ogden the car climbed nearly 4,000 feet more until the highest elevation—8,000 feet—was reached at Cheyenne, Wyo. Mud was encountered through Nebraska, so that the tourists were unable to make up lost time, and took 11 days to reach Chicago. The only engine trouble they had was the giving out of spark plugs. Had they not run off the road and been delayed, they would have made the trip in thirteen days.

Correspondence.

Trans-Neptunian Planets.

To the Editor of the SCIENTIFIC AMERICAN:

In these days of large telescopes and modern astronomical methods, it seems strange that no vigorous efforts are being made to discover planets beyond the orbit of Neptune, which is now considered the outermost limit of the solar system. It has been noticed that seven comets have their aphelia at a point that would correspond to the orbit of a planet revolving around the sun at a distance of about 100 astronomical units (9,300,000,000 miles).

Now several have suggested that such a planet exists, and has captured the comets by attraction. This is probable, as Jupiter and others also mark the aphelia of many celestial wanderers. The writer has noticed that a great many comets cluster around a point 50 units out, where a large body might revolve. If the great mathematicians of the day should try to compute orbits from these aphelia, it is doubtful if they could succeed; but if all the observatories that possess celestial cameras should band together and minutely photograph the ecliptic, as is done in asteroid hunting, the bodies might be revealed on their plates. Even if no discoveries were made, the accurate star photographs would almost be worth the time and trouble.

H. P. LOVECRAFT.

Providence, R. I., July 16, 1906.

Block Signal Systems Should be Automatic.

To the Editor of the SCIENTIFIC AMERICAN:

I have read with some interest your editorial commenting upon the joint resolution of Congress instructing the Interstate Commerce Commission to investigate the various safety devices for the prevention of railroad wrecks.

Might I be permitted to suggest that you in common with others have fallen into the error of using the term "block signal system" in a specific sense, whereas the Esch bill introduced in the House of Representatives uses the term generically, distinctly stating in the last paragraph that such term shall be taken to mean any system, whether non-automatic or automatic, that provides a way whereby certain distances may be established between trains.

Any signal system is an absolute preventive of collision if all the parts that go to effect the desired result are in accord, but in all the non-automatic signaling systems, the ingenuity, wakefulness, and watchfulness of man is depended upon, and thus *ipso facto* the whole system is no stronger than its weakest part; some one must see that the batteries are in proper shape, that signals are well oiled; and no matter how dark or stormy the night, the engineer *must* see the signal by the side of the track. So, though these non-automatic systems are a step forward in the right direction, yet expediency would seem to demand that an absolute automatic system be adopted, one that after installation does not depend on any man's watchfulness. This would be the ideal signal system, and would indeed mark an epoch in railroading.

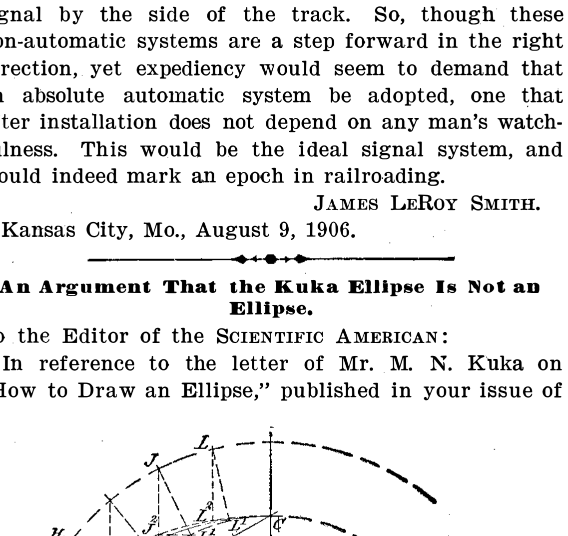
JAMES LEROY SMITH.

Kansas City, Mo., August 9, 1906.

An Argument That the Kuka Ellipse Is Not an Ellipse.

To the Editor of the SCIENTIFIC AMERICAN:

In reference to the letter of Mr. M. N. Kuka on "How to Draw an Ellipse," published in your issue of



July 14, I beg leave to say that the figure submitted is not an ellipse at all, but merely a curve composed of the arcs of two pairs of circles.

In his figure he has a curve of constant radius from C to K of MK and from K to B of FK, reference being made to one quadrant only. In the true ellipse, in any one quadrant there are no two points of the curve having the same radius.

I inclose a figure comparing the curve given by Mr. Kuka with the true ellipse, the curve, according to Mr. Kuka's method, being shown by the solid line, $AKDC$, and the true ellipse by the dotted line $AB''H''J''L''C$.

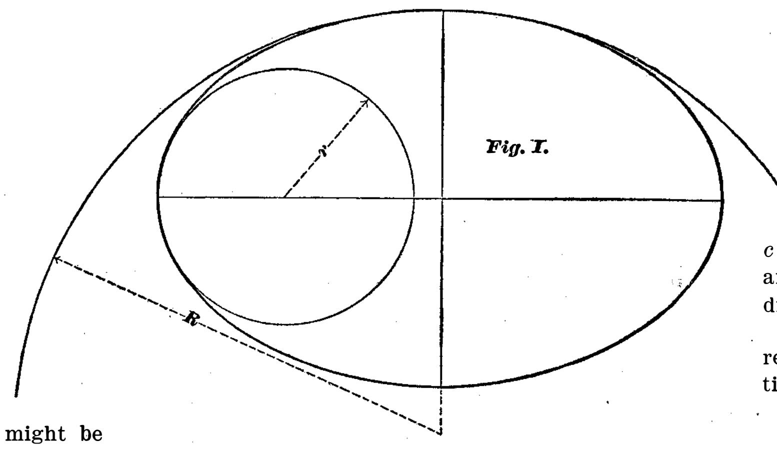
J. F. B.

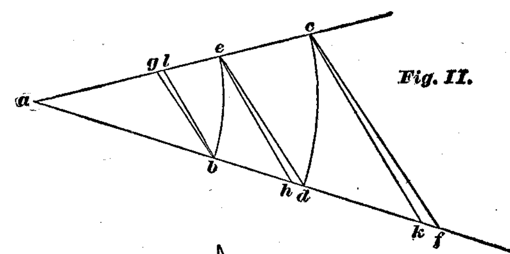
Portsmouth, Va.

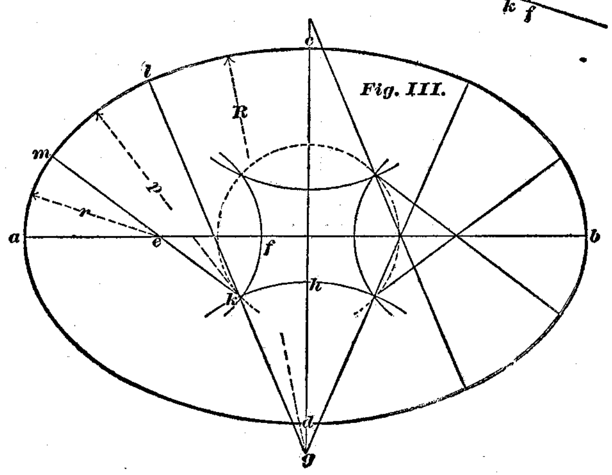
How to Construct an Ellipse: Two Interesting Letters.

To the Editor of the SCIENTIFIC AMERICAN:

The article on the construction of an ellipse, pub-







THE EIGHT-CENTERED ELLIPSE.

lished in your columns of July 14, tempts me to call to the attention of your readers a method of drawing the eight-centered oval and ellipse, which method I devised some years ago, and which I have successfully used in classroom work:

By a careful selection of radii, an eight-centered oval may be drawn which will very nearly coincide with the ellipse constructed on the same axes, and may, within wide limits, be accepted as a representation of it. By this method the use of the curve ruler is avoided, and symmetry with respect to the axes is maintained. The construction given below is the result of an extended series of observations upon eight-centered ovals constructed on axes of various proportions, and a comparison of these curves with the corresponding ellipses.

In drawing an eight-centered oval, three radii are employed. With the shortest radius we describe the two arcs which pass through the vertices of the major axis; with the longest the two arcs which pass through the vertices of the minor axis; and with the third radius the four arcs which connect the former; i. e., the figure is an assemblage of eight arcs of circles.

Fig. 1 represents an ellipse with the osculating circles—or circles of curvature—at the vertices of the minor and major axes. A simple method of determining the radii of curvature is illustrated in Fig. 2. Draw the straight lines af and ac forming any angle at a. With a as a center, and with radii ab and ad respectively equal to the semi-minor and semi-major axes, draw the arcs be and dc. Join ed and through b and c respectively draw bg and cf parallel to ed intersecting ac at g, and af at f; af is the radius of curvature at the vertex of the minor axis; and ag the radius of curvature at the vertex of the major axis.

From the similarity of the triangles acf, aed, and agb, the student will see that this construction is in conformity with a demonstration in the calculus, viz., that the radius of curvature at the vertex of an axis is a third proportional to the semi-axes. With these radii (R and r) the osculating circles in Fig. 1 are described.

One of these circles falls wholly *without* the ellipse, while the other falls wholly *within* the curve. It is evident, then, that in order to represent an ellipse approximately by arcs of circles the longest radius should be less than R, and the shortest radius greater than r.

The following empirical construction gives the best result: Lay off dh (Fig. 2) equal to one-eighth of bd. Join eh, and draw ck and bl parallel to eh. Take ak for the longest radius ($=R$) al for the shortest radius ($=r$) and the arithmetical mean, or one-half the sum of the semi-axes, for the third radius ($=p$) and employ these radii in the well-known construction for the eight-centered oval.

In case the student may not be familiar with this figure it is illustrated. Let ab and cd (Fig. 3) be the major and minor axes. Lay off ae equal to r, and af equal to p; also lay off cg equal to R, and ch equal to p. With g as a center and gh as a radius, draw the arc hk; with the center e and radius eg draw the arc fk intersecting the former at k. Draw the line gk and produce it, making gl equal to R. Draw ke and produce it, making km equal to p. With the center g and radius gc ($=R$) draw the arc cl; with the center k and radius kl ($=p$) draw the arc lm; and with the center e and radius em ($=r$) draw the arc ma.

Since the remainder of the work is symmetrical with respect to the axes, the student will need no explanation beyond that which is afforded by the drawing.

FREDERIC R. HONEY.

Trinity College, Hartford, Conn.

To the Editor of the SCIENTIFIC AMERICAN:

I noticed in the issue of July 14 an article written by M. N. Kuka on how to construct an ellipse. He requests the readers of your paper to endeavor to find a proof for its being an ellipse. I was unable to do this, but I think that I have established the contrary fact—that it is not an ellipse.

Referring to Mr. Kuka's first figure, let $OB=a$, and $OC=b$. There can be only one ellipse having the axes AB and CD. Its equation is: $\frac{x^2}{a^2}+\frac{y^2}{b^2}=1$. The equation of the circle having its center at the point F and a radius FB is: $4(x-a+\frac{1}{2}b)^2+4y^2=b^2$.

According to Mr. Kuka's construction, all points on the arc BK of this circle lie also on the ellipse having the axes AB and CD.

In order to obtain the co-ordinates of the points common to the ellipse and the circle, their equations must be solved simultaneously.

In this way it is found that the circle and the ellipse have only two points in common at the very most. The abscissa of the first point is a, and its ordinate is O; the abscissa of the second point is:

$$\frac{a(a^2-ab+b^2)}{(a^2-b^2)}$$

and its ordinate is:

$$\frac{b}{(a^2-b^2)}\sqrt{(a^2-b^2)^2-(a^2-ab+b^2)^2}$$

Sometimes this second point is imaginary, according to the values of a and b.

Thus it is seen that the circle and the ellipse cannot possibly have more than two points in common, whereas in Mr. Kuka's figure the entire arc BK is common to both. This shows that his figure is not an ellipse, although it looks very much like one.

K is one of the points of intersection of the circle with the line CG. It can be proven that the point K does not lie upon the ellipse unless: $a^6-6a^5b+14a^4b^2-18a^3b^3+14a^2b^4-6ab^5+b^6=O$.

It is also very doubtful whether $MK=CM$, although I have not investigated that.

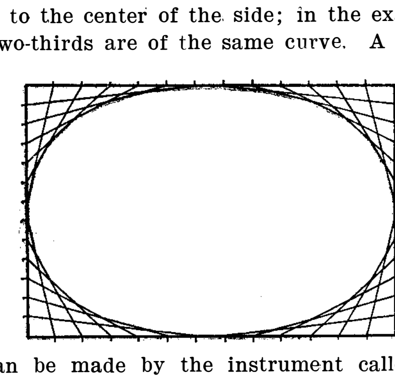
FRED. EATON.

Scranton, Pa.

A Denial of the Compass's Ability to Draw an Ellipse.

To the Editor of the SCIENTIFIC AMERICAN:

I wish to make a few suggestions in reply to a communication from M. N. Kuka, in your issue of July 14, and first, I wish to say that a perfect ellipse cannot be made with a compass, that the true and perfect figure must decrease in curve from the center of the end to the center of the side; in the examples he gives, two-thirds are of the same curve. A perfect el-



lipse can be made by the instrument called the ellipsograph, and by the "string," also by the following process: Square the length and width you desire your ellipse to be. Divide the sides and ends in thirteen equal parts, and draw lines as in the figure. By this process a perfect ellipse may be obtained of any size and shape.

J. B. G.

Brooklyn.

JAPANESE MILITARY SANITATION AND HYGIENE.

BY BARON K. TAKAKI, SURGEON-GENERAL (RESERVE) OF THE IMPERIAL JAPANESE NAVY; FORMERLY DIRECTOR OF THE MEDICAL BUREAU OF JAPAN.

Because an army is a fighting machine, it is obvious that its efficiency must depend primarily on the men of whom it is composed. For that reason the selection of recruits at the time of enlistment is a matter of considerable importance with us in Japan. A high standard of physical health and strength has been adopted, with which every enlisted man must conform. A weak man is not much better than a sick man. Sooner or later he will fill a cot in a military hospital, and that probably at a time when he is most needed in the field, and when hospital accommodations are taxed to their utmost.

Next to the soldier himself the most important factor of an army's efficiency is the food which is supplied. How vitally important in military hygiene is the regulation of diet, may be gathered from the single circumstance that during my period of service as surgeon-general of the Japanese navy, I succeeded in all but totally extinguishing kahke or beri-beri from the navy, merely by introducing a new diet. For thirty-three years or more the disease had wrought fearful havoc in the army and navy. As a result of considerable experiment, I discovered that the food of the average Japanese soldier and sailor contained too much carbohydrate and too little nitrogenous material. Instead of containing 1 part of nitrogen to 15.5 parts of carbohydrate, as it nominally should have contained, the food of the Japanese army and navy comprised about 1 part of nitrogen to 18 to 28 parts of carbohydrates. After much opposition I succeeded in introducing a new regimen, in which a better proportion was observed. Kahke almost immediately disappeared, and has been practically unknown in the navy for twenty-two years.

During the recent war the problem of serving rations was one of the most difficult with which we had to cope. Food was sent to the front under strict superintendence. Victuals were also bought in the field; but the utmost precautions were taken in the purchase for fear of poison. During the severe winter the men were ordered to wrap their provision boxes in flannel and to strap them beneath their overcoats, in order to prevent the freezing of moist foods. Whenever rice was eaten it was previously cooked—a standing order. In the heat of summer a small amount of acetic acid was added to the rice or barley, in order to prevent its decomposition. Besides eating the rations which the commissary department supplied, the men were permitted to buy eatables, following, however, the strict letter of the regulations. No soldier was permitted to purchase directly from the natives. Saké was served by the medical officers to the amount of about two ounces. The men who cared nothing for saké were given sweets. In general, it may be said that the food supply was scientifically distributed in accordance with the recommendations of the medical staff. Army surgeons inspected whatever was eaten, both before and after cooking. Rations were never served to fatigued men, because of the possible harm which might have been done. Unripe fruit was disbarred. Tea and tobacco were used in moderation as stimulants after hard marches.

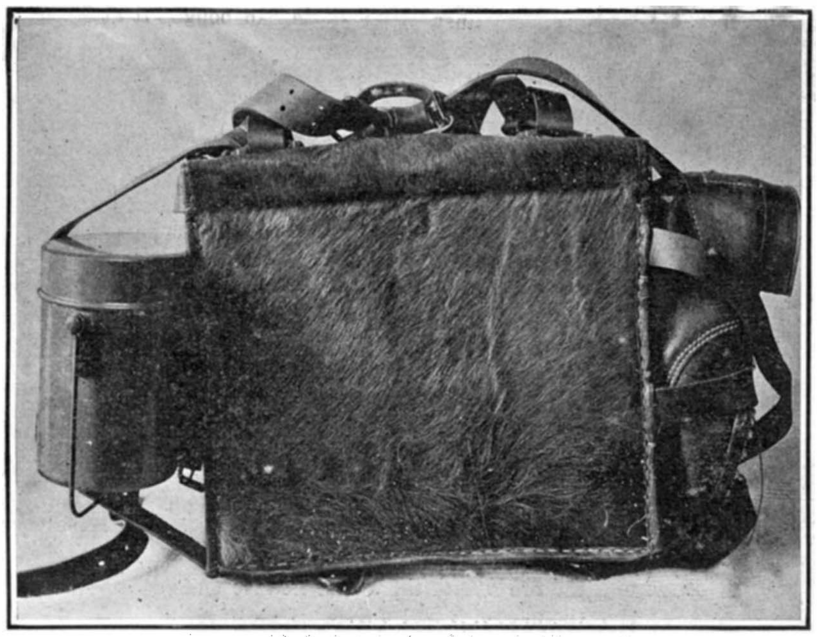
Extreme indeed were the precautions taken to supply potable water, and successful because they were extreme. Water was transported in special wagons drawn by four horses. A boiler cart drawn by one horse provided the necessary means of distillation. In addition the men were instructed to boil their drinking water in their provision pans, when they were unable to supply themselves from the boiled-water wagon of the company. At every mess each soldier filled his canteen with boiled water. Whenever a stream was resorted to, the men were instructed to take only the water in the center of the stream, so that the impurities which cling to the bank were avoided. Even this water was boiled.

To the medical staff was assigned the duty of locating suitable water supplies along the line of march. Medical scouts were sent out to test wells and springs. If the water of a well was unfit to drink, a signpost was erected at the spot giving timely warning of the dangers that lurked in the well. If it were advisable to boil the water, a conspicuous notice was also posted. Guards were sometimes stationed about springs of impure water; for a weary, hot soldier, thirsting for a cool draft, is not apt to be over-nice in his selection of drinking water.

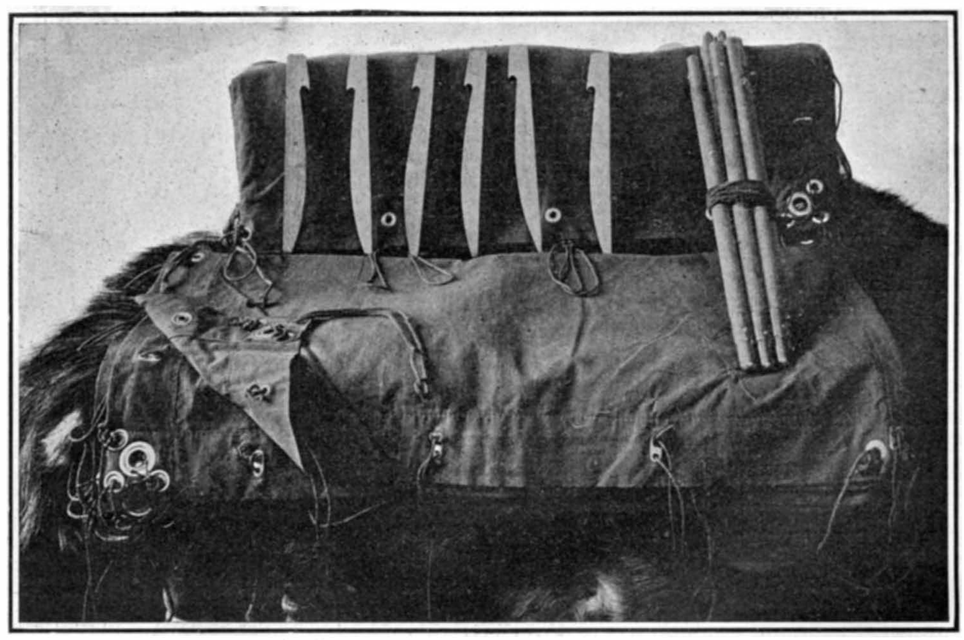
Next in importance to good food and pure water comes the matter of bodily cleanliness. Clothes, shirts, blankets, and the like were washed with scrupulous care whenever the opportunity presented itself. The character of the clothing, too, received not a little attention. Too much clothing causes excessive perspiration, and is therefore injurious; too little clothing is manifestly a poor protective against cold. During rest or while on sentinel duty, the men were warmly clad. When undergoing much bodily exertion, they rid themselves of all that was superfluous.

The overcoat was perhaps the Japanese soldier's most indispensable article of wearing apparel, serving him as it did not merely for keeping him warm, but also often as a bed. After a severe rain it was dried on reaching quarters. Shirts and socks were washed very frequently. In very cold weather the feet were swathed in bandages of flannel. Bootsores are caused by stiff, unyielding shoes. For that reason the soldiers softened their boots, first by soaking them in water, and then by treating them with melted lard. Wet shoes were not allowed to dry quickly; they were bound in straw or cloth, and dried out gradually. When shoes and boots were so badly torn that they became useless, and no shoes were available, the men were instructed to bind their feet in dried grass or straw, and to cover this first wrapping with cloth. Straw shoes were also worn in such emergencies.

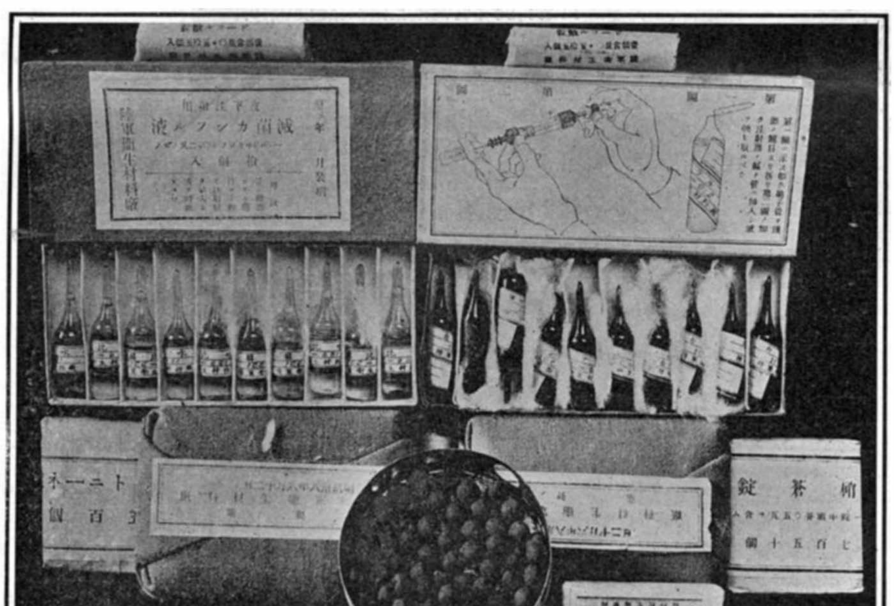
Before a long march was undertaken, or before going into battle, the soldiers were made to bathe, to arrange shoes and socks properly, to repair broken strings and laces, and to fill their canteens with boiled water or tea. Cloths were disinfected at frequent intervals by special apparatus. During the march excessive drinking of water was forbidden, because thirst is thus not assuaged. Water was permitted only in quantities necessary for the preservation of bodily strength. The eating of ice or snow was likewise forbidden. In win-



Waterproof Horsehair Knapsack.



A Tent and Its Stakes.



How Medical Supplies Were Packed.

Aluminium Water Flask and Cooking Utensil; Implements Used for Boiling Water and Cooking Rice.

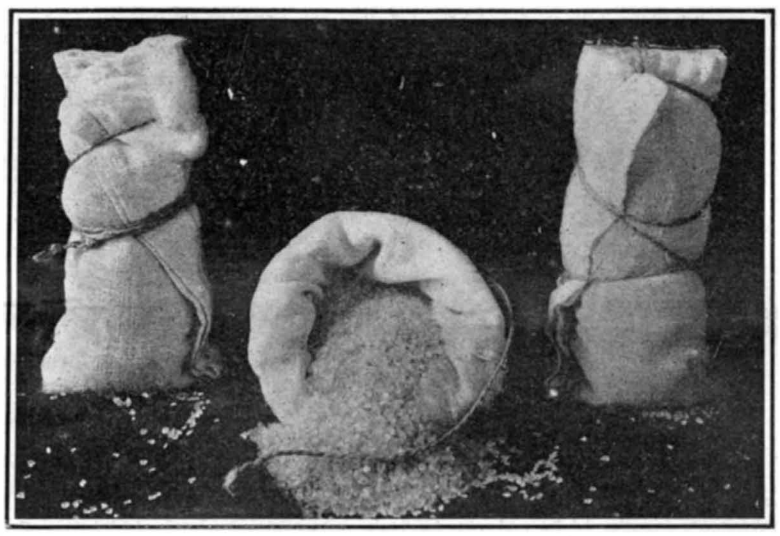
JAPANESE MILITARY SANITATION AND HYGIENE.

ter barracks the men were prone to use the Japanese charcoal pot. Inasmuch as there was much danger of asphyxiation, the use of these pots was sanctioned only when proper ventilation was possible. Summer insect pests, however, gave us more trouble than winter ventilation. In Korea and China flies are annoyingly numerous, and consequently a splendid means of carrying infectious diseases. We took special precautions to dispose of all refuse and manure, and succeeded in reducing the number of flies considerably. In order to guard against infection as much as possible, the soldiers were made to wash their hands before eating.

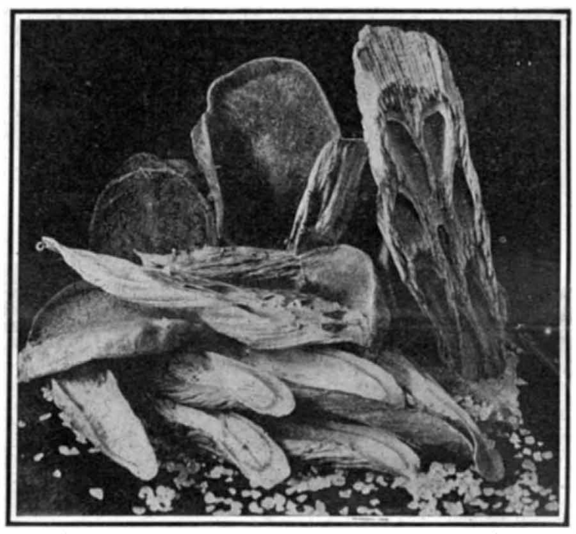
The drinking of boiled water and the eating only of cooked food made typhoid, dysentery, and cholera almost an impossibility. To be sure, we did lose men by disease, but in all human history there has never been a record like ours. We established a record of four deaths from bullets to one from disease. In the Spanish-American war fourteen men died of preventable sickness to one man killed on the field of battle. The following table gives a comparison of the mortality from disease per 1,000 men in the Japanese-Chinese war and the Japanese-Russian war:

JAPANESE-CHINESE WAR.		JAPANESE-RUSSIAN WAR.	
Cholera.		Cholera.	
Cases.	Deaths.	Cases.	Deaths.
82.77	50.86	None.	None.
Typhoid.		Typhoid.	
Cases.	Deaths.	Cases.	Deaths.
37.14	10.98	9.26	5.16
Malaria.		Malaria.	
Cases.	Deaths.	Cases.	Deaths.
102.58	5.29	1.96	0.07

Some difficulty was experienced from smallpox, prevalent to a certain extent among native Chinese and Koreans. Still, out of 347 cases only 33 resulted in death, due probably to the fact that the medical staff carefully inspected all houses and camp sites before their occupation by the troops. Of typhoid fever there were in all 9,722 cases, resulting in 4,073 deaths. Of dysentery there were 7,642 cases and 1,804 deaths. The actual number of officers who were killed outright was 1,657; of petty officers and soldiers, 41,562. The rate of instant death in the navy was 51 per cent, in the army 28 per cent. The discrepancy is due no doubt to the high explosives used in naval shells. To the strict medical precautions which were taken may be attributed the good health of the army and its comparative freedom from infectious diseases. Our invasion of Manchuria was an antiseptic invasion. Disinfecting apparatus played as big a part as cannon in our ultimate victory.

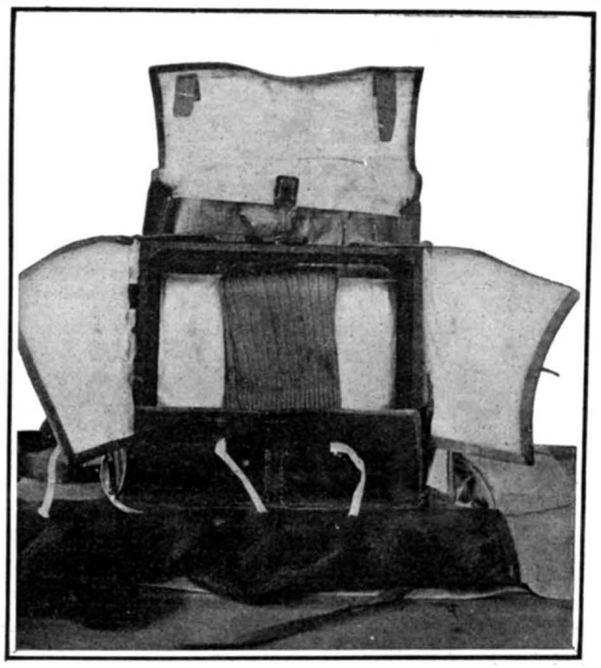


How Emergency Rations of Barley and Rice Are Packed.



Dried Japanese Vegetables Used as Army Rations.

This course of disinfection began even before the men set foot in Manchuria. Men who had the slightest taint of epidemic disease were rejected. The transports were disinfected and quarantined before and after they had disposed of their consignments of troops. Three quarantine stations were utilized. The main station was that of Ninoshima, where 6,000 men could be disinfected in twenty-four hours. The chief means of treatment were baths, steam sterilization, and steam mingled with formalin. Army medical officers were supplied with textbooks, which were used in the instruction of the men; and this instruction played just as important a part in their daily life as their drill.

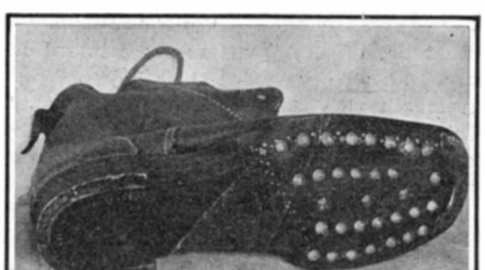


Interior of Soldier's Horsehair Knapsack.

We had a surgically clean army, all but immune from disease; a body of men who fought well because they were physically perfect.

A French company has commenced the manufacture of a product called hydrolithe. It is obtained by the reaction of metallic calcium on a metallic salt. This hydride of calcium gives, under the action of water, pure hydrogen, just as calcium carbide gives acetylene. The industrial product gives 1,000 liters per kilo.

Tent Used as a Rain-Coat on Picket Duty.



Sole of the Army Shoe.

The Army Shoe.

Winter Marching Equipment.

JAPANESE MILITARY SANITATION AND HYGIENE.

A Repeating Gun of 1688.

BY ABBÉ J. ROUQUETTE.

In the course of researches among the archives of the ancient province of Languedoc, at Montpellier, I have found some curious and interesting documents, of which the following is a summary:

On the 21st of August, 1688, a prisoner who called himself Abraham Soyer was brought before the Abbé Du Chayla, arch-priest and inspector of the missions of the Cévennes. Among this man's luggage the arch-priest found and recorded in his inventory " a small arm that could be taken apart, which he (the prisoner) had carried to St. Estienne to have several others made like it, which the most skillful workmen to whom he showed it were not willing to attempt. Yet it was loaded with powder and about a dozen balls."

The prisoner was therefore taken to Montpellier and examined by the intendant of the province, the "small arm" being brought into court as evidence. The examination is reported as follows:

"We showed to the prisoner the breech of a gun of a new invention, which was loaded through the end of the stock, and asked him if he did not have it when he was arrested.

"He answered that he had bought it at Lyons from a peddler for thirty livres.

"Asked if he had not taken this weapon to St. Estienne to have others made like it, he replied that he had.

"Asked if he had loaded it, he replied that it was loaded by the St. Estienne gunsmiths."

In this deposition the prisoner appears to have contradicted some of his previous statements, a circumstance not surprising in the case of a man who was acting as a guide to Protestants endeavoring to escape from France, and who assumed three names, two nationalities, and two religions within the next fortnight. The governor of Languedoc was puzzled and very much interested, for it would be a serious matter if the Protestants were armed with this gun "of a new invention." He wrote to every town through which the prisoner said he had passed. Of the numerous documents relating to the case, only two, besides those already quoted, make particular mention of the gun itself. These are letters signed De Bérulle, without address, but evidently sent from Lyons. In the first, dated September 5, 1688, occurs this passage:

"I have written to St. Estienne to inquire if he was there, if he showed his gun which fires two shots, if he ordered others like it, and how many."

The second letter, dated September 7, 1688, says:

"I have written to St. Estienne to inquire if it is true that he showed the best gunsmiths a gun which fires twenty shots, and if his name is known."

In the first letter the gun is called a *"fusil à deux coups,"* the word *deux* (two) being written out in full; in the second it is called a *"fusil à 20 coups,"* with the 20 in figures.

The gun contained two new inventions: a breech-loading device and a mechanism permitting the discharge of "several" shots. How many? Two or twenty? For two, it would only be necessary to have two barrels. This alone would have been a great improvement; but there is every reason to believe that Abraham Soyer's gun had a special mechanism which made a profound impression on the governor of Languedoc because it enabled "several" shots to be fired. In other words, it was a repeating gun.

THE BRITISH BATTLESHIP "DREADNOUGHT."

The construction of the new British battleship "Dreadnought," of which so much has been said and written during the past few months, has progressed to a point at which it has become possible to make a drawing of the ship which is essentially accurate. The accompanying engraving is reproduced from a wash drawing of the "Dreadnought" which appeared in a recent issue of our esteemed contemporary, The Engineer.

Perhaps the most striking feature in this battleship is her extraordinary length; for her over-all length of 520 feet renders her longer even than the biggest of the armored cruisers, and longer by 70 feet than any battleship afloat. Another striking feature in the outboard profile is the long, unbroken sweep of the topsides, which to the level of the upper deck are unpierced by a single gun port, the usual secondary battery of 6-inch guns being entirely absent from the ship. The two funnels appear to be very stunted, but in reality are not so, their apparent lowness being due to the fact that they are elliptical in section, being very narrow in a transverse direction and of unusual length on the major axis parallel with the ship. The masting, also, has an extremely odd appearance, the foremast being removed from the neighborhood of the conning tower to a position abaft the forward smokestack. It is of tripod construction, consisting of a vertical hollow steel mast, and a pair of forwardly-inclined and diverging struts, one object of which construction is to prevent the mast being brought down by a single well-placed shot. At the top of the foremast, and immediately over the forward smokestack, is the fire-control platform, upon which will be placed the range-finders. It is probable that on this platform and in the turrets will be installed a new automatic system of range finding and gun elevating, by which the range will be electrically transmitted to each gun position, where by means of synchronized motors, the elevation of the guns will be steadily changed to correspond with the decreasing or increasing range as recorded by the range-finder on the platform. This method removes all possibility of error in the transmission of the ranges or the manual elevation of the guns, and leaves to the gun crew the duty of merely traversing the guns and keeping them fixed upon the enemy. It will be noticed that because of the lofty foretopmast the total height of the fore truck must be fully 200 feet above the water line. A short mainmast is carried in the usual position, mainly for the support of the antennæ of the wireless telegraph.

COMPARISON OF SOUTH CAROLINA AND DREADNOUGHT.

	SOUTH CAROLINA.	DREADNOUGHT.
Length	450 ft.	520 ft.
Beam	80 ft. 2½ in.	82 ft.
Draft	24½ ft.	26½ ft.
Displacement	16,000 tons.	18,000 tons.
Horse-power	16,500	23,000
Speed	18½ knots	21 knots
Coal supply	2,200 tons	2,700 tons
Maximum freeboard	20 ft.	28 ft.
Minimum freeboard	12 ft.	20 ft.
Belt armor	12 in.	11 in.
Main armament	Eight 12-in.	Ten 12-in.
Number of guns ahead	Four 12-in.	Six 12-in.
Number of guns astern	Four 12-in.	Six 12-in.
Number of guns broadside	Eight 12-in.	Eight 12-in.
Minimum distance between centers of gun positions	35 ft.	110 ft.

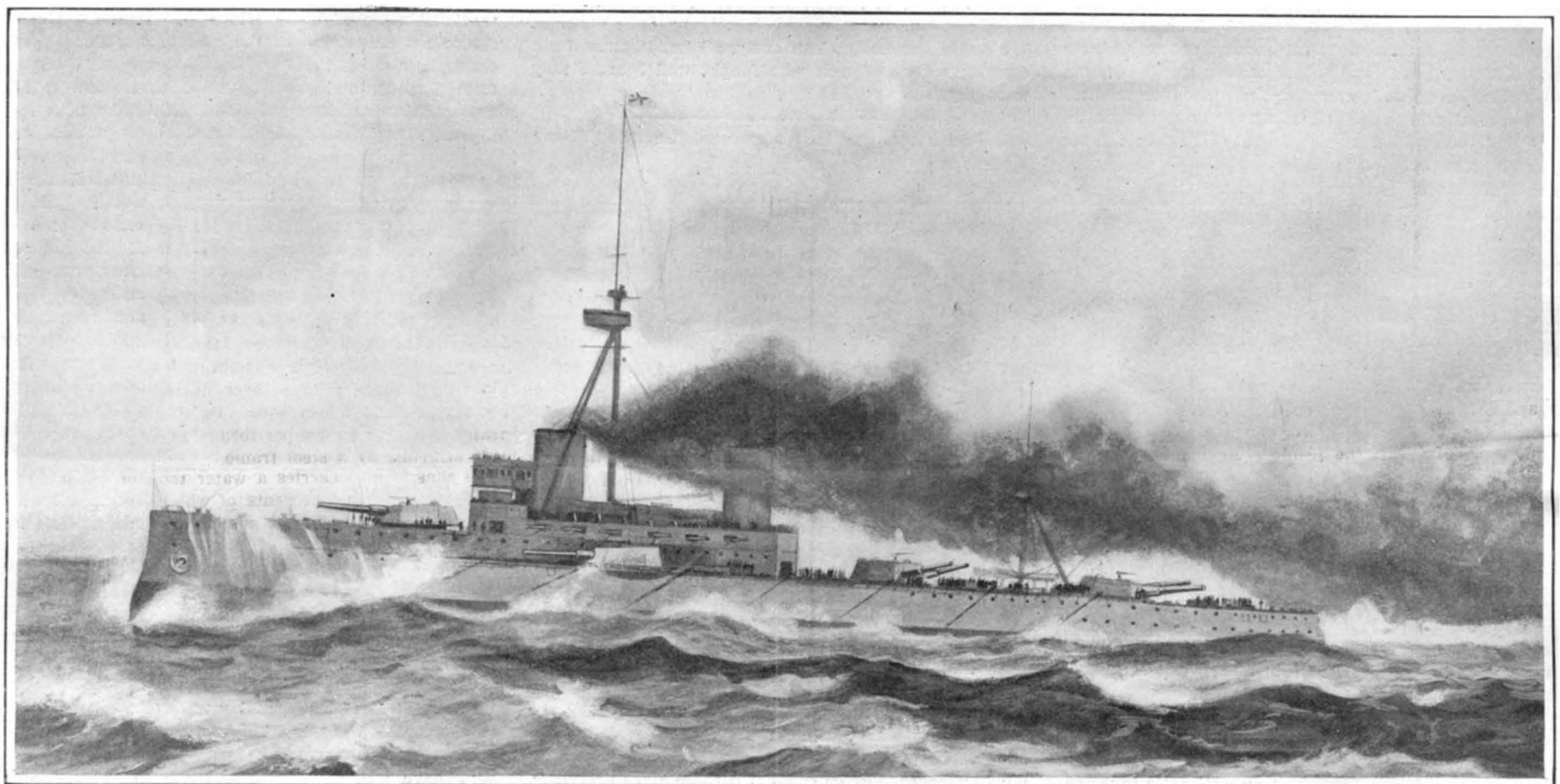
Taken altogether, the appearance of the "Dreadnought" is about as wide a departure from previous battleships as can well be imagined. With her high forecastle, wide smokestacks, and lofty foremast, she might well be mistaken at a great distance for a torpedo-boat destroyer—a delusion which would be greatly helped by the comparative absence of yards and general top hamper. She should prove to be a fine sea boat, her freeboard being nowhere less than 20 feet, and her forecastle deck, upon which the forward pair of 12-inch guns is mounted, having a clear freeboard of 28 feet. The forecastle deck extends for about one-half of the length of the ship, and on its after portion is carried a superstructure deck, upon which is mounted a numerous battery of small rapid-fire guns for defense against torpedo attack. Another novelty is that the officers' quarters are forward instead of aft.

The great length and beam of the "Dreadnought," the latter being 82 feet, render it possible to give the heavy battery of ten 12-inch guns both a lofty command and a wide distribution. In addition to the pair of 12-inch guns on the forecastle deck, the ship carries eight 12-inch guns in four turrets mounted on the upper deck, the axes of these guns being 24 feet above the water. Two of the turrets are mounted on the center line of the ship aft of the superstructure in widely-separated positions, the aftermost pair being about 125 feet (center to center) astern of the forward pair. The other two turrets are mounted, one on each side of the superstructure, about 110 feet distant from the forward turrets. This wide distribution of the armament is one of the excellent military features of the "Dreadnought"; for it reduces the amount of damage which may be effected by a single heavy shell. Moreover, it complicates the work of the enemy's gunners by offering several widely-distributed centers of attack in place of a single position, such as the conning tower with its adjacent military mast, forward 12-inch turret and flanking 6-inch turrets, which formed such a favorite and successful point of attack for the Japanese in their engagements with the Russian battleships. In this respect the "Dreadnought" also has a decided advantage over our own "South Carolina" and "Michigan," in which the turrets are placed in pairs, with only sufficient distance between them for clearance in turning. This feature in the "Dreadnought" is a striking evidence of the advantages that come from large displacement and great size; for such a separation of gun positions would not be possible on a smaller ship. It has the further advantage, moreover, from the naval architect's point of view, that the weights are more evenly distributed throughout the ship, and that it is not necessary to introduce material into the hull merely for the purpose of counteracting the excessive bending strains which would come from the concentration of the heavy armament near the ends of the vessel.

The guns appear to be admirably placed with regard to the two important features, first of securing a maximum concentration of fire in every direction, and second of avoiding the disastrous consequences of "blast," or the disturbance of the crews of one gun position by the blast of other guns that are placed too contiguous to them. The two turrets which are carried on either beam abreast of the superstructure are sponsoned out beyond the side line of the ship, and the superstructure itself is cut away in the forward and aft direction sufficiently to allow the guns of each turret to be fired either dead ahead or dead astern. This enables the "Dreadnought" to concentrate six 12-inch guns ahead, six astern, and eight on either broadside. When these guns are firing dead ahead, there can be no blast interference with the guns on the forecastle deck, which are shielded by the vertical walls of the superstructure, and, moreover, are about 110 feet distant, nor when firing dead astern will there be any interference with the crews of the aftermost turret, which is fully 250 feet distant, and furthermore, is shielded by the after wall of the superstructure. To enable the broadside guns to be fired parallel with the superstructure, the walls of the latter will be specially strengthened.

The "Dreadnought" will be driven by triple turbine engines at an estimated speed of 21 knots an hour. She will carry 2,700 tons of coal, and will be protected by a continuous belt of 11-inch armor, while as a protection against torpedoes a new system of subdivision of the hull of the ship has been adopted which, it is believed, will render her unsinkable by any weapon except a ram.

Since the announcement of the general features of the "Dreadnought" there have been many rumors of ships being built to "beat her," and various statements of the size, speed, and armament of these ships have been published. The only reliable figures of battleships that are comparable to the "Dreadnought" are those of our own "South Carolina" and "Michigan," an illustrated description of which appeared in our issue of August 4. These ships, however, were not built with any idea of surpassing the "Dreadnought," which, because of her much larger displacement, must naturally be a more formidable vessel; for the fighting efficiency of the modern battleship (so well are the principles of design understood the world over) must be directly in proportion to her displacement, however. The tabular comparison which we have made of the military elements of the two ships will, we think, be found to be decidedly interesting.



Length, 520 feet. **Beam,** 82 feet. **Draft,** 26½ feet. **Displacement,** 18,000 tons. **Speed,** 21 knots. **Armor:** belt, 11 inches; turrets, 11 inches. **Guns:** ten 12-inch, eighteen 3-inch.

THE NEW BRITISH BATTLESHIP "DREADNOUGHT."

A WHEEL WHICH CARRIES ITS OWN TRACK.

BY DR. FR. HOUSSAY.

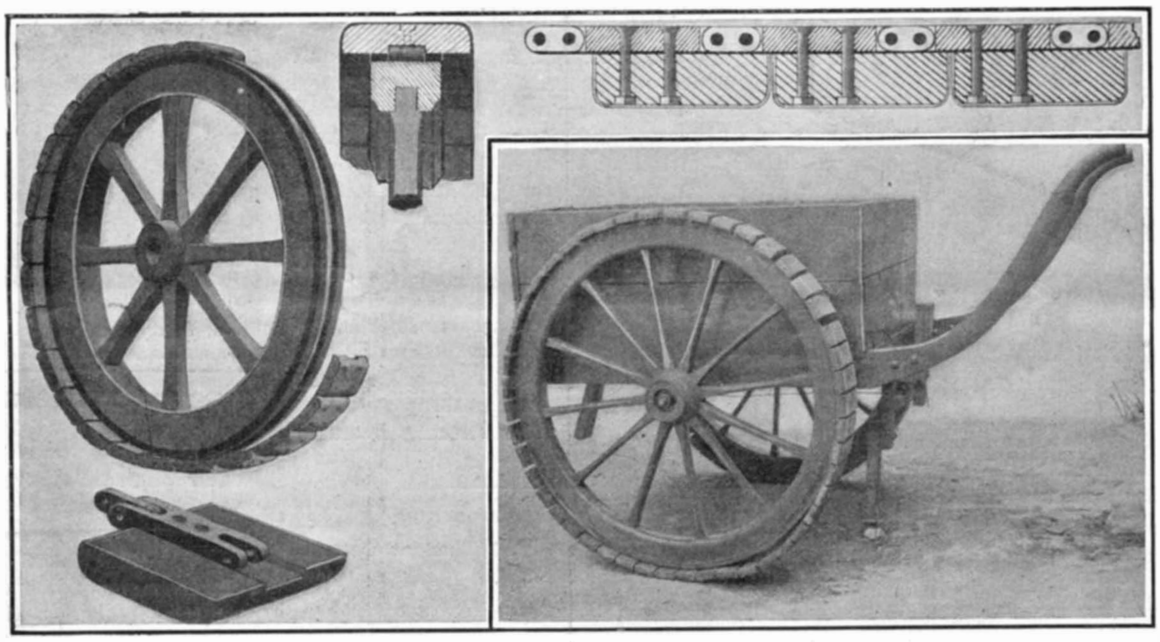
The reduction of tractive effort produced by the use of rails suggested to me the idea of constructing a wheel which should carry its own rail. The difference between traction on rails and traction on roads and fields is enormous. According to Poncelet's experiments, a horse drawing a loaded cart of a total weight of 1,000 kilogrammes (2,200 pounds) over dry, sandy, level ground exerts a pull of 250 kilogrammes (550 pounds), while the traction is reduced on smooth stone pavement to 30 kilogrammes (66 pounds), and on iron rails in good condition to 7 kilogrammes (15.2 pounds), or even to 5 kilogrammes (11 pounds) if the axles are continually lubricated.

The base of my portable track consists of a series of rectangular wooden blocks, with their lower edges rounded and their lower faces shod with sheet iron. In the upper face is a shallow transverse groove, into which a short segment of iron rail is fitted and fastened to the block with two rivets. The length of the rail is equal to the width of the block, but it is placed unsymmetrically, so that one-quarter of its length projects beyond one side of the block. Therefore, if several blocks are laid on the ground, side by side and in contact, with their protruding rails pointing in the same direction, each of these projections will fall in the groove of the next block, and the rail segments will also touch each other, forming a continuous rail. Consecutive segments of rail are then fastened together by short iron bars, which enter mortises in the ends of the segments, and are secured by pins which pass through holes in the ends of the bars and the sides of the mortises. When all the rail segments and their attached wooden blocks have been assembled in this way, the result is an endless chain or band, somewhat longer than the circumference of the wheel to which it is to be applied. The face of the wheel has a groove lined with iron, which the rail enters and which constitutes the bearing surface.

As the jointed rail is longer than the circumference of the wheel, the segments in front of the lower part of the wheel, when the latter is in motion, become separated from it, and are gently deposited on the ground, forming a smooth and straight or nearly straight track, at least two segments long, upon which the wheel can run with all the advantage that would be afforded by a rail of indefinite length.

The hardness and smoothness of the jointed rail diminish the tractive effort, and the wide wooden blocks prevent the sinking of the rail in loose soil, and practically efface the inequalities of the ground by forming an inclined plane before every obstacle and depression. A portable rail of this construction is applicable everywhere except in very wet ground and roads badly washed by floods. Sand and mud forced between the blocks are usually dislodged by the motion of the vehicle, and in any case are easily removed. For this reason I have not attempted to cover the joints, and have thus avoided a useless complication.

The jointed rail may be applied to vehicles of every form and size, from the railway truck and hand cart to the heaviest of automobile or other wagons. Its advantages increase with the size of the vehicle, provided that the strength of the rails is proportioned to the load, a condition which is easily satisfied by using two rails instead of one, for each wheel. The system was first applied, however, to the hand cart or two-wheeled barrow, which may assume various forms according to the use to which it is to be put. One of these forms, shown in the accompanying illustrations, is a box cart for sand, earth, etc., which is propelled by pushing, and may be dumped by throwing up the shafts and removing the board at the end opposite to them. A platform cart, with racks, for hay, straw, and other bulky articles has also been devised; it cannot be pushed, as the load obstructs the view of the operator, but is drawn.



A WHEEL WHICH CARRIES ITS OWN TRACK.

The direction of motion is indicated by the slack of the jointed rail, which is always in front of the moving wheel.

As the rail allows a greatly increased load to be moved with the same effort, these carts may be made much larger and stronger than those in common use. The principal dimensions, in meters and decimals, are the following: For example, the diameter of the wheel is 80 centimeters (32 inches) and the width of its felloes 5 centimeters (2 inches). Of this width, 3 centimeters (1.2 inches) are occupied by two iron hoops of rectangular cross section, each 1.5 centimeters (0.6 inch) wide and 1 centimeter (0.4 inch) thick, which are bolted to the felloes. A band of thin strap iron of sufficient width is applied over these hoops, and bent into the valley between them, the width of which, 2 centimeters (0.8 inch) is sufficient to accommodate this lining in addition to the rail, which is 1.5 centimeters (0.6 inch) wide. The rail segments are 7 centimeters (2.8 inches) and the coupling pieces 2 centimeters (0.8 inch) in length. The wooden blocks measure 7 by 12 centimeters (2.8 by 4.8 inches), the smaller dimension being equal to the length of the rail segments, and the greater one equaling the width of the trace which the blocks make on the ground. Carts of this construction, furnished with brakes, would be very useful on farms and in factories, quarries, etc., where the business does not warrant the installation of even a portable railway of the Décauville type.

I have seen two workmen transport, with the aid of these carts, hundreds of cubic yards of earth for the purpose of filling up an abandoned limestone quarry. They accomplished the task with little fatigue, and in one-third of the time that would have been required with the means previously at their disposal.

AN AUTOMATIC STREET SWEEPER AND SPRINKLER.

The street-cleaning machine shown in the accompanying illustration is a recent French invention, patented by Muller de Cardevar. One of its special merits is the placing of the scraper and the revolving brush within the rectangle formed by the wheels. This arrangement secures a proper distribution of the weight among the wheels, simplifies the transmission of power, and, in particular, eliminates the tendency to tilt which is manifested by machines of this sort, in which these working parts are placed before or behind the wheels. All the machinery is mounted on a steel chassis. In front, under the driver's seat, is the two-cylinder, 12-horse-power motor, which is adjustable to three speeds—5, 11, and 15½ miles per hour. The lower speeds are made by the machine at work, according to circumstances; the highest speed, 15½ miles, is that with which the machine can travel when not working and empty.

The brush is driven by a chain and sprocket, and is raised and lowered by a lever at the driver's side. It sweeps a strip 6 feet wide. Behind the brush and parallel with it is a scraper formed of an India-rubber blade stiffened by a steel frame.

The chassis also carries a water tank of about 600 gallons capacity, the contents of which are applied to the pavement by means of a sprinkling pipe parallel to the brush and in front of it. The flow of water is controlled by a handle within reach of the driver.

Behind the reservoir and the hind wheels are two side spindles, one on each side, which may be put into operation, together or singly, from the driver's seat. When all three sprinklers are in action, the width of the sprinkled strip is about 20 feet.

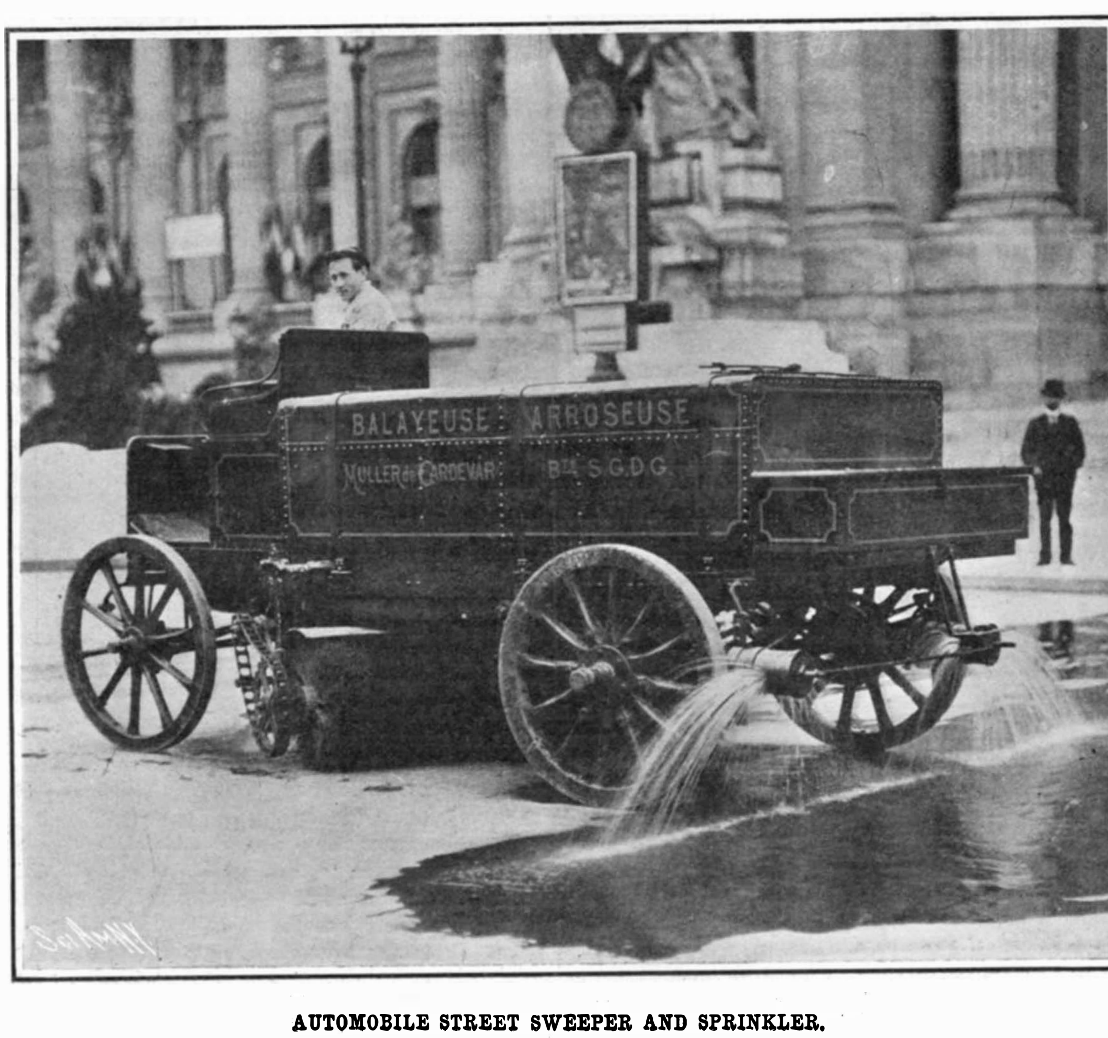
The operation of the machine is as follows:

When it is simply traveling without either sweeping or sprinkling, the brush and the scraper are raised. With an empty tank, the speed may attain 15 or 16 miles an hour.

For sweeping and sprinkling, the cock of the front sprinkler is opened, and the brush and scraper are lowered to the pavement by means of their respective levers. If the street is already wet with rain, the brush and scraper are used without the sprinkler.

For sprinkling only, the brush and scraper are raised and one, two, or all three sprinklers used.

The advantages in compactness, convenience, and efficiency obtained by placing all the apparatus between the wheels have already been mentioned. In machines in which the brush, etc., are placed at the back, their weight tends to raise the front wheels, and therefore to diminish the tractive effect. A further advantage is obtained by the addition of the rubber scraper, which is usually an independent hand tool, even when sweeping machines are employed.

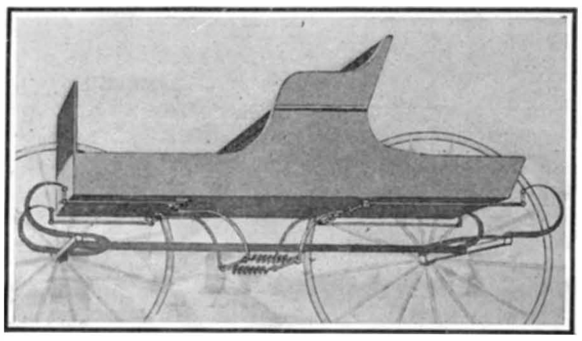


AUTOMOBILE STREET SWEEPER AND SPRINKLER.

Patent Department

IMPROVED VEHICLE SPRING.

Pictured in the accompanying engraving is a novel form of spring for vehicles, which provides a number of important improvements over the ordinary type. The objects of the new construction, as outlined by the inventor, Mr. Hubert R. Rockwell, of 512 West

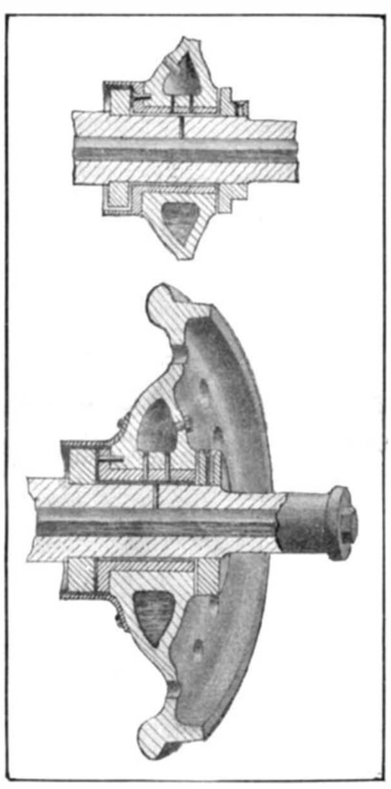


IMPROVED VEHICLE SPRING.

Sixth Street, Chattanooga, Tenn., are to provide an even distribution of the load on the running gear and springs, to maintain the vehicle body at all times on a parallel plane even though the load may be unevenly placed in the vehicle, and to provide a differential action of the springs which will add to the comfort of the persons riding in the vehicle. The construction is very strong and is equally applicable to any kind of a vehicle, from a baby carriage to an automobile. The illustration shows the underside of a carriage fitted with the improved springs. Mounted on the front and rear axles, respectively, are two pairs of C-springs which are bent upward and inward. These springs are built up of a series of leaves. The vehicle body is supported by a pair of levers fulcrumed thereto and with their outer ends suspended by hangers from the C-springs. The inner ends of the levers are bent downward and are connected together by a pair of spiral springs, which will obviously yield equally as load pressure is brought to bear upon the vehicle body. The front and rear levers are each formed of a single rod bent to engage the springs at opposite ends of the axle and providing a long bearing at the fulcrum, as indicated in the drawing. The arm to which the spiral springs are secured is U-shaped, thus linking together the leverage of opposite sides of the vehicle. This connection, however, is not absolutely necessary and the inventor also provides a construction in which four levers instead of two double levers are used.

CAR AXLE AND WHEEL.

There are some features of railroad engineering which have made no advance since the very first days of railroading. For instance, we still cling to the



CAR AXLE AND WHEEL.

practice of mounting car wheels rigidly on their axles, even though this construction offers some very decided disadvantages. In rounding a curve, the outer wheels of the car must travel faster than the inner ones; but since each pair of outer and inner wheels is coupled to the same axle, this relative adjustment of travel on curves is impossible, and as a result, one or both of the wheels must slip and grind on the rails. A long list of evils may result from these conditions. Not only do the wheels and rails wear out, but there is danger of breaking the wheel flanges, and sometimes at high speeds the wheels may climb up on the rails, and thus derail a car. Aside from this, there is an enormous waste of energy in drawing the cars around curves. The theoretical advantages of loose wheels for cars have long been recognized, but owing to expense and complication of parts, the older and cruder construction is still used. However, a very simple loose wheel construction has recently been invented by Mr. Thomas E. Lambert, of 67 Clarkson Street, New York, N. Y. This improved car wheel and axle is illustrated in the accompanying engraving. The axle is bored axially to provide an oil chamber, which is closed at opposite ends by screw plugs. The car wheels are also provided with oil chambers, which are formed in the webs. The hub of each wheel is fitted with a bushing adapted to take up wear. The car wheel has a broad bearing surface on the axle, and is held in place by a pair of collars secured thereto by set screws. Over each collar a dust shield is fitted. The bearings are kept well lubricated by the lubricant in the oil chambers. That in the axle chamber is preferably of such consistency that oil will not flow unless the axle is heated, as it would be, by friction after the other oil supply was exhausted. When a bushing wears out a new one may be substituted, thus virtually renewing the life of the wheel.

Brief Notes Concerning Inventions.

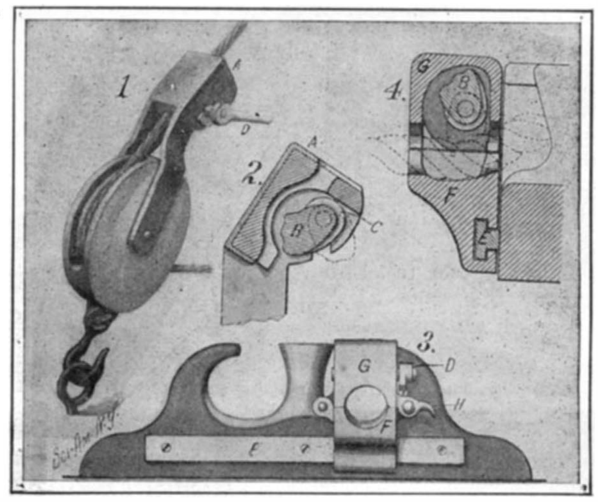
A new industry soon to be established at Oswego, N. Y., is the manufacture of a recently patented double glass phial. The patent not only covers the bottle, but also the process of making it, which can be done at a low cost. The bottle was primarily designed to meet the demands of the perfume trade, it being desirable to put ordinary perfume in one receptacle, and smelling salts or some special product in the other. It will be also found to fill a place in medicine. It is quite common for homeopathic physicians to prescribe two medicines to be taken alternately, and in such cases this bottle will be very convenient. The bottle really consists of two phials end to end with a perfect division, and in the shape of a pencil it will be easy to dispose of in the pocket.

A resident of Connecticut has recently invented a metal belt made of a number of spring loop links spaced by elastic drag links, and connected by diamond-shaped stay rods, forming what is known as a "knife edge" or "scale point." There being no sliding movement, it cannot wear out and needs no oiling. Because of the nature of its construction, the belt can be built up to any length or width—a very important feature of the new system. The inventor claims that his belt will always retain its elasticity. and never require to be taken up, as is the case with leather and its substitutes. The weight is more than that of leather, but its cost is very much less. The demand for some substitute for leather grows more and more urgent every year, and anything which will take its place will be gladly welcomed.

One of the novelties just being introduced to the trade is a folding skate. It is instantly ready to be folded when removed from the shoe. The wing-like projections which are necessary to clamp the skate to the heel and sole are made to turn lengthwise with the skate, and when in this position the bulk is transformed into a perfectly flat shape, one-half inch in thickness. On being applied to the foot it is capable of the same adjustment as the skate of the ordinary kind, and is secured in place by the same lever adjustment as is now in common use. Packing for sale is done in a neat leather wallet with two pockets, each one designed to hold a skate. This makes a package a little more than an inch in thickness and three and a quarter inches wide, the length being regulated by that of the skate.

CHECK ATTACHMENT FOR PULLEYS AND CHOCKS.

The accompanying engraving shows an attachment for chocks and leading pulley blocks which can be set to permit the free passage of the rope through the chock or pulley, or can be set to clamp the rope. Furthermore, the rope will be so clamped that the strain to which it is subjected will only increase the security with which it is held. In Fig. 1 we show a leading pulley block hooked to a holdfast. The block is provided with a pair of straps which culminate in a hood *A*. A section of this hood is represented in Fig. 2, which shows the groove formed therein for the passage of a rope. Journaled in this hood is a fan-shaped cam *B*, formed with a groove *C*, through which the rope normally passes. A handle, *D*, connected to this cam provides a means of turning the latter, so that it will press its serrated edge into the rope, when the rope will be immediately locked against movement through the hood. Fig. 3 shows the invention applied to a chock of ordinary type. The chock is provided with a T-rail *E*, on which a member, *F*, is adapted to travel. Hinged to the member, *F*, is a member, *G*, and the two are fastened together by a lock, *H*. The members, *F* and *G*, combine to form a passage for the rope or cable. As shown in the section, Fig. 4, the member, *G*, is formed with a chamber, in which is journaled the fan-shaped cam, *B*. The latter is operated as in the pulley by a handle, *D*, to clamp the

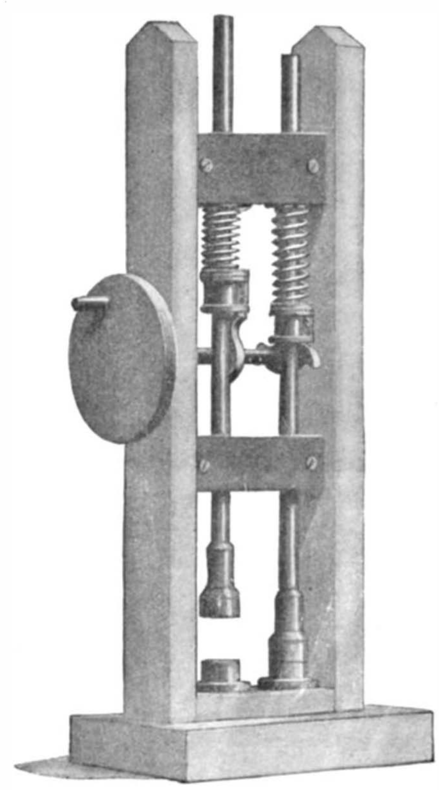


CHECK ATTACHMENT FOR PULLEYS AND CHOCKS.

rope passing between the members, *F* and *G*. The inventor of this improvement is Mr. Rudolph Kurella, 2419 Tenth Street, West Berkeley, Cal.

ORE STAMP MILL.

In ore stamp mills, as heretofore constructed, it has been the common practice to make the stamps as heavy as possible, with the idea that thereby a more effective blow can be delivered. Gravity alone is depended upon to move the stamps downward; consequently, the stamps cannot be operated very rapidly, for the cams will lift them before they can deliver their blows. With the purpose of providing a high-speed stamp mill, as well as one that will deliver sharper blows, the mill illustrated herewith has been invented by Mr. Thomas E. Lambert, of 67 Clarkson Street, New York, N. Y. The illustration shows a mill with a battery of two stamps. The general principle of operation is the same as usual. A pair of cams lift the stamps to their upper position and then permit them to drop, but in place of depending on gravity alone to cause the downward movement, springs are used to increase the speed and the force of the blows. This permits the mill to be operated at a much more rapid rate. In order to reduce the power necessary to lift the stamps, as well as to utilize the full efficiency of the spring action, the stamps are made extremely light. The shoes are reduced in form, and are made of chrome steel. The stems also are made hollow, so that the inertia of the stamps is materially reduced. As a consequence, the stamps respond more quickly to the action of the springs, and thus deliver smarter blows. To illustrate the economy of this design, Mr.



ORE STAMP MILL.

Lambert has constructed a model provided with two stamps, both of which are fitted with springs of equal power. One stamp, however, is solid, and the other hollow, but in actual tests the crushing effect of the lighter stamp is greater than that of the heavier one, whereas a greater power is consumed in lifting the heavier stamp than the lighter one.

RECENTLY PATENTED INVENTIONS.

Of Interest to Farmers.

TRACTION-ENGINE.—L. G. Dix, Hood River, Ore. The invention relates to improvements in traction-engines, and more particularly to the belt-wheel thereon, the object being to provide a belt-wheel for operating a threshing machine or the like, the parts being so arranged that the wheel may be locked to the driving-gear when the engine is stationary and operating a machine, or released and remain idle when the engine is traveling or moving into position for connection with a threshing-machine or the like.

MILK-CAN SEAL.—W. F. Brunssen, New York, N. Y. This invention has reference to improvements in devices for sealing milk-cans, the object being to provide a sealing or cover securing device of simple construction and so arranged that it cannot be removed from the cover without breaking the seal of soft metal.

WIRE-REEL.—A. Asper, Hudson, S. D. This improvement in wire-reels is in the nature of an attachment for use on ordinary farm-wagons on which to reel up and unreel barbed or other wire used for farm-fencing or other purposes. The reel is secured in connection with the farm-wagon, so that the drive-pulley for turning the reel may be operated from one of the wheels of the wagon by frictional contact therewith.

GATE.—F. E. Nelson and G. W. Tribbey, Marshfield, Ore. This invention relates to improvements in gates in which a sliding weight traversing an oscillatory bar is used to cause the gate to swing in either direction to open and close the same. It can be readily operated to open and close at a considerable distance from the gate, whereby the necessity of leaving a vehicle approaching the gate is obviated.

Of General Interest.

LEVELING-ROD.—E. Wiswall, Lawrenceville, Ill. The invention is in the nature of a novel leveling-rod for the use of surveyors, engineers, and others in establishing levels and which shall be self-reading, or, in other words, shall indicate on its face without computation the distance in level between any two points, so as to permit of rapid work and avoid errors incident to computation. An endless belt connects with the rod, which belt is provided with a novel sequence of numbers. There is a foot-arrangement, and further a graduated scale to catch the eye and fix the reading of the hair-lines.

STOCK AND DIE.—N. Tobias, Kingston, Jamaica, W. I. In the present patent the invention has reference to metal tools and implements; and the object is the provision of a new and improved stock and die arranged to permit convenient and accurate cutting of right and left hand single threads of the same or different pitch.

FORCEPS.—J. Somers, San Juan, Cal. One purpose of the invention is to provide a conveniently-operated forceps to facilitate the cleanly removal of live or dead fetus in difficult parturition and also to provide an instrument wherein the various parts thereof can be quickly separated and the instrument reduced in size, for transportation or for cleansing purposes and the parts be readily and expeditiously assembled.

HOLDER FOR REEDS FOR MUSICAL INSTRUMENTS.—E. D. Snodgrass, Tillamook, Ore. The invention pertains more especially to pocket-cases to be carried by players on musical instruments of a certain type, in which to place the reed of the instrument during the time the latter is unused, so as to preserve the intended or original shape of the reed, and thereby enhance the availability or usefulness thereof for a longer period than ordinary.

HOSE-COUPLING.—J. F. Polmann, Wallington, N. J. In Mr. Polmann's patent the invention refers to improvements in couplings for hose or pipes, the object being the provision of a threadless coupling so constructed as to prevent any possible leaking at the joint and to provide for a quick coupling of joints.

HOLDER FOR NURSING-BOTTLES.—A. H. Oberg, Sheridan, Wyo. One purpose of this inventor is to provide a holder especially designed for the form of nursing-bottles commercially known as the "hygeia" bottle, and to so construct the holder that it will be strong, light, and economic, and so that it will stand firmly in any position placed, whether the support be soft or hard.

KNOCKDOWN CABINET.—P. Morrison, Chattanooga, Tenn. In this instance the invention relates to knockdown cabinets; and the inventor's object is to produce a cabinet of this kind which is very simple in construction and the parts of which are adapted to be readily assembled without necessitating the use of a great number of fastening devices.

COMBINED LAWN-RAKE AND SNOW-SCOOP.—R. F. Lawson, Effingham, Ill. This implement is especially designed for use in raking lawns and in shoveling snow and which may also be used for other purposes, comprising devices whereby to readily adjust the several parts of the implement to adapt it to any of said uses. It may also be used as a hoe, being useful on freshly-plowed ground. The scoop will also be found useful for mixing mortar.

DIGESTER FOR EXTRACTING SPIRITS OF TURPENTINE.—F. D. McMillan, Atlanta, Ga. The invention refers to a form of digester which employs a vertical or upright cylinder. In this form difficulty has been found in discharging the woody residuum, owing to the fact that under the influence of heat the woody material becomes compacted and conglomerated or glued together and so tightly held by swelling as to be difficult of discharge, requiring several hours to discharge a single charge of residuum. The improvement promotes the discharge of this conglomerate mass remaining as residuum rapidly and conveniently.

Hardware.

SHEARS.—W. J. HANCOCK, Freeland, Colo. The invention has reference more especially to tinners' shears or such as are employed for cutting sheet metal or the like of the type in which the edges of the cutting-blades meet or close on a plane extending to one side of the pivot for the blades, thus to derive an increased leverage for the blades when manipulated through the medium of their rigid handles and to cause the latter to be brought to the outer face of the work operated upon by the shears.

Heating and Lighting.

HEATING SYSTEM.—J. O'NEILL, New York, N. Y. More particularly this invention relates to heating systems in which a by-pass is furnished about the radiators to maintain the circulation when these are closed, and where under certain conditions the movement of the heating fluid is liable to be somewhat throttled at points and surge laterally through the return openings and meeting the flow-water, diminish or neutralize the circulation. To obviate these difficulties and furnish an arrangement having but few fittings and in which a proper circulation is insured are the principal objects of the inventor.

Household Utilities.

CLOTHES-DRAINING DEVICE.—L. T. COOK, Atlanta, Ind. One purpose here is to provide a device adapted for use in connection with any form of washboiler, especially rectangular or oval, which drainer normally lies in the bottom of the boiler and is adapted to be lifted up and supported at the top of the boiler when the clothes are to be drained, thus preventing the water spilling over upon the attendant or the support for the boiler. A further purpose is to provide means for lifting the drainer to an upper position, supporting it while in such position, and finally when the clothes are sufficiently drained forcing the drainer in position to conveniently dump the clothes therefrom.

WATER-CLOSET SEAT.—L. KRAMER, Evansville, Ind., and F. L. KRAMER, East Orange, N. J. The purpose in this instance is to provide a construction of seat wherein the greatest possible amount of strength will be obtained, together with economy in labor and material. In order to strengthen the structure, glue or its equivalent is applied at the tongue-and-groove connections to the keys and dowels. The grains of the wood are also run to obtain a maximum of strength.

Machines and Mechanical Devices.

SAWMILL-FEED.—G. S. SERGEANT, Greensboro, N. C. The invention is an improvement in rope or cable feeds for sawmill-carriages. Many objections incident to the use of a certain form of drum are avoided in this invention by a novel construction suitably supported from the mill-frame and adapted for adjustment to exert any suitable tension on the rope. It can be readily applied to mills already built as well as to those in the course of construction.

MOLD.—I. ROBBINS, Wilkes-Barre, Pa. Mr. Robbins's invention pertains to a mold which is particularly applicable to the molding of concrete building-blocks and the like. The principal objects of the invention are to provide a mold of great simplicity and of low cost to manufacture and to operate. The device can be used for solid or hollow articles.

ADJUSTABLE RIG FOR CIRCULAR SAWS.—J. H. MARTIN, Springfield, Mo. The invention is an improvement in sawing-machines adapted for sawing down trees or cutting up logs and other analogous work. It is more particularly an improvement in that class of machines in which a circular saw is supported in a swinging arm pivoted upon a wheeled frame upon which is carried means for imparting rotation to the saw.

ROPE-UNTWISTING MACHINE.—F. A. KAISER, Scranton, Pa. The invention refers to such machines as are used for untwisting twisted strands or fibers. The object is to produce a machine which is simple in construction and which will operate with speed and efficiency. It is intended to be used especially for the purpose of untwisting African fiber, which is a commercial product in the form of a rope.

RECORDING ATTACHMENT FOR LIQUID-DISPENSING APPARATUS.—E. C. GRAHAM, Washington, D. C. In this patent the invention is an improvement in recording mechanism, and has for an object the provision of a novel recording mechanism by which to indicate the amount of liquid dispensed and the person dispensing the liquid from a dispensing apparatus.

SASH-OPERATING MECHANISM.—G. P. BULL, Ojus, Fla. In this instance the invention has reference to improvements in mechanism for raising and lowering window-sashes, the object being to provide a simple means in connection with the sash-weight whereby the sash may be conveniently operated from the side of the window-casing.

Prime Movers and Their Accessories.

PISTON-PACKING.—T. W. W. SMITH, Baltimore, Md. Mr. Smith's improvement relates to packing, commonly known as "packing-rings," for pistons, and has for its object certain improvements in the construction thereof over similar packing as same has heretofore been fashioned, the same to be effective to an improved degree and adapted for use in piston rods, and similar reciprocated bodies requiring packing therebetween and their inclosing body.

VALVE-GEAR FOR STEAM-ENGINES.—J. W. DAVIS, Olney, Ill. In this case the invention is an improved means for effecting instant movement of the slide or other regulating valve of an engine, it being adapted to cut off at full stroke, if desired, and the usual eccentric cam or cam-rod and other valve-gear being dispensed with.

TUBE-CLEANER.—T. ANDREWS, Rockaway, N. J. The improvement is in devices for cleaning scale or the like from the interior of steam-boiler tubes, the object being to provide a tool for this purpose of the turbine type that may be operated by air, steam, or water pressure and having ports and turbine-blades so arranged that the motive agent may operate with great force.

Railways and Their Accessories.

TRAIN SIGNAL APPARATUS.—J. R. MONROE, Haskins, Iowa. As its object the invention provides apparatus which will insure that a train-order is delivered to a train before the train is allowed to pass a signal station. More specifically the invention contemplates an arrangement for controlling the semaphore-levers through the medium of the pad upon which the orders are copied.

RAIL-JOINT.—W. D. MCCURDY, Dennison, Ohio. The joint is formed by means of a metal coupling or connecting-piece applied to the meeting ends of the rails and which is effective without the aid of bolts or spikes, while providing a firm and rigid support for the rail ends. The coupling comprises a form of chair adapted to receive the meeting ends of the rails and a block, preferably of iron, which serves as a wedge for holding the coupling firmly engaged with the rails.

RAILWAY-TIE.—C. J. KOPF, Paducah, Ky. In the present patent the improvement has reference to railway-ties, the object of the inventor being the production of a metal tie provided with simple means for attaching rails thereto, and, further, provided with means for yieldingly supporting a rail upon the tie.

Pertaining to Recreation.

NET.—H. J. HUGHES, New York, N. Y. The object of the invention is to provide a new and improved net arranged to clearly and accurately indicate the side lines of the lawn-tennis court to aid the players in properly serving the ball and to readily determine whether a ball was passed over the net within the proper boundaries.

CABINET.—J. L. COLEMAN, Fargo, N. D. The invention pertains to a cabinet intended to be placed in a pool or billiard parlor for the purpose of receiving the balls when removed from the tables. The object is to produce a cabinet of improved construction, which is especially adapted to facilitate the removal of the balls when they are to be racked up or spotted upon the table.

Pertaining to Vehicles.

VEHICLE-WHEEL.—L. A. ALLWINE, Lorain, Ohio. The invention relates to wheels commonly known as "elastic" or "spring" wheels, and has for its object the cure of objections to wheels of this character as they have been heretofore constructed. It consists of a novel arrangement and construction of cushioning means interposed between two independent portions in the make-up of the wheel and also novel details of construction whereby the invention is practiced.

LANTERN-HOLDER.—H. WALDSCHMIDT, Benson, Ill. This invention relates to improvements in holders for lanterns or lamps used on vehicles—such as buggies, wagons, and the like—the object being to provide a holder that will be simple in construction, inexpensive, and having no parts liable to get out of order, and that may be readily placed in position.

ELECTRICALLY-OPERATED VEHICLE.—H. DUCASSE, Paris, France. This case is a division of an application for Letters Patent for an electrically-propelled vehicle formerly filed by Mr. Ducasse. His invention relates to an electrically-operated vehicle, and more particularly to the means for supporting the controlling mechanism and other parts related thereto. To this end it comprises a cross-bar extending from one side to the other of the vehicle-frame and carrying the entire group of parts to be thus supported.

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.

Business and Personal Wants.

READ THIS COLUMN CAREFULLY.—You will find inquiries for certain classes of articles numbered in consecutive order. If you manufacture these goods write us at once and we will send you the name and address of the party desiring the information. **In every case it is necessary to give the number of the inquiry.**

MUNN & CO.

Inquiry No. 8299.—Wanted, to buy black skunks' tails which are brought on the market by furriers as a waste product.

Inquiry No. 8300.—For manufacturers of illuminating lamps that would burn denatured alcohol.

Inquiry No. 8301.—Wanted, parties who could manufacture pressed metal coat hangers.

Inquiry No. 8302.—For a machine that extracts oil from all kinds of seeds.

Inquiry No. 8303.—For the address of manufacturers of Victor collar button.

Inquiry No. 8304.—For firm making rustless pipe by the oxidizing procss.

Inquiry No. 8305.—For parties who manufacture novelties and patented articles.

Inquiry No. 8306.—For makers of concentrators for treating low-grade gold and platinum bearing sands and gravels.

Inquiry No. 8307.—For manufacturers of collapsible tubes for salves, etc.

Inquiry No. 8308.—Wanted, a wire mattress weaving machine for weaving wire fabric for mattresses.

Inquiry No. 8309.—Wanted, address of Earl Mfg. Co., manufacturers of the new aluminum " Name in your coat " coat hangers.

Inquiry No. 8310.—For manufacturers of a patent cistern cleaner.

Inquiry No. 8311.—Wanted, a hand power machine for ginning, carding and spinning cotton.

Inquiry No. 8312.—For parties to manufacture home savings banks, or pocket size, by the thousand.

Notes and Queries.

HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters or no attention will be paid thereto. This is for our information and not for publication.
References to former articles or answers should give date of paper and page or number of question.
Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all either by letter or in this department, each must take his turn.
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(10093) J. O. D. says: Do you publish an Encyclopedia of Receipts and a book on patent laws? A. We recommend and can supply you with the "Scientific American Cyclopedia of Receipts, Notes and Queries," last edition containing 15,000 receipts, 736 pages, cloth bound, price $5: Our "Scientific American Reference Book," price $1.50, gives the patent laws. Always give full name and address when corresponding.

(10094) Constant Reader says: A constant reader wishes to know if bodies drowned in the middle of the ocean will sink to the bottom of the ocean, or remain stationary at a certain depth. You will oblige me greatly by answering these questions in your valuable paper. A. We do not answer unsigned communications as a rule. Always send your name and address. The name will not be published. The probability is that bodies would sink to the bottom, unless it was very deep. The specific gravity of the body is so nearly that of water, that slight water currents might keep it from sinking to the bottom. It would not stay there very long, however, as decomposition would produce gases which would distend the body and lower its specific gravity, and eventually bring it to the top.

(10095) J. G. B. says: I was much interested in your description, a few weeks ago, of the wire-wound gun, and I would like to ask if the exploding gases do not exert the same force between shot and the breech as they do between the sides of the gun; if so, where is the advantage of this form of gun? Or is there any compensating strength given by electric welding or otherwise, to prevent the blowing off of the breech? A. At the moment of explosion, the pressure on the sides of the powder chamber, on the breech and at the base of the shell, is uniform per unit of area. The advantage of the wire-wound system is that the wire possesses a considerably greater tensile strength per square inch of section than the hoops used in the ordinary hooped system of construction, and there is also more certainty as to absence of flaws. Sufficient longitudinal strength has been secured in the latest guns by the use of powerful reinforcing hoops. Electric welding would decrease the strength of the gun if it were applied to the whole mass of wire winding.

(10096) W. V. says: 1. Will you please give a receipt for softening chilled cast iron castings so as to be able to drill or file same easily? A. Chilled cast iron can be drilled by the use of specially-constructed drills, or the chilled part of the casting can be made soft by packing in red hematite in pots or boxes, from which the air is completely excluded, and heating them for a prolonged period. 2. Give a receipt for brazing cast iron. A. With reference to brazing cast iron, we would say that it is difficult for one who has not had a great deal of experience in doing this work to make a satisfactory job. It is necessary to file or grind the ends of the pieces of cast iron, so that they will make a proper scarfed lap-joint. Be sure that the surfaces are perfectly clean and bright. Use powdered resin as a flux and hard solder. When all is in readiness, apply the flux to the joint, put on a few small pieces of the solder and grip the joint tightly with a pair of blacksmith's tongs, the jaws of which have been heated to a bright red heat. The heat in the tongs is sufficient to braze the joint.

(10097) W. A. L. asks: Is there any other metal that can be used in a gravity battery besides zinc that will not dissolve? A. There is no way of obtaining electricity without using up some material. In the dynamo steam or water power is employed. In the battery we usually burn up zinc. It is just as impossible to produce electricity without a disappearance of some other form of energy as it is to heat a house and still have the coal, or cool a refrigerator and still have the ice.

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Railway crossing signal, electric, E. W. Vogel 828,788
Railway, electric, C. J. Kintner 828,322
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Railway rail, A. M. Clark 828,459
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Railway track adjuster, Wieberg & Hausner 828,359
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Railway track construction, street and other, R. D. Culver 828,718
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Rake. See Hay rake.
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Receptacle closing machine, C. H. Burckett 828,381
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ON A CUBAN TOBACCO FARM

$300,000,000 a Year Spent by Americans for Cigars

Every smoker every time he smokes invests an installment on this immense total amount. Is this $300,000,000 spent with the proper degree of care for the value received?

The "chance-may-offer"—"hope-I'm-lucky" manner of buying cigars has in the past been largely due to the absence of any reliable standard of cigar values. Until recently all but the highest priced cigars had always been sold without any definite assurance as to their quality or value and in nearly every case the responsibility of the retail dealer for the cigars he sold has been very undependable.

The smoker of medium priced cigars has been at the mercy of thousands of brand names, plenty of them merely stock labels that left room for plain robbery. Cigars worth $10 to $15 a 1000 have sold for 5c. each—generally to the manufacturer's profit. The dealer has been deceived fully as much as the public.

Five years ago the dealer could offer the public no definite reliable assurance of the quality of the cigars he sold—and the smokers of medium-priced cigars could not prevent these impositions.

To-day conditions are changed. In the past few years cigar quality has been immeasurably improved—and the new standard of quality—*real, tangible* cigar value—is distinguished by a simple mark—the "A" (Triangle A) mark of merit.

The American Cigar Company follows a certain well-defined policy to support a certain well-defined theory. That theory is, that the surest foundation for a permanent business success is square dealing with both the trade and the public.

This policy has been consistently and conscientiously followed as a fundamental principle and every effort made toward improving cigar quality and lowering cigar cost to the public.

The "Triangle A" Merit Mark — *Insures Honest Cigar Values*

HOW YOU CAN GET HONEST VALUE FOR EVERY CENT YOU SPEND

The American Cigar Company claims your patronage entirely on the merit that is in the cigars which it manufactures. It offers *better* cigar values than are obtained from any other manufacturer on the Continent.

The American Cigar Company produces a great many classes of cigars, of characteristics varied to suit every whim and variety of public taste. No one brand will suit all smokers, nor is any one man sure to be suited with any one brand for any considerable time.

What you want is a guarantee that covers a lot of brands of different characteristics, so that you may make a selection in the comfortable assurance that whatever "A" (Triangle A) brand suits your taste it will be the best value your money can buy, and always uniform in quality as long as you smoke it.

So the American Cigar Company has established a distinctive mark of merit—a reliable standard of cigar qualities—this "A" (Triangle A) mark of merit. Fundamentally this merit mark stands for honest cigar value in whatever cigar you buy, wherever you buy it. The object of the American Cigar Company is to make good cigars and keep them good. We expect the public to buy "A" (Triangle A) brands for one reason only—and that is because they represent the best values and the best quality in the stores.

Among the brands distinguished by the "A" (Triangle A) guarantee of honest cigar values are the following:

The New Cremo (Victorias), Anna Held, George W. Childs (Cabinets), Buck, Spanaflora, Tarita, Stickney's New Tariff, Cubanola. The Continental, Chancellor, Caswell Club. The Unico, Benefactor, Captain Marryat, Roxboro, General Braddock, Orlando. Also the Palma de Cuba and Isle of Pines.

Smoke any one in critical comparison with the best cigar you know at the same price and prove to your own satisfaction that the "A" (Triangle A) merit mark does really mean better cigars for you if you look for it every time you buy.

AMERICAN CIGAR COMPANY, Manufacturer

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Pressure recorders, Bristol Company 55,532
Razors, George Wostenholm & Son 55,379
Razors and pocket knives, A. L. Silberstein 55,299
Roofing, ready felt, National Coal Tar Co.. 55,399
Roofing slates, Old Bangor Slate Co........ 55,510
Rubber heels, Thompson-Ehlers Co........ 55,409
Saws, circular, band, hand, and crosscut, Joshua Oldham & Sons 55,503
Scales, Kimball Brothers Co. 55,543
Scales and appurtenances thereof, weighing, E. and T. Fairbanks and Co........ 55,449
Scissors and shears, E. Krusius 55,375
Shellac substitute, E. Calman & Co. 55,492
Shirt waists and shirt waist suits, ladies', Einstein, Guggenheim & Co. 55,535
Shirts, Cutter & Crossette 55,586
Shirts, certain named, Regent Shirt Company 55,439
Shoes, leather, Heywood Boot & Shoe Co.. 55,309
Shoes, leather, F. Loeser & Co. 55,311
Shoes, leather, canvas, or cloth, Chambersburg Shoe Mfg. Co. 55,476
Silver and plated ware, W. Hutton & Sons. 55,386
Silver tableware, hollow ware, and flat ware, Alvin Mfg. Co. 55,363
Snuff, J. P. Larson 55,545
Soap, William Waltke & Co. 55,474
Soap, Fels & Company 55,478
Soap containing a fine grit, Kleanit Manufacturing Co. 55,458
Soap, fluid, R. Hudnut's Pharmacy 55,573
Soap, laundry, J. G. Haas Soap Co........ 55,457
Sound records, American Record Co. 55,323
Spices and mustard, E. R. Durkee & Co.... 55,448
Spices and mustard, Sprague, Warner & Co.. 55,465
Splints, J. Ellwood Lee Co. 55,538
Starch for food purposes, A. E. Staley.... 55,577
Stoves, ranges, attachments, parts, and repairs, Sill Stove Works 55,408
Syringes, Johnson & Johnson 55,542
Syrup, Sprague, Warner & Co. 55,466
Talking machines and parts thereof, Victor Talking Machine Co. 55,410, 55,443
Tap receptacles, Dale Company 55,262
Thermometers and telethermometers, Bristol Company 55,533
Thread, all kinds of cotton, Clark Thread Co. 55,558
Thread, cotton, Jonas Brook & Bros........ 55,568
Tin and terne plates, Follansbee Brothers Co. 55,450, 55,451
Tires for vehicle wheels, rubber, Electric Rubber Manufacturing Co. 55,346
Tobacco and snuff, smoking and chewing, Bernard Gebruder 55,530
Tobacco, chewing, Ryan-Hampton Tobacco Co. 55,461
Tobacco, smoking and chewing, Herman Rippen 55,576
Tracing cloth, L. & C. Hardtmuth 55,384
Trees, buds, and scions thereof, fruit, Oregon Nursery Co. 55,312
Trusses and supporters, J. Ellwood Lee Co.. 55,540
Typewriter ribbons, DeFi Manufacturing Co. 55,326
Utensils made of enameled metal ware, household, Reed Manufacturing Co..... 55,336
Valves and parts thereof, Star Brass Manufacturing Co. 55,580
Varnishes, japans, liquid fillers, and waterproof finish, Keystone Varnish Co..... 55,505
Varnishes, mixed paints, and enamels, Valentine & Co. 55,526
Violins and parts, bows, strings, and pegs, Buegeleisen & Jacobson 55,368
Vitreous material, slabs or plates of, Pressed Prism Plate Glass Co... 55,437, 55,438
Wall ties, Imperial Specialty Mfg. Co. 55,456
Washboards, Manchester Furniture Co..... 55,571
Washing machines, power operated, P. T. Coffield & Son 55,370
Watches and parts thereof, Dubois Watch Case Co. 55,374
Watches, watchcases, and watch movements, D. Gruen & Sons........ 55,327
Watches, watchcases, and watch movements, Keystone Watch Case Co. 55,389
Whisky, A. Graf Distilling Co........ 55,256
Whisky, Bluthenthal & Bickart 55,260
Whisky, Corning & Co. 55,261
Whisky, Gottschalk Co. 55,266
Whisky, H. J. Lebovitz 55,269
Whisky, Mueller, Wathen & Kobert........ 55,271
Whisky, Severn Liquor Co........ 55,274
Whisky, A. Berkowitz 55,281
Whisky, G. Cohn 55,282
Whisky, H. F. Corbin & Co. 55,283
Whisky, Eminence Distillery Co. 55,284
Whisky, Erdreich Bros. & Marx........ 55,285
Whisky, Friedman, Keiler & Co.... 55,287, 55,288
Whisky, Goodhart Hartman Co. 55,289
Whisky, Herman Popper & Bro........ 55,291
Whisky, Hulman & Co. 55,292
Whisky, W. W. Johnson & Co. 55,293
Whisky, L. Lazarus 55,294
Whisky, R. M. Rose Co. 55,297
Whisky, Showell & Fryer 55,298
Whisky, Standard Distilling Co. 55,300
Whisky, Stone Hill Wine Co. 55,301
Whisky, Union Distilling Co. 55,302
Whisky, H. Rosenheim & Son 55,320
Whisky, Swope & Mangold 55,322
Yeast in solid form, Vienna Pressed Yeast Co. 55,584

LABELS.

"Beeman's Massage Cream and Skin Food," for massage cream and skin food, C. E. Beeman 13,042
"Bestoby," for toilet paper, Scott Paper Co. 13,047
"Broadway Bits," for stogies, J. Fisher .. 13,036
"Campho-Menth Tooth Paste," for tooth paste, W. F. Blocker 13,040
"Fisher's Tiger-Claw Brand," for stogies, J. Fisher 13,035
"Indian Fish Bait Makes All Fish Bite," for fish bait, W. C. Andrews 13,048
"Krieger's Antiseptic Balm," for medicine, Krieger Bros. 13,039
"Krieger's Kascara Kastor-Oils," for medicine, Krieger Bros. 13,038
"Madame Celeste Depilatoire," for hair remover, Collins & Co. 13,041
"Malt-Ease," for malt tonic, Wilmanns Bros. Co. 13,037
"North Star Brand Coats," for working-men's coats, M. J. Collins 13,046
"Sicilia Puro Oliva Oilo," for olive oil, Sicily Pure Olive Oil Co. 13,043
"The Lox Hose Supporter," for hose supporters, A. Frankenstein & Co. 13,045
"White Rose," for bread, H. Woehlick.... 13,044

PRINTS.

"Adler's Nobby Fall and Winter Clothes for 1906-1907," for men's apparel, David Adler & Sons Clothing Co. 1,755
"Doctor's Special," for whisky, A. J. Kitz.. 1,752
"Indian Fish Bait Makes All Fish Bite," for fish bait, W. C. Andrews 1,757
"Man-a-lin The Ideal Laxative," for laxative medicine, Manalin Co. 1,753
"Men's Apparel," for men's apparel, Schloss Bros. & Co. 1,754
"The Merrow Machine Company," for sewing machines and products thereof, Merrow Machine Co. 1,756

A printed copy of the specification and drawing of any patent in the foregoing list, or any patent in print issued since 1863, will be furnished from this office for 10 cents, provided the name and number of the patent desired and the date be given. Address Munn & Co., 361 Broadway, New York.

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