SCIENTIFIC AMERICAN

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THE NICARAGUA CANAL.

The discovery or construction of a route for passengers and merchandise across the American continent is a project of many centuries' standing. As early as 1502 the Central American coast was explored by Columbus in his search for the route to the Indies, for whose discovery his first voyage was undertaken. In 1510 a Spanish colony was founded near Darien, on the shores of the Caribbean Sea. Eleven years later Panama was founded on the shores of the Pacific Ocean, following out Vasco Nunez de Balboa's discovery of the Pacific Ocean in 1513. In 1522 Lake Nicaragua was discovered by Gil Gonzalez Davila. Two years later Francisco Hernandez de Cordova, who had been dispatched by Charles V. on a secret search for the supposed strait which it was supposed must penetrate the isthmus, took possession for the king of Lake Nicaragua. He landed at the Gulf of Nicoya. He here took to pieces one of his vessels, transported it piecemeal overland to Lake Nicaragua, and there reconstructed it. He circumnavigated the lake, found its one outlet, the San Juan River, which he could not descend. In 1523 the same king had enjoined upon Hernando Cortez to search for the "secret of the strait," and Cortez himself was an enthusiastic believer in the probabilities and the possibilities of the strait, and much of his work was devoted to its discovery. At a later date the Cabots and Jacques Cartier sought to penetrate the American continent.

Eventually the hope was pretty well abandoned, as regards a natural waterway. The last survival of this idea is found in the "Northwest Passage," now also relegated to the past. The

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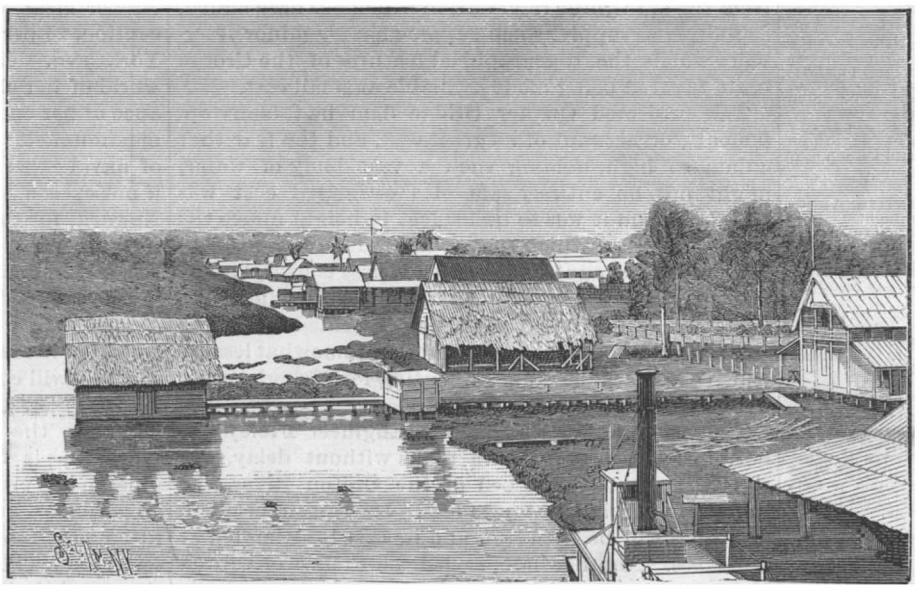
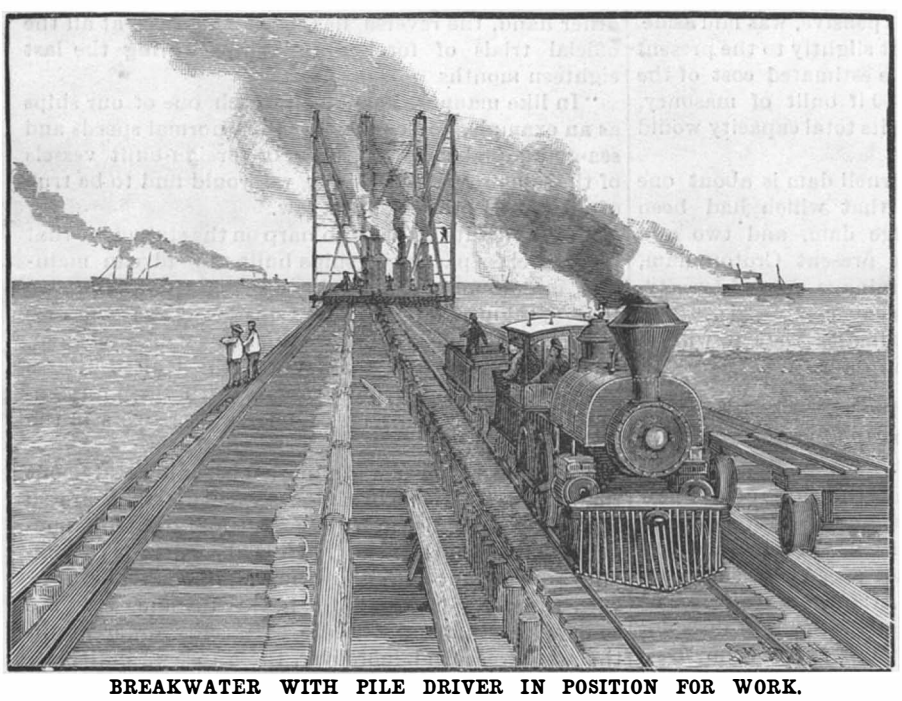
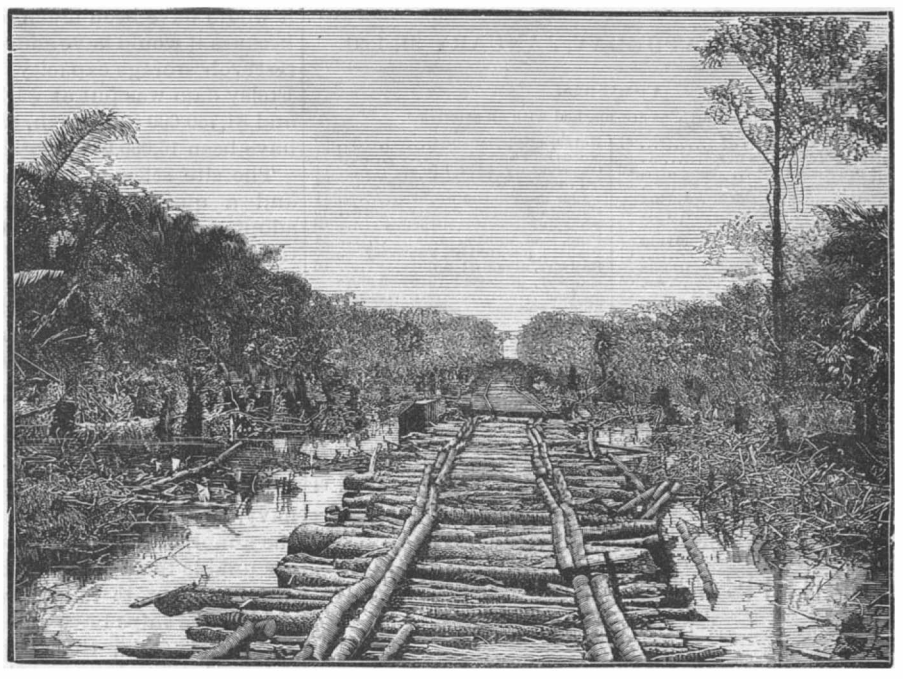


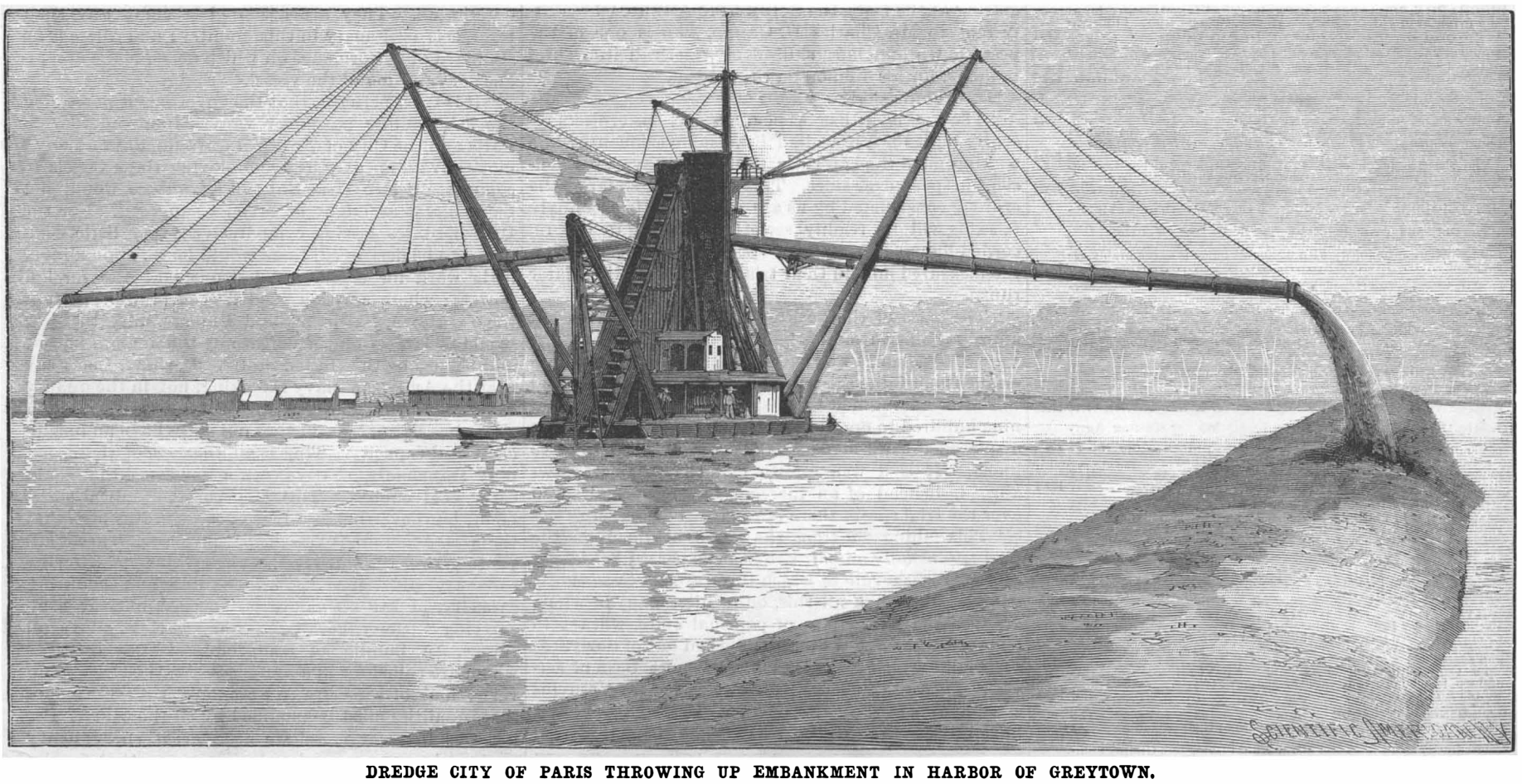
GENERAL VIEW OF GREYTOWN.



BREAKWATER WITH PILE DRIVER IN POSITION FOR WORK.



CONSTRUCTION OF RAILROAD ACROSS SWAMP BACK OF GREYTOWN.



DREDGE CITY OF PARIS THROWING UP EMBANKMENT IN HARBOR OF GREYTOWN.

PROGRESS OF WORK ON THE NICARAGUA CANAL.

Scientific American.

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NEW YORK, SATURDAY, JANUARY 31, 1891.

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(Illustrated articles are marked with an asterisk.)

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SCIENTIFIC AMERICAN SUPPLEMENT

No. 787.

For the Week Ending January 31, 1891.

Price 10 cents. For sale by all newsdealers.

THE NEW YORK WATER SUPPLY—A GREAT DAM DECIDED UPON.

Ever since the water supply of New York City actually commenced to flow through the splendid new aqueduct completed last July, the public interest in the projected great dam, which formed a part of the whole water supply enterprise, has manifested itself in many ways. At the time the aqueduct was decided upon, the plans and specifications were submitted for the immense complementary work since known as the Quaker Bridge dam,* which was to be about four miles below the present Croton dam, and give a total storage capacity of 34,000,000,000 gallons. The great dam, however, has not been commenced, and the water supply coming through the new aqueduct is still obtained from the old Croton reservoir, to which has been added, as sources of supply, some supplementary minor reservoirs which the topographical features of the Croton basin favored being made available at small cost.

The projected Quaker Bridge dam had many opponents, on account of its great cost, and the fear that a dam so high, holding such a vast body of water, might not be entirely safe. Its estimated cost was $4,087,000, and it was to be 180 feet in height above the river bed, below which the foundations would go down 91 feet. On account principally of these considerations the New York Aqueduct commissioners, in whom the necessary authority is vested, have decided upon the construction of a dam designed to be somewhat less expensive and at a location presenting fewer engineering difficulties, at Cornell.

The new dam, for which Chief Engineer Fteley has been instructed to prepare plans without delay, will rise 159 feet above the bed of the Croton River, the foundations going down 70 feet. Its length between flow lines will be 1,736 feet, and its cost is estimated at $3,650,000. Another dam, styled the Fteley, or Croton No. 2, had been projected, to be located about a mile below the present Croton dam, but this plan, although it would have been much less expensive, was laid aside, because it would have added but slightly to the present reservoir storage capacity. The estimated cost of the Fteley dam was put at $2,450,000 if built of masonry, and $1,750,000 if of earth, while its total capacity would have been 16,000,000,000 gallons.

The site selected for the Cornell dam is about one and a quarter miles above that which had been adopted for the Quaker Bridge dam, and two and three-quarters miles below the present Croton dam, and will give an additional drainage area of twenty-one square miles, and a storage capacity of 30,000,000,000 gallons. The engineer estimates that it will require five years to build the new dam.

*For illustration of proposed Quaker Bridge dam, building of new aqueduct, and map and profile of route, see SCIENTIFIC AMERICAN SUPPLEMENT, No. 558.

MR. CRAMP THE SHIPBUILDER, REPLIES TO HIS CRITICS.

The charge is often made that the ships of our new navy, though making fast time under the special and the abnormally favorable conditions of their trial trips, are unable to approach contract speed with such conditions as obtain in ordinary Atlantic weather. The work these ships have done lends color, if it does not actually sustain, the charge. Whether or no these ships, if pressed, can really repeat their initial performances is an interesting one, and, with a view of getting at the facts, the SCIENTIFIC AMERICAN recently sent to Mr. Charles H. Cramp, who is one of the best known and most skillful of American iron shipbuilders, for his opinion on the subject.

Mr. Cramp said:

"The statement has been made that the cruisers recently built for the United States government, while making good time on their trial trips, have been deficient in speed ever since. This statement, so far as the cruisers constructed by us are concerned, is absolutely false, as will be readily seen by referring to the recorded figures showing the speed our vessels made on the measured mile in their trial trips and in their later runs.

"The cases of the Yorktown and the Vesuvius will afford an illustration of the truth of my assertion. The Vesuvius, when submitted to the trial test by the government officials, registered a speed of 20·5 knots; and this after having had her displacement increased from nine hundred to one thousand tons. With her former displacement we made her register a speed of 21·65 knots. It is a well known fact that in most cases abroad, instead of an increase in the normal speed over the trial speed, there is a marked decrease.

"This falling off from the speed attained on the trial trip usually amounts to from 20 per cent to 25 per cent. This is a rule to which there are few exceptions; and yet, in spite of all this, our critics, many of whom are actuated by feelings of personal spite, will try to have it believed that the ships turned out of our yards are found wanting in speed after a short term of service. Look at the foreign-built vessels of the Vesuvius class, known as the Sharpshooter class. These vessels have been trying to reach a speed of 21 knots, forced draught, for nearly two years, without success. As yet they have not succeeded in making over 17 or 18 knots, natural draught. This falling off in speed of the foreign-built vessel is not due to any inefficiency of the officers, but to the fact that the engines of these vessels have not the quality of endurance, a defect which may be ascribed to the absence of good workmanship.

"The cruiser Yorktown, built by us for the United States, is absolutely without a parallel so far as continued excellence of speed is concerned. The officers in charge of this vessel can make her register the speed she reached on her trial trip whenever they desire to do so.

"Compare this with the performance of the corresponding type of foreign-built vessels, known as the Archer class. These vessels are, without a single exception, 25 per cent slower in normal speed than the Yorktown. The Baltimore is the fastest cruiser in the world of her class, and the excellence of the performance of her engines is still maintained even up to their maximum efficiency. And it is the unanimous opinion of naval experts that the Philadelphia will maintain, if not exceed, the speed attained on her trial trip. The Newark, for the weight of her engines, is the best performing vessel of all the large vessels built by us for the government; the speed attained by her on her preliminary trips being greater than any yet attained abroad with a similar weight of engines and displacement. It is the opinion of experienced naval men that she, too, will continue to maintain the speed developed on her trial trips. An important element going to make up the superiority of American over foreign built ships is the excellence of the engines. The engines in the cruisers recently turned over by us to the government are more expensively constructed and fitted out than any engines ever built for a naval vessel abroad. This is true particularly of the boilers. Of the vessels built by us for the United States, there has not been a single instance of defective boiler. On the other hand, the reverse has been the case at all the official trials of foreign-built ships during the last eighteen months.

"In like manner, I could cite each one of our ships as an example, and comparing their normal speeds and sea-going qualities with those of foreign-built vessels of the same respective classes, we would find to be true of all what I have said of a few.

"These astute critics also harp on the statement that the first-class passenger ships built abroad can maintain, and do maintain, a rate of speed almost equal to that developed on the trial trips. They cite figures which they allege go to prove this statement, and then, for a climax, they ask what vessel the United States now possesses that could compete with these foreign-built passenger ships as commerce destroyers in the event of a war.

"Well, there never was a more misleading statement than that. It is one of those statements that are so hard to handle, because they take for granted something which does not exist. How absurd it is to compare an elephant with a greyhound, or a naval cruiser with a passenger ship! So in this instance they are comparing things which are essentially different in their nature. And, moreover, these foreign-built passenger ships have no trial record from which to fall short of, and no 'contract standard' from which to deteriorate. They are accepted without any such tests as is customary in this country; and there is no standard of performance on which depends the acceptance or rejection of the vessel.

"It is true, perhaps, that the government possessing the swift-sailing passenger vessels, like the City of Paris and the City of New York, would have an enormous advantage over us by employing these vessels as commerce destroyers. But this advantage would not be so great as might at first be supposed. For the United States having comparatively very little commerce to be destroyed, there would be correspondingly little work for commerce destroyers of the foreign powers; whereas with a good fleet of cruisers, such as the Yorktown, Baltimore and Philadelphia, the war would be largely one of defense by the foreign power, and offense by the United States. In short, I may say that the American navy is lacking, not in the quality of its vessels, but in the quantity.

"It has been also said that our ships have an insufficient coal capacity. That is another one of those slippery statements. I never saw a war vessel that could carry coal enough. This is, perhaps, a radical statement, but nevertheless a true one. And it is here that the armed merchant vessel will have such a great advantage over the war vessel, in its greater coal-carrying capacity, and hence its swift-sailing and enduring capacity. I say no war vessel has a sufficient coal-carrying capacity, because a war vessel is, above all things, 'a bundle of compromises.' The qualities which are called for in a first-class war vessel are so diverse, and of a nature so antagonistic, that each of these qualities must be modified by all the others. For instance, in a war vessel we need great speed, heavy engines, heavy guns and enduring power, that is ability to maintain the maximum rate of speed. But to secure great speed, the models must be fine and en-

gines heavy, and hence the ship cannot be given such a large coal-carrying capacity.

"Another difficulty under which our navy is laboring is the lack of good sailors to man the vessels and operate the complicated machinery and apparatus. A few of our American sailors, it is true, are highly efficient, but we have not enough men capable of properly handling a modern ship. This, however, is a question of administration, and the defect will, without doubt, soon be remedied.

"The proposition to keep the engines in good condition and up to their maximum efficiency by employing the vessels in carying the mails, or in some similar work, is highly impracticable. In the first place, a cruiser is made to cruise, not to carry freight or passengers other than the crew, but to act in the event of war as a commerce destroyer, combining the quality of speed and a gun-carrying capacity. Now, to employ a cruiser for any such purpose as the one mentioned would be entirely subversive of the very end in view. It would result, not in the improvement of men or machinery, but in great detriment to the engines and apparatus. The simile comparing the proposed plan with putting a race horse through his paces is a faulty one. There can be no comparison between a living being and a machine. The former has the power of recuperation. It repairs itself automatically. The engine has not this power, and for every pound of work performed it is less efficient than before. So the cases are essentially different. With one the product is exercise, with the other it is wear and tear.

"In all the discussion concerning naval matters in general, and armed cruisers in particular, there is, I think, too much importance given to high speed as a factor. Now, if we bear in mind what I have said, that a war vessel is a bundle of compromises, and also the fact that the commerce of the world is carried in slow-going ships, it will be seen that continuous high speed is not the all-important factor in the construction of commerce destroyers."

POSITION OF THE PLANETS IN FEBRUARY.

JUPITER

is evening star until the 13th, and then becomes morning star. He comes to the front on the February annals, for an important epoch in his course takes place. This is his conjunction with the sun, on the 13th, at 10 h. 5 m. A.M. He is then in line with the sun and earth, the sun being in the middle, is at his greatest distance from the earth, and, passing beyond the sun, appears on the sun's western side, to commence his role of morning star. The giant planet is conspicuous by his absence from the sky during the month, for he is so near the sun as to be hidden in his light.

The new moon, when only three hours old, is in conjunction with Jupiter on the 9th, at 0 h. 32 m. A. M., being 4° 12′ south.

The right ascension of Jupiter on the 1st is 21 h. 38 m., his declination is 14° 59′ south, his diameter is 31″.4, and he is in the constellation Capricornus.

Jupiter sets on the 1st at 5 h. 54 m. P. M. On the 28th he rises at 6 h. 10 m. A. M.

VENUS

is morning star. She reaches her greatest western elongation on the 13th, at 3 h. 40 m. P. M., and is 46° 51′ west of the sun. She then takes on a beautiful form, that of the moon in quadrature. Before western elongation her form is that of a crescent, after western elongation she becomes gibbous. Her decreasing size and brilliancy and her approach to the sun after elongation are worthy of note for observers who are up betimes to behold this peerless star, a glorious object in the morning sky during the month. The western elongation of Venus occurs about five hours after the conjunction of Jupiter with the sun, and as soon as Jupiter is far enough from the sun to be visible there will be two bright morning stars approaching each other.

The waning moon, about three days before her change, is in conjunction with Venus on the 5th, at 0 h. 34 m. P. M., being 5° 27′ south.

The right ascension of Venus on the 1st is 17 h. 48 m., her declination is 19° 19′ south, her diameter is 28″.8, and she is in the constellation Sagittarius.

Venus rises on the 1st at 4 h. 4 m. A. M. On the 28th she rises at 4 h. 13 m. A. M.

SATURN

is morning star. His role in this character is nearly completed, for when the month closes he rises only a few minutes after sunset. He is, however, on the western side of the sun, and, according to astronomical classification, is ranked as morning star. He shines in the eastern sky, early in the evening, as a conspicuous star, southeast of Regulus, his close companion during the last year, but now far removed.

The moon, the day after the full, is in conjunction with Saturn, on the 24th, at 7 h. A. M., being 3° 4′ north.

The right ascension of Saturn on the 1st is 11 h. 12 m., his declination is 7° 27′ north, his diameter is 18″.4, and he is in the constellation Leo.

Saturn rises on the 1st at 7 h. 54 m. P. M. On the 28th he rises at 5 h. 58 m. P. M.

MARS

is evening star. There is nothing new or interesting in his course as he makes his way toward the sun, and increases his distance from the earth, but, indifferent to terrestrial observation, he plods on in his appointed course, and little heeds the sensation he may create when he returns to our nearest neighborhood in 1892.

The moon is in conjunction with Mars on the 12th, at 5 h. 46 m. A. M., being 4° 38′ south.

The right ascension of Mars on the 1st is 0 h. 17 m., his declination is 1° 34′ north, his diameter is 5″.6, and he is in the constellation Pisces.

Mars sets on the first at 9 h. 33 m. P. M. On the 28th he sets at 9 h. 28 m. P. M.

MERCURY

is morning star. He reaches his greatest western elongation on the 6th, at 4 h. 48 m. A. M., and is 25° 40′ west of the sun. He is then, and for a few days before and after, visible to the naked eye, but is not in favorable condition for observation on account of his southern declination.

The right ascension of Mercury on the 1st is 19 h. 18 m., his declination is 20° 55′ south, his diameter is 7″.2, and he is in the constellation Sagittarius.

Mercury rises on the 1st at 5 h. 42 m. A. M. On the 28th he rises at 6 h. 1 m. A. M.

NEPTUNE

is evening star. He is in quadrature with the sun on the 22d at 5 h. P. M., is then 90° east of the sun, and is on the meridian at sunset.

The right ascension of Neptune on the 1st is 4 h. 9 m., his declination is 19° 22′ north, his diameter is 2″.6, and he is in the constellation Taurus.

Neptune sets on the 1st at 2 h. 28 m. A. M. On the 28th he sets at 0 h. 42 m. A. M.

URANUS

is morning star. His right ascension on the 1st is 13 h. 58 m., his declination is 11° 27′ south, his diameter is 3″.6, and he is in the constellation Virgo.

Uranus rises on the 1st at 11 h. 45 m. P. M. On the 28th he rises at 9 h. 58 m. P. M.

Mercury, Jupiter, Venus, Uranus, and Saturn are morning stars at the close of the month. Mars and Uranus are evening stars.

Tricks of the Imagination.

BY H. C. HOVEY.

The delusions and hallucinations of insanity have been remarked upon by all writers on mental derangement. But my intention now is to give a few authentic cases where the excited imagination of people with seemingly sound brains has played them singular tricks.

A report has gone the rounds to the effect that a certain lady residing in Bridgeport, Conn., called her physician in mortal agony because she had, as she supposed, swallowed her false teeth. She could feel them far down in her throat and was actually choking to death. Eminent doctors consulted and agreed to resort to tracheotomy, to which they were about to proceed when one of them happened to step on some object under the edge of the bed, which on examination proved to be the missing molars. As soon as they were exhibited to the patient her convulsions ceased, and she recovered her normal condition. Sifting the facts from the sensational accompaniments, there remains the delusion as to the teeth, the calling for medical aid, and the finding of the teeth before the doctor arrived on the scene. But even thus modified the case was quite remarkable. It suggests instances of somewhat the same nature.

During the war an officer had to send a messenger across an opening where the bullets were flying dangerously. He selected a very brave men and cautioned him as to his peril, telling him to ride for his life on reaching the open field. The officer watched him through his field glass, saw him fling himself behind the flank of his horse for safety, and finally saw him drop from the steed as if mortally wounded. A second man was sent safely on the same errand, while the wounded soldier was cared for. He had merely fainted. On coming to he found the surgeon at work over him, and anxiously inquired as to the precise nature of the wound. He was told by the surgeon that he had been squarely hit, and that the injured part could never be made whole again. "But rest easy," said the doctor, "for the shot only took effect—in the *canteen!* " The man had not been injured in the least, but had been deceived by the flowing of the contents of his cherished canteen, which under the circumstances he naturally mistook for his heart's blood. The soldier is living yet to laugh over his ludicrous mishap.

As names are not mentioned, I may be pardoned for narrating an incident in the experience of an evangelist of renown, and as remarkable for his common sense as for his piety. He came to a sudden pause in an impassioned discourse to fully 5,000 people. As I happened to be near him, he beckoned to me to accompany him to a private room, while the choir should entertain the astonished audience during the interim. My clerical friend solemnly assured me that he was about to die, and that sensations of mingled pain and rapture had seized him such as he had never felt before, and that convinced him that his time had come to depart. With some difficulty he was led to submit to an examination, when it appeared that a vial of aconite which, for some reason, he carried in an inner pocket, had been broken by one of his more vigorous gestures, and the pungent contents flowing over his chest had caused the peculiar burning sensations described. After a process of sponging the saint decided to tarry among sinners for a while longer, and resumed without special explanation his interrupted sermon.

A gentleman who is now the admired editor of a popular scientific magazine was some years ago made the victim of a practical joke that narrowly escaped a serious termination. He entered a room where some of his jovial friends were having good cheer. Being himself, at that period of his life, of a convivial turn, he readily joined his comrades in cracking a fresh bottle. Presently one of them anxiously looked at the label, that had been modified for the occasion, and exclaimed that they had been drinking poison. The visitor grew alarmed, manifested dangerous symptoms, took to his bed, and his comrades themselves becoming frightened, sent in haste for a physician, whom it took a long while to satisfy his imaginative patient that he was not perishing from a deadly potion.

An eminent New York physician, who was fond of experimenting, told a friend that he had compounded some wonderful pills, a single one of which would cause certain described symptoms. His friend volunteered to take one. The symptoms followed exactly as foretold; but the pill was afterward noticed in the tangles of a very full beard, not having been swallowed at all. The doctor's faith in the potency of his pills was such as to make him think that their mere proximity to the mouth might prove to be efficacious. But we bystanders attributed the unquestioned symptoms to the influence of an excited imagination over the physical condition.

To the foregoing authentic instances now first published might be added a long list of recorded cases with every variety of delusional fancies, the victims being of sound mind and in ordinary health. These phenomena cannot be classed as morbid, nor can they readily be explained by hypnotism. But they certainly have a value in the delicate task of determining the significance of bodily symptoms. They teach that acute pain, great discomfort, deadly wounds, and also the beneficent effects of curative medicines may be simulated by experiences that in reality are purely mental. To make light of such ills would be cruel. To treat them physically would seem to be absurd. Their remedy, like their cause, must be mental. Herein is the secret of the "bread pill" system. A sidelight is also thrown upon the marvels of faith cures, mesmeric healing, mind cure, and, if we may say so, of so-called Christian Science itself. And spurning quackery and imposture, there certainly is room, in a wise and sensible system of healing, for an agency known to have such amazing power as the imagination.

A caution is also in order of an educational sort. Constant appeals are being made to the imaginations of children, some of which may be temporarily beneficial, but most of which are harmful first or last. The bold climber is warned that he will fall; and giddiness follows, provoking the very evil shunned. Shout to the careless swimmer that he is beyond his depth and cannot possibly reach the shore, and he may fancy that his case is really desperate and be drowned, when considerate encouragement would have strengthened him to gain the strand. Cram a young mind with a horror of mad dogs, and in later years nervous symptoms may follow the bite of a non-rabid animal almost as serious as hydrophobia itself. The physical effects of pernicious literature are deplorable, as well as the depravation of morals. In short, the imagination is not to be trifled with. Its wonderful power should be used only for good. Thus used, it is the handmaid of science and of virtue, the helpful servant of the healing art, and the fountain of happiness. A clean, sound, wholesome imagination, as contrasted in its effects with one that is foul, depraved, and disordered, is probably what the wise man had in mind in saying, ages ago, "Keep thine heart with all diligence, for out of it are the issues of life."

Agricultural Electricity.

M. Comille Gonzy, the proprietor of numerous small farms in the commune of Millas (Western Pyrenees), having an area altogether of nearly 1,500 acres, has, for some time past, been utilizing a neighboring stream for electric lighting purposes. He has now applied electric power to the working of a wine-crushing plant. Besides providing the power for lifting and driving purposes, electricity is made to work the pumps for irrigating the vines. The 180 16-candle power lamps employed are distributed over all the farms, and the area which they cover may be judged from the fact that the length of telephone wire connecting the buildings is 62 miles.

THE UNICYCLE ELEVATED RAILWAY.

One of the most interesting features of the recent electrical exhibition at St. Louis was a model truck of the National Unicycle Elevated Railway Company's system. The model seated two persons and ran on a short elevated track. Fig. 1 shows the construction of the track. One main rail and two guide rails are used, the main rail being supported by posts and uprights. Side braces, curved at the lower end, are bolted to the main rails, the guide rail resting in the curved part of the brace and held in position by bolts.

In Fig. 2 is shown the truck, the main wheel being grooved and resting on the main rail. Iron cross bars support four smaller wheels, also grooved, which fit the guide rails and hold the truck to the track. Friction rollers, resting on springs, are placed between the truck and the car bottom, enabling the car to take a very short curve easily. The inventors claim that double the highest speed known may be made on this road with safety.

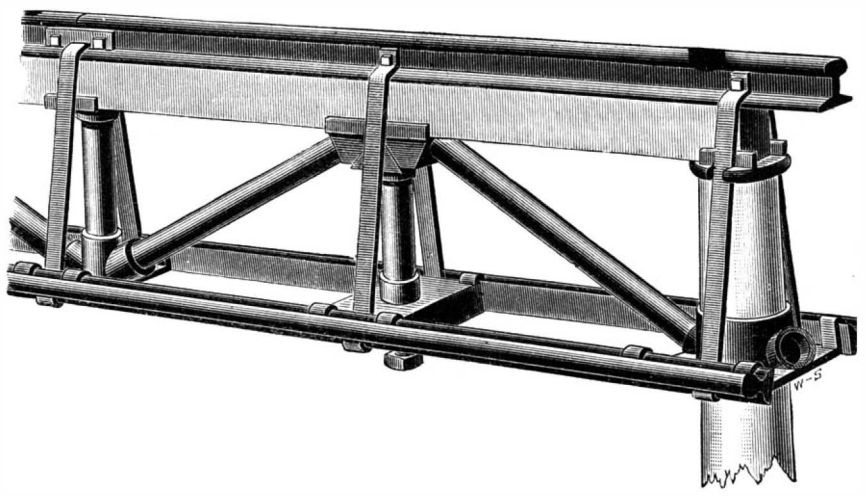


Fig. 1.—UNICYCLE RAILWAY TRACK.

Foreign Exhibits at the World's Fair.

The Secretary of the Treasury has issued a circular to customs officers regarding the free entry of articles for exhibition at the World's Columbian Exposition to be held in Chicago in 1893. Congress passed an act last April that all articles imported for the sole purpose of exhibition should be admitted free of duty, customs, fees, or charges, and if sold during or after the exposition, or withdrawn for consumption in the country, should be subject to the duty.

The regulation of the Treasury Department is that invoices shall be made in triplicate, and one copy forwarded to the Collector of Customs for the port at which it is intended such articles shall enter the United States, one copy to the Collector of Customs for the port of Chicago, and one copy to the consignee. The shipper of such goods may declare to the invoice as the agent of the exhibit, and the invoice shall be authenticated by one of the commissioners for the exhibition, appointed by the government of the country from which the goods are exported, or by a United States consul, at the election of the party declaring to such invoice. Articles intended for exhibition which are government property, used solely for government purposes and not intended for sale in this country, will be admitted to entry upon a certificate to that effect by the commissioner for the international exhibition of the government to which such property belongs.

All packages containing such articles must be plainly addressed to the Collector of Customs, Chicago, U. S. A., and conspicuously marked, "Exhibits for the World's Columbian Exposition," and also bear the names and addresses of the shipper and consignee and appropriate invoice marks and numbers. Upon arrival of articles for such exposition, entry thereof may be made by the consignee or agent thereof, for immediate transportation without appraisement at Chicago. Upon arrival of the articles at Chicago, the conductor or agent of the railroad company will present the manifest to the customs officer, who shall compare the same with the copy received by mail, and superintend the opening of the cars, taking care to identify the packages by marks and numbers as described in the manifest. In case of the non-receipt of the manifest, the unloading of the cars shall not for that reason be delayed, but the invoice will be used to identify the packages. When such articles arrive at Chicago by vessel direct from a foreign country, a special entry for warehouse may be made, and special permit issued for the transfer of the articles to the exposition buildings. The packages will be retained by the customs officers unopened until special entry for warehouse is made by the owner, consignee, or agent authorized to make entry, but no warehousing bond will be required. The appraiser will be furnished with the invoice of the articles to be appraised, and will indorse his report in like manner as if such article were regularly entered for consumption or warehouse. The entry will then be liquidated, the full amount of duties ascertained, and the whole transaction entered upon a record to be kept in the form of a special warehouse ledger. The articles may then be exhibited, but will remain under the custody of the customs officers, and will not be removed without a permit. Nothing can be removed from the building unless the same shall have been regularly entered for withdrawal for consumption, warehouse, or export. In case of exportation of such articles, existing regulations requiring exports to be made in original packages will be waived. The special forms of entries, permits, manifests, and records to be used under these regulations will be prepared and furnished by the Treasury Department. Show cases will be admitted free, but, if sold, will become subject to duty. It is not contemplated that duties shall be levied except on goods which have actually entered into consumption in this country.

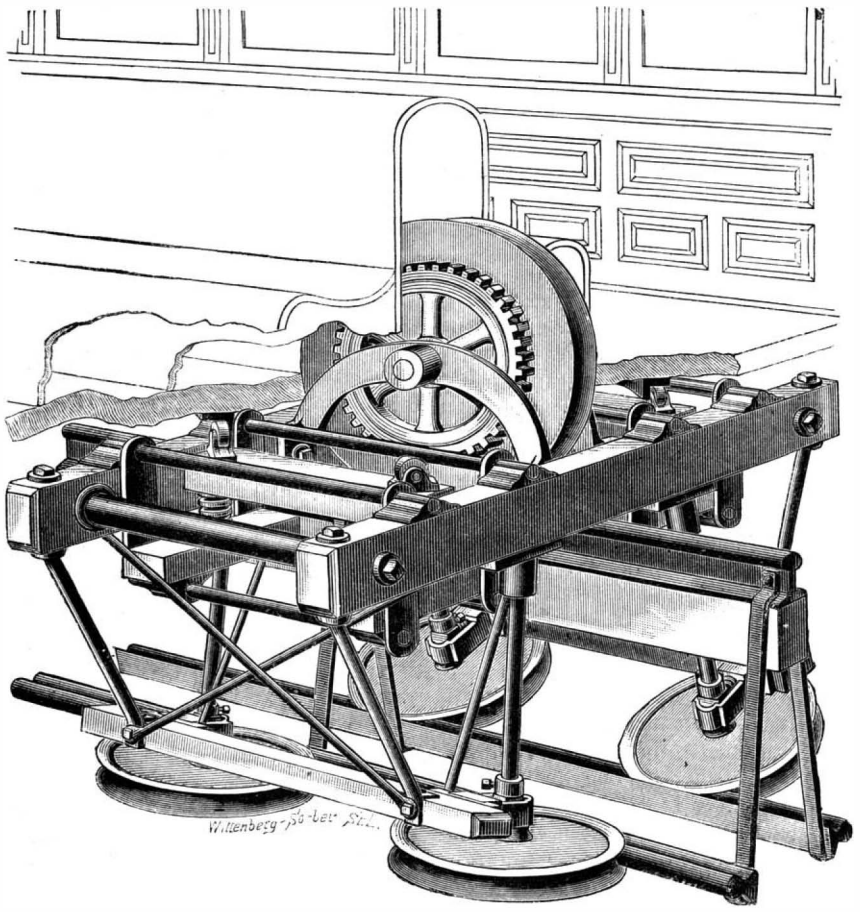


Fig. 2.—UNICYCLE RAILWAY TRUCK.

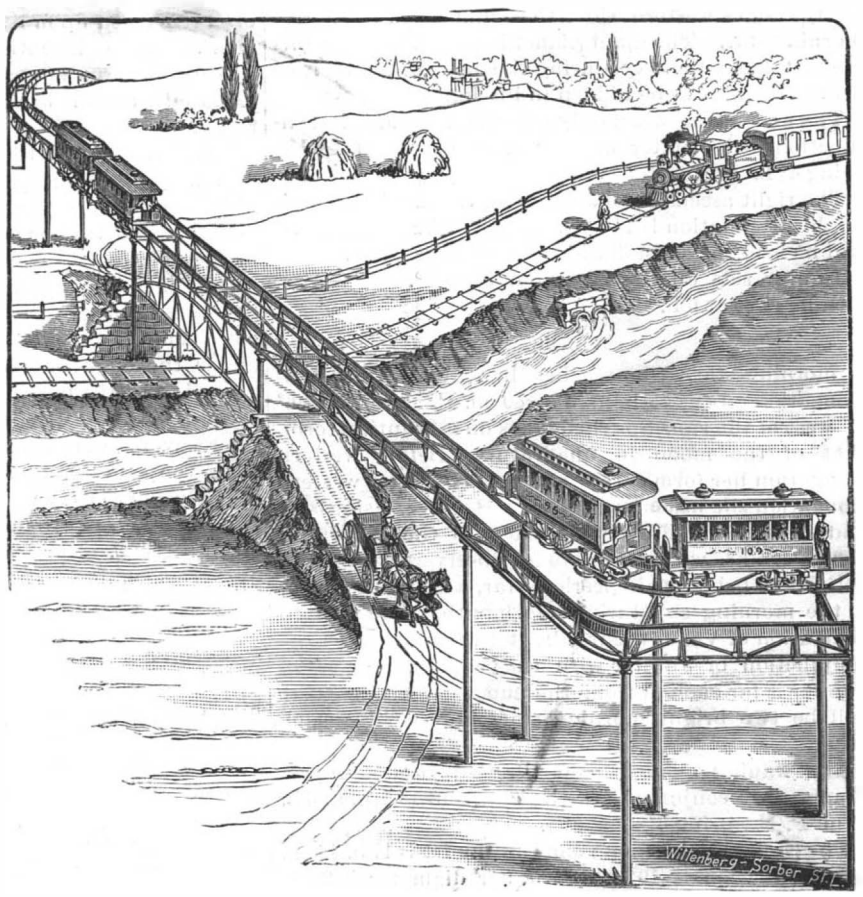


Fig. 3.—VIEW OF UNICYCLE RAILWAY.

STATISTICS collected abroad show that for short distances, as 1,000 yards, wire cables furnish the most efficient means of transmitting power, but for greater distances, as 5,000 yards, electricity is by far the least wasteful of all methods.

Wonders of the Oil Regions.

A dispatch from Grafton, West Va., January 20, says the people along Buffalo Creek and the Monongahela River, between Mannington and Uppington, were treated to a magnificent conflagration last night. The great pipe of the Eureka Oil Field Company broke where it crosses Buffalo Creek, and for hours the oil flowed into the river unnoticed. The stream is high and the current swift, and by the time the break was discovered and stopped, the creek and river for twenty miles were covered with oil. After dark some one fired the oil, and in an incredibly short time the streams were on fire for twenty miles. The flames seemed to touch the very skies, and the mountains on each side glowed like burnished gold in the magnificent light. Every object for miles was visible, and distant houses stood out like a mirage.

At the point where the creek and river meet, the sight was indescribably grand, and the flames rolled up against the hills in enormous clouds of light that showed the landscape as far away as Fairmouth. The skies seemed a vast mirror, which reflected the landscape for miles, and Uppington, twenty miles away, could be seen across hills a thousand feet higher than the town itself.

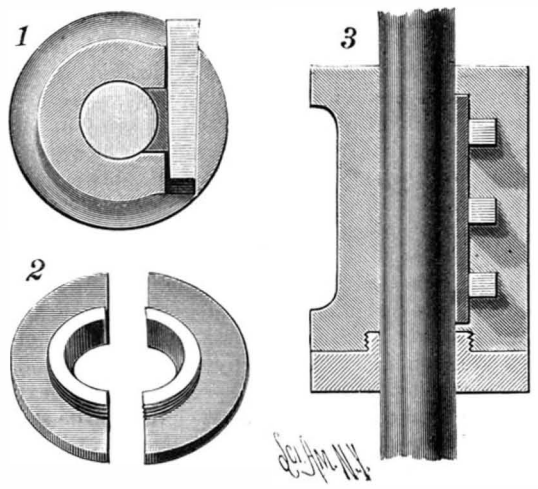
The reflection of the conflagration was seen fifty miles away. The heat was something awful, and thousands of trees were killed and fine bridges burned, including the great iron bridge at Pine Grove. The fire burned the greater part of the night. Hundreds of fences caught fire. The inhabitants of the country for miles remained up all night, and say it was the greatest fire America ever saw.—In Lawrence County, Ala., recent borings have been successful, and oil in paying quantities, it is believed, has made its appearance.

Sault Ste. Marie.

A company is organized for utilizing the enormous water power of Lake Superior and constructing very extensive works in the vicinity of Sault Ste. Marie. The waters of Lake Superior fall at the Sault about 30 feet to the level of Lake Huron, the velocity being recorded by Gen. Powell of the United States service as a little more than 90,000 cubic feet a second. Careful and accurate measurements and calculations show the actual velocity and volume of water to be 122,000 feet per second, equivalent to 236,000 horse power. This company intend to build a tail race five miles long on the Canadian side and a canal five miles long on the American side. These canals will be each 1,000 feet wide, the widest in the world. They will construct large dry docks on both sides, to be filled and emptied by gravitation. On the Canadian side all the principal works will be above the rapids, and on the American side below the rapids. Blast furnaces and shipyards, and it is expected paper mills, pulp mills, flour mills and other industries, will be established, whose motive power will be supplied by this company or by one of the several subsidiary companies which it is expected will be formed.

AN IMPROVED TAPPET.

A tappet which is simple and durable in construction, and permits of quickly removing a worn-out face and inserting a new one, is shown in the accompanying illustration, and has been patented by Mr. Walter N. Nolan, of El Oro, Tultenango, Mexico. The body of the tappet is preferably keyed to the stem, as shown in Fig. 3, and in the sectional view, Fig. 1, and on its under side is screwed a face made in ring shape and



NOLAN'S TAPPET.

formed of two or more sections. On the face is a hub, as shown in Fig. 2, with a thread adapted to screw into a corresponding thread on the under side of the tappet body. The thread on the latter is arranged in the direction of the travel of the cam, so that an accidental unscrewing of the face is impossible. When the face is worn out, it is easily unscrewed and a new face screwed on in its place. Old tappets may be thus faced up and fitted with rings, thereby saving expense, and the faces when adjusted form a smooth and level surface for the cams to operate on.

Dry Battery.

The mixture for filling dry cells prepared by Mr. A. V. Meserole consists of the following solid ingredients in the form of powder: Charcoal, 3 parts; mineral carbon or graphite, 1 part; peroxide of manganese, 3 parts; lime hydrate, 1 part; white arsenic (oxide), 1 part; and a mixture of glucose and dextrine or starch, 1 part; all by weight. These are intimately mixed dry and then worked into a paste of proper consistency with a fluid solution composed of equal parts of a saturated solution of chloride of ammonium and chloride of sodium in water, to which is added one tenth volume of a solution of bichloride mercury and an equal volume of hydrochloric acid. The fluid is added gradually and the mass well worked up.

HOW HERON SOLVED IT.

Said Ctesibius to his pupil: "Heron, will you have a glass of soda?"

"I don't care if I do," said Heron.

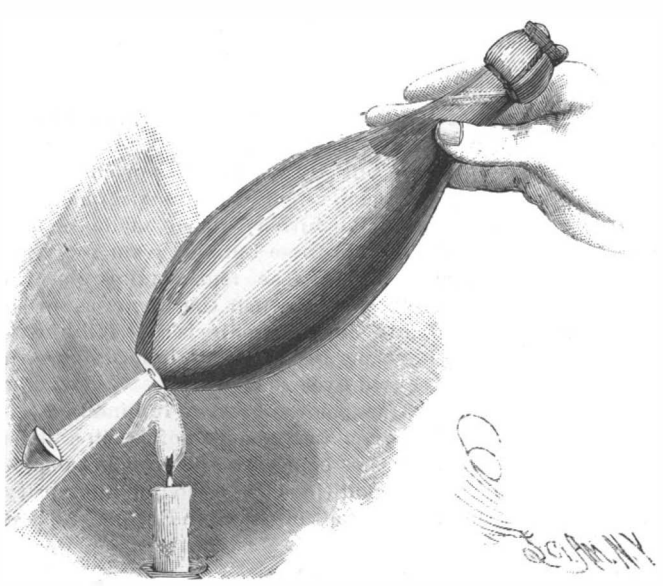
Whereupon Ctesibius produced a quaint glass bottle, having a thick conical bottom, and containing a liquid said to be soda water.

"Heron, my boy," said he, "here is your soda; drink it without removing or perforating the cork or breaking the neck of the bottle."

Heron scratched his head, and revolving the bottle in his hand, while the problem was going through a similar evolution in his brain, said: "As you well know, dear teacher, I am up in mathematics, proficient in mechanics, and not behind the age in pneumatics and hydraulics, but for this problem I have no solution."

"Heat! Unequal expansion!" said Ctesibius, impatiently.

Heron, being an apt scholar, needed no further hint. Lighting a candle, he held it under the thick conical end of the bottle, and in less than a minute by the clepsydra, the bottom of the bottle cracked around, the pressure from within blew out the detached piece, and the soda was discharged with a fizz into the tumbler. The rest goes without saying.



DRAWING SODA WITHOUT REMOVING THE CORK OR BREAKING THE NECK OF THE BOTTLE.

The New York Belting and Packing Company.

This well known concern has obtained an English incorporation under the English companies acts, 1862 to 1890, as manufacturers of India rubber goods. They have been established 44 years, and their works or processes have several times been illustrated and described in the SCIENTIFIC AMERICAN. The new organization places them in a position of a stock company, open for subscriptions here and abroad. The subscription lists are in the hands of August Belmont & Co., of this city, and Lee, Higginson & Co., of Boston, Mass. A rate of profit continually increasing is shown for several years; for the five months ending May 31, 1890, the rate exceeded $500,000 per annum. For plant and goods on hand a price of $2,813,000 (£580,000) is asked. The capitalization includes first mortgage bonds $1,091,250 (£225,000), ordinary stock $970,000 (£200,000), preferred stock $1,091,250 (£225,000), and founders' shares $4,850 (£1,000). The preferred stock is entitled to 8 per cent preference of dividends, the ordinary stock to any further dividends up to 12 per cent, the bonds are issued at 6 per cent interest. The balance of profits after providing for a reserve fund and sinking fund go half to the ordinary and half to the founders' shares.

Synthesis of Ammonia.

It was demonstrated long ago, by Bunsen and Playfair, that when charcoal and potassium carbonate are heated to redness in an atmosphere of nitrogen, a certain quantity of cyanide of potassium is formed. Since that time Margueritte and Sourdeval have further shown that barium carbonate may be used instead of the potash, and that the barium cyanide produced may be again decomposed by steam into ammonia and barium carbonate. Theoretically, these reactions afford a continuous process for the conversion of atmospheric nitrogen into ammonia—a process which, if it could only be worked on a large scale commercially, would doubtless be of immense value. Unfortunately, only small proportions of the substances employed appear to enter into the reaction at ordinary pressures, hence the yield is insufficient to render the process economical. Professor Hempel has now shown by means of a simple pressure apparatus that the reaction is very much more complete, and, when potash is used, very energetic, under a pressure attaining sixty atmospheres. His apparatus consists of a solid steel cylinder closed at one end, and stopped with a screw at the other. A connection is made by a pipe from a pressure pump, and a carbon electrode also enters, and is plunged into a mixture of carbon and the alkaline oxide or carbonate. The electrode is made red hot, and nitrogen is forced in until the desired pressure is obtained. This process is not, of course, commercial, but it indicates an advance in the actual synthesis of ammonia compounds.

The Proposed Three Americas Railway.

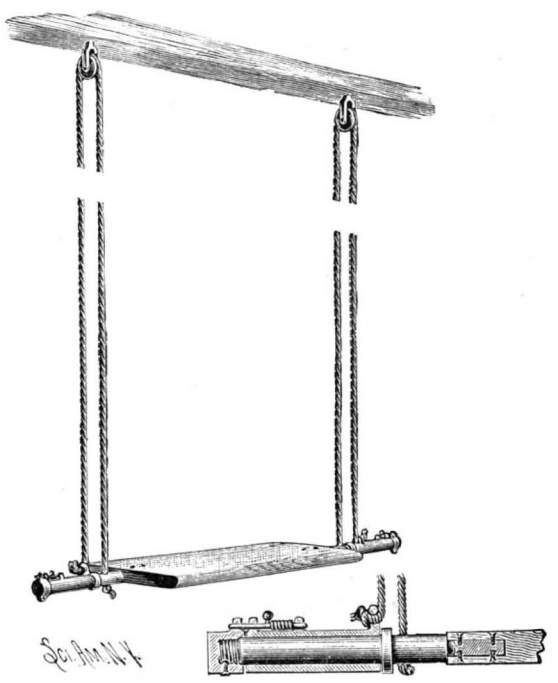
The grand scheme of a continuous intercontinental railway line connecting the countries of North, Central, and South America, which has been occasionally suggested for years past, only to be received by people generally as the dream of enthusiasts and not entitled to serious consideration, has within the last year or so assumed the aspect of a practicable and desirable enterprise of great magnitude, indorsed by the government of all the nations along the proposed route and already about to undergo the inspection of engineering science in order to obtain the necessary data for further action. The international American conference in session in Washington last year, representing eighteen different American governments, passed formal resolutions in favor of the construction of a railway connecting the nations represented, and recommending that each of the governments contribute a share toward the expense of preliminary surveys of the proposed line. The report of the conference on this subject was transmitted to Congress by President Harrison. Thus officially and favorably brought to the attention of the governments and people of the chain of nations along the American continent, the grand idea of an intercontinental railway has excited great and growing interest, and information in regard to it is eagerly received. It is required to build 4,300 miles.

The distance from New York to Buenos Ayres by land is about 9,000 miles. More than half of this distance is already covered by railways, and lines aggregating nearly 2,000 miles more are now being surveyed and constructed; so that the undetermined and doubtful portion of the great intercontinental railway seems to be reduced to something like 2,300 miles. As to the real practicability, from both an engineering and financial standpoint, of building such a line nothing can yet be said with positiveness, and the report of the corps of engineers which the different governments will unite in sending out must be awaited. At the best, its construction would mean a prodigious outpouring of money. One rough estimate suggests $300,000,000, or $75,000 per mile. How can the money be provided? Would the railway, if built, ever pay any return on the vast cost, bearing in mind the severe competition of the water routes? These are questions which may tend somewhat to check the enthusiasm which the thought of so wonderful a possible journey as one of 9,000 miles and more unbroken over American soil, through almost a score of nations, tends to inspire.—*Railway Age.*

A SWING READILY ADJUSTABLE FOR HEIGHT.

The illustration shows a swing which may be quickly altered as to its height to adapt the seat board to the use of adults or children. The swing has doubled ropes on each side passed over pendent pulley brackets, as shown, or ring eyes may be substituted for the brackets. To each end of the seat board is secured a short shaft, as shown in the sectional view, a sleeve being loosely held on each shaft, a short distance from the seat board, a collar on the shaft limiting the inward movement of the sleeve. One end of each rope is passed through the shaft, and secured in position by knotting the end, while the other end, the rope being passed over the pulley, is similarly secured to an ear on the sleeve. In ears projecting from the opposite end of each sleeve is a spring-pressed slide bolt adapted to engage lugs on cap nuts at the outer end of each shaft, and, in adjusting the height of the seat, these slide bolts are retracted, permitting the seat to be revolved, when the rope ends attached to the shaft are wound thereon, thus shortening the suspending ropes and raising the seat, which is lowered by reversing this operation.

Further information relative to this invention may



MILLER'S ADJUSTABLE SWING.

be obtained by addressing the patentee thereof, Mr. William K. Miller, Troy, Kansas.

Carbonic Acid in the Air during Fogs.

It is recorded in a local newspaper that recently, on the occasion of a particularly dense fog in Dundee and its neighborhood, a chemist attached to the University College took the opportunity of investigating the amount of carbonic acid in the atmosphere within the college grounds. The test was taken at 8 A. M., when the fog appeared to be at its thickest. At this time the proportion of carbonic acid in the air was 8 volumes in 10,000, or more than double the normal amount in the locality. It is remarked in the report of this experiment that, although the air in fog has often been analyzed before, the circumstance of the high proportion of carbonic acid present in the atmosphere under such conditions appears to be of peculiar interest, and the question is asked whether attention has been called to it. To this, says the *Journal of Gas Lighting*, the answer must be in the affirmative. If the air of a dense fog in Dundee only contains the stated maximum of carbonic acid, the people of this locality are very much better off than those condemned to breathe fogs in London or Manchester, where the maximum of the noxious gas named is at such times much higher. For the rest, an excess of carbonic acid is to be expected under the circumstances, from the stagnation of the air, which hinders the dispersion of the products of combustion and animal respiration.

A PHOTOGRAPHIC study of stellar spectra has been commenced at South Kensington under the direction of Prof. Lockyer, and one of the first results obtained was the discovery that α Lyrae is a binary star of the β Aurigae type.

Curative Use of Charcoal.

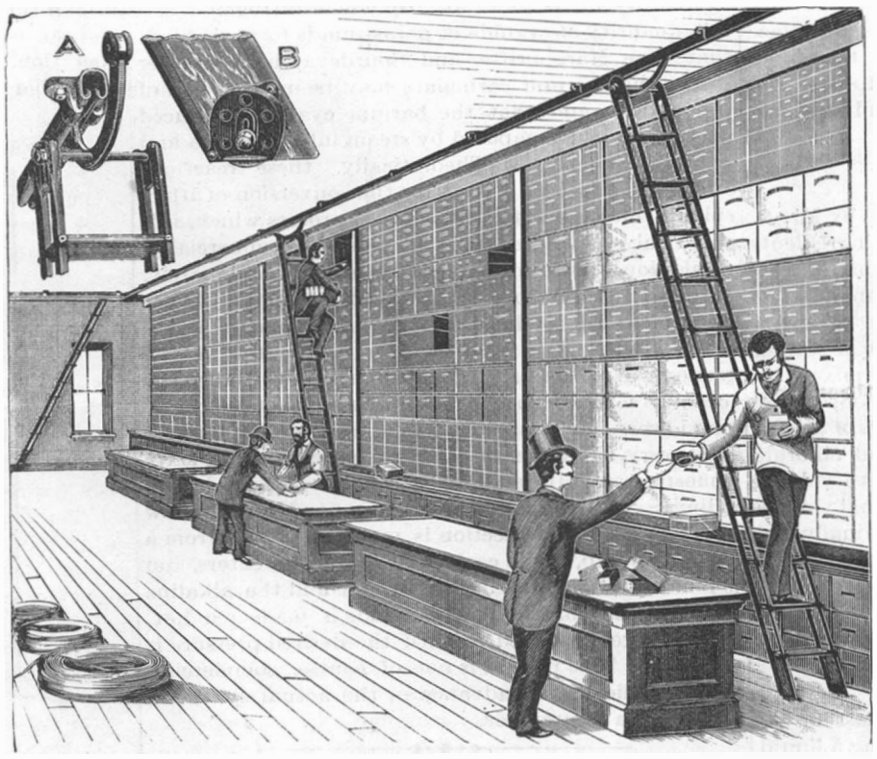
The Boston *Journal of Commerce* discourses thus on the uses of charcoal: Besides being valuable as fuel, it has other uses which make it one of the most serviceable of articles. When laid flat, while cold, on a burn, it causes the pain to abate; by leaving it on for an hour, the burn seems almost healed when the wound is superficial. Tainted meat surrounded with it is sweetened. Strewn over heaps of decomposed pelts or over dead animals, charcoal prevents unpleasant odors. Foul water is purified by it. It is a great disinfectant, and sweetens offensive air if placed in shallow trays around apartments. It is so very porous that it absorbs and condenses gases rapidly. One cubic inch of fresh charcoal will absorb nearly one hundred inches of gaseous ammonia. Charcoal forms an excellent poultice for malignant wounds and sores. In cases of what is called proud flesh it is invaluable. It gives no disagreeable odor, corrodes no metal, hurts no texture, injures no color, is a simple and safe sweetener and disinfectant. A teaspoonful of charcoal in half a glass of water often relieves sick headache. It absorbs the gases and relieves the distended stomach, pressing against the nerves which extend from the stomach to the head.

Headache Caused by Eyeache.

Eye strain should be the first throught suggested by any complaint of headache, says an intelligent writer in the *Times and Register*, for in our day and civilization it is by far the most common cause of that symptom. It enters as a factor into the causation of nearly all headaches not due to pyrexia, toxæmia or diseases of the brain or its membranes. The simple existence of headache, therefore, should suggest eye strain, but frequently a careful inquiry as to the manner and time of occurrence of the attack and the location of the severest pain will be almost conclusive as to the origin of the trouble. Often it comes on whenever the eyes are used, and is absent when the eyes have had a proper season of rest. The occasions of most severe requirement in the direction of eye work are the doing of anything requiring accurate near vision, taxing both the accommodation and the convergence, or traveling, shopping, attending at public gatherings, which entail more use of the eyes than the patient is at the time conscious of, and often under unfavorable conditions. In hyperopia in young people, the accommodation is in excessive use so long as the eyes are open and the attention fixed on any visible object, and hyperopia is the most common cause of constant headache. The writer was formerly subject to a constant headache whenever confined to the house, and regarded it as caused by breathing vitiated air, until it was quite cured by the correction of his hyperopic astigmatism. Many persons have the same idea as to the causation of the headaches they always experience when attending the theater or other places of public amusement, and which are really due to eye strain. Others ascribe these headaches, and those experienced in traveling and shopping, to exhaustion. This is nearer the truth, only they commonly have in mind a condition of general exhaustion, whereas it is largely one of local exhaustion of the special nervous apparatus concerned in the act of seeing. Congestion, irritability, or inflammation of the eyes and their appendages should always suggest the suspicion of eye strain. A single attack or manifestation of this kind has no special significance, but repeated attacks of inflammation, or prolonged congestion, or irritability are exceedingly suggestive of a continuing cause, and the most common of these is the one now under discussion. No case of chronic inflammation of the margins of the lids, or of recurring conjunctivitis, or repeated sties, has justice done to it until it has been carefully investigated for eye strain. Persons at the period when they begin to feel the effects of the loss of accommodation in presbyopia or absolute hyperopia suffer from repeated attacks of conjunctivitis, which they commonly ascribe to "taking cold in the eye," but which are cut short by use of the appropriate lenses, and which, if unchecked, would tend to establish a chronic catarrhal condition, which is a chief discomfort in the lives of many people. I should like, also, adds the editor of the *Times and Register*, in a recent issue, to call attention to car sickness in connection with eye strain. I have had eight or nine cases of this kind, all of which were relieved by glasses. One case was that of a gentleman who on every journey had car sickness. While he had the mydriatic in his eyes he went to Washington, and suffered no inconvenience whatever. Subsequently, after he had glasses, he made a trip to St. Paul without any of the former trouble. Recently I have had two cases—one that of a girl who could not ride a short distance in the street cars without vomiting. I found a decided degree of hyperopic astigmatism. With the mydriatic in her eyes she rode home without her usual trouble. A strange thing with reference to eye strain is that it often exists to an exceptional degree without showing any symptoms in the eye. The patient will often say that the eyes are perfectly good and have never caused any irritation. The reflexes seem to have settled in some other place. This is an interesting pathological and physiological question. Another writer says: "Sleep, if taken at the right moment, will prevent an attack of nervous headache. If the subjects of such headache will watch the symptoms of its coming, they can notice that it begins with a feeling of weariness or heaviness. This is the time that a sleep of an hour, or even two, as nature guides, will effectually prevent the headache. If not taken just then it will be too late, for after the attack is fairly under way it is impossible to get sleep till far into the night, perhaps. It is so common in these days for doctors to forbid having their patients waked to take medicine if they are asleep when the hour comes round, that the people have learned the lesson pretty well, and they generally know that sleep is better for the sick than medicine. But it is not so well known that sleep is a wonderful preventive of disease—better than tonic regulators and stimulants." Now if this scientific writer had only given us an infallible recipe for inducing this much desired sleep, what a boon he would have conferred on suffering millions!

A DEVICE FOR REACHING HIGH SHELVING.

A convenient manner of arranging a rolling step ladder, whereby high shelving is made accessible, is shown in the accompanying illustration. Attached to the steps at the top is a trolley having two small wheels adapted to run in a track secured to ceiling strips, as shown at A, the steps resting on the floor on rollers, whereby they may be easily propelled either way by one using them without coming down to the floor. The steps thus arranged are at the same distance from the shelves at both top and bottom, and can be raised from the floor and carried over obstacles when desired. The track is made in sections which can be easily put up by any one, and all the appliances for this patent store-step service are made by the Coburn Trolley Track Manufacturing Co., of Worcester, Mass. For further information and catalogue address A. L. D. Buxton, treasurer, Worcester, Mass.



THE COBURN TROLLEY TRACK FOR STEP LADDERS.

Natural History Notes.

Function of Tannin in Plants.—Dr. K. Bauer (in *Oesterr. Bot. Zeitsch.*) describes in detail the mode of occurrence of tannin in the following plants, chiefly in leaves, stem, root, and rhizome: *Iris pseudacorus*, *I. sibirica*, *Marica northiana*, *Ficus elastica*, *Ficus australis*, *Cyperus papyrus*, *Saururus cernuus*. It may occur either in the ordinary cells of the tissue or in specially formed cells—idioblasts. In the former case, it is often accompanied with starch or chlorophyl; in the latter case, it is always the sole content of the cell. As for the function of the tannin, it is clear that, in many cases, especially when stored up in the testa of the seeds, it serves to protect the part against the attacks of animals, and also as an antiseptic agent. The immense quantities in which it is stored up in the rhizome of *Iris pseudacorus* and *sibirica*, and especially in the spots where adventitious roots are about to be formed, appears to indicate that it is, at least in these cases, something more than a mere product of excretion, and is used up again in the process of metastasis.

Change of Flowers to Tubers.—Mr. C. A. Barber, in the *Annals of Botany*, describes a plant of *Nymphæa lotus* which shows great abnormality in the formation of its flowers. While the first formed flower buds were developing into the normal flowers, a further and very large development of buds took place; and these buds, which were of slow growth, were found to be curiously deformed. The sepals, which appeared as usual, were not followed in due course by petals and stamens, but were found to enfold a number of green leaves, with occasional buds in their axils, separated from one another, and almost concealed from view by a dense mass of long white hairs. This formation of foliage, instead of floral leaves, accompanied as it was with a swelling of the end of the axis of the flower, may be briefly described by saying that tubers were developed instead of flowers. The author characterizes the deformity as a case of chloranthy.

Sense of Smell in Star Fishes.—Mr. Pronho has made a number of experiments with one of the star fishes—*Asterias glacialis*. Some of these have shown him that when the animal is excited by a desire for food, the sensations which it obeys are perceived by the extremity of the arms; but others show that it is the sense of smell and not of sight that guides it to its food. The tentacles near the eye-like spot, which are useless for locomotion, were removed from a star fish, which, for a month or more afterward, never showed the least excitement in the presence of either living or dead food; the retention of the ocular spot makes no difference. It is clear, then, that the sense of smell is not diffused in star fishes, but is localized in the ambulacral tubes, which are unsuitable for locomotion, and are situated behind the eye spot.

Production of Spines in Dry Air.—In the *Bull. Soc. Bot. de France*, M. Lathelier gives the results of some experiments made to ascertain the conditions under which thorns and spines are produced. He grew young plants of *Berberis* and *Cratægus* in dry air and in moist air under otherwise similar conditions. He found that dry air, which retards the development of the soft tissues, promotes the growth of the hard tissues of which spines and thorns are formed.

Phosphorescent Centipedes.—That there are luminous myriopods has been known for many years, as also the fact that they occur only among the family *Geophilidæ* of the chilopod myriopoda. Both sexes are luminous, sometimes quite intensely so, and the luminosity spreads out over the whole ventral surface of the animal. If one of these geophilids is taken up, the luminous matter communicates to the hand of the observer, or to anything else with which the specimen comes into contact.

There is considerable dispute regarding the origin of this phosphorescent matter. According to Dr. R. Dubois, it is contained in the epithelial cell of the digestive tube, and the emission of the light depends on the moulting of the digestive tube. Mr. Mace, on the contrary, contends that the luminous matter is a glandular excretion, and that these glands (*glandes preanales*) are situated on the last two segments of the animal. Mr. J. Gazagnaire has satisfied himself that the luminous matter is secreted from glands situated on the sternal and episternal plates. Upon pressure these glands excrete a yellowish, viscous substance, having a peculiar odor, and which is highly phosphorescent.

In a more recent article (*Mem. de la Soc. Zool. de France*, v. iii., 1890, pp. 136–146), Mr. Gazagnaire reviews all previous observations on luminous geophilids, and finds that, so far as the European fauna is concerned, luminous specimens were found only between the end of September and beginning of November. The luminosity appears, therefore, only at a certain epoch in the life history of these myriopods. Further, in all more carefully recorded cases, luminous specimens were never found singly, but always in pairs or companies of three or more specimens. The few and fragmentary observations that have hitherto been made on the mode of reproduction in these animals seem to prove that the fecundation of the female takes place in autumn, or just at the time when the luminous specimens are found, and Mr. Gazagnaire is thus fully justified in connecting the appearance of luminosity with the excitement caused by sexual instinct.

In Algiers, Mr. Gazagnaire observed luminous specimens of *Orya barbarica* in the month of April, and he concludes that in other countries and in consequence of altered climatic conditions the period of luminosity probably differs from that observed in Europe.—*Insect Life.*

A TORPEDO net constructed of interlocking steel rings is soon to be put to a practical test.

Correspondence.

Ginseng.

To the Editor of the Scientific American:

In the SCIENTIFIC AMERICAN of January 10, 1891, appeared a very interesting article on the "ginseng" root. The article I shall copy for my paper, as several thousand pounds of the root are dug and sold every season in this vicinity, and it will, of course, be of interest. Will you kindly answer the following questions through your valuable paper:

Is the steaming process spoken of in the article for bleaching the root done before or after the root is dry?

Do exporters ship by way of New York and London or San Francisco?

Is the imperial tax spoken of an "import tax," and if so, what is this duty per "picul"?

L. C. SHUSSAR.

Office of the Mancelona *Herald*,
Mancelona, Mich., Jan. 13, 1891.

Consul Nicolas Pike, to whom we submitted our correspondent's letter, answers as follows:

In reply to the first question, I would inform you that the steaming of the ginseng root is done immediately after it is dug and washed. This makes it more transparent, and it will bring a higher price in the market.

All ginseng raised in this country is sold direct to brokers, who make it a special business. They sell it to Chinese merchants here, who also make a special business of ginseng and other roots. It is shipped by them to China, by way of San Francisco.

The imperial tax is only on ginseng grown in the Chinese empire. There is no import tax on foreign ginseng.

How Steam Boilers Furnish Water Instead of Steam.

To the Editor of the Scientific American:

The following theory accounting for the fact that water is frequently drawn from steam boilers to the engines feeding from them, and sometimes in sufficient quantities to wreck the latter, I believe is new, and it appears to me plausible. If it is unsound I hope you, or some of your readers, will show wherein is the flaw.

Air or water, in moving from all sides toward a common center at which it escapes, does not move in direct lines, but approaches the center in spiral currents, the velocity of which will be proportional to the speed at which the fluid escapes at the center.

Let the water from a bucket or basin escape through a hole, at or near the center of the bottom, and the water in the vessel will form in a whirling current around a vertical line above the outlet. If the water escapes through a pipe, so that there will be a downward suction, the velocity of the whirling current will be increased. A storm center or area of low barometric pressure is another illustration. Toward such an area all of the air currents influenced by it will move, the same as water in a maelstrom moves toward the center. Now the question is, Will not steam in escaping from a boiler directly upward into dome or steam pipe act in the same manner as water does in escaping from a bucket or basin, as referred to in illustration, or as air does in moving toward a storm center? and in this connection it should be remembered that a storm center is a point where the air is escaping upward, and that it is the escaping air which causes the outside air to move toward, and in so doing around the storm center, just the same as the water escaping from the basin causes the water in the basin to form in a whirling current around the outlet.

It is well known that in the center of a whirling current the fluid, owing to centrifugal force, is rarefied, and the degree of rarefaction depends entirely upon the velocity of the whirling current; for this reason a whirlwind of sufficient velocity passing over water causes a waterspout. Now if the steam escaping from a boiler in the usual manner causes the steam in the boiler and in a small area below the outlet to form in a whirling current, the velocity of which will increase as that of the escaping current increases, what is to prevent a waterspout in the boiler and a wrecked engine as the result whenever the escaping steam reaches a sufficient velocity? And to prevent the escaping steam from attaining such a velocity, is the pipe connecting engine with boiler always of a sufficient area?

WARD STONE.

[This is probably the true theory of the lifting of water in boilers having small steam room, in which the lifting of water has suggested the use of dry pipes and domes.—EDITOR.]

The Belt Problem.

To the Editor of the Scientific American:

Your correspondent Quirk questions the correctness of the reason I gave for the creeping of the belts in his "Belt Problem," and cites as proof some tests he made and illustrated in your issue of Dec. 20, 1890.

Now, I must take exception to those tests, from the fact that no belts work under the conditions shown. In order to get correct results from belt tests, the belts should be placed in actual working conditions. It is well, also, to remember that different conditions very materially affect the results.

For instance, it makes quite a difference what size of pulleys are used to get at what your correspondent is driving at, for this reason: We will say a belt is working on a pulley 6 inches diameter, engaging 9 inches of its circumference, and is ¼ inch thick. Then the outer surface of that 9 inches of belt is ¾ inch longer than the inner. But if the pulley is five times as large, engaging 45 inches of its circumference, the expansion of the outer surface of the belt will be just the same—¾ inch. From this it is evident the ¾ inch expansion over 45 inches of belt will not affect its operation near so much as it would over 9 inches. That there is a tendency in leather belts to expand and contract more on the hair than on the flesh side I know, but the effect must decrease as the size of the pulleys increases.

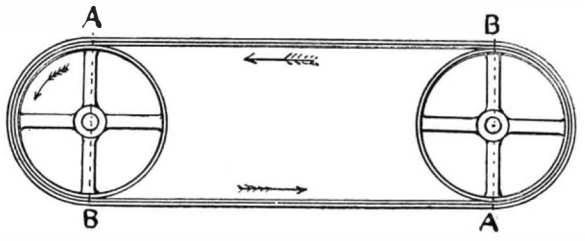
It appears to me, from your correspondent's articles, he is looking for the force which pulled the rivets through his belts in some creeping action of the belts while in contact with the pulleys. I cannot see anything in that, but can in the stretch of belt between the two pulleys, because it is there the outside belt gains on the inside one, and the gain is in the same ratio as circumference is to diameter. J. A. LOUGH.

Chetopa, Kansas.

THE BELT PROBLEM.

To the Editor of the Scientific American:

I would like to offer a solution to the belt problem, page 213 of SCIENTIFIC AMERICAN, Oct. 4, 1890, and will begin by answering Quirk's last question first. By referring to the drawing, A and A are the points at which



the belts change their course from a straight line to that of a curve, and B and B is where they resume a straight course again. Now it is quite evident that the outside belt will have to travel farther in going from A to B than the inside one will, and has to do it in the same period of time; therefore it has to travel at a higher rate of speed than the inside belt. Although the outside belt travels at a higher rate of speed, it does not gain a particle on the inside one while going from A to B, because it is describing a larger circle and has to go farther; but in going from B to A, where the belts have a straight course, the outside one, having a greater speed, gains on the inside one until they reach the next curve, where they travel together again until another straight course is reached, when the outside one will gain again, and so on.

I think that all belts, whether single or double, have this same tendency to a more or less degree, according to their thickness, as the outside surface of any belt must have to travel farther in going round a pulley than the inside surface does; but in the case of a single belt, or of a double one glued and riveted so that this gaining or creeping cannot take place, the difference traveled by the two surfaces in going round a pulley is met by either a stretching of the outside surface or a compression of the inside surface, or both, which must absorb power. It is certain, however, that Quirk's belts preferred to creep, or his rivets would not have drawn out. The rivets offered a direct resistance to the motion of the belts. L. H. L.

Contest between a Spider and a Beetle.

To the Editor of the Scientific American:

An article in a recent number of the SCIENTIFIC AMERICAN, describing a "Remarkable Engineering Feat of a Spider," reminds me of a no less remarkable exploit of a tiny spider, which I witnessed, in which the insect's ingenuity in improvising a hoisting tackle gave him the victory.

Potato beetles were very numerous last summer, and were often seen crawling about on fences and buildings. One of these, climbing up on the inside of a wood shed, came in contact with a spider's web stretched across the corner of the building. The watchful spider came out at once and endeavored to entangle him. The propensity of these beetles for "playing 'possum" in time of danger is well known. In this case the insect did not drop to the ground, as they are wont to do when potato vines are disturbed. He held fast to the board with his claws, but drew down his head and antennæ, and remained motionless. The spider, which was a very small one, ran about over the big beetle's oval back, like a cat on a barrel, winding his threads rapidly around his captive until he seemed satisfied, and retired to await results.

The beetle, finding himself left alone, woke up, and tried to move off. Lifting one foot at a time, he succeeded in breaking the cords which bound each one. Then tugging forward with his shoulders, like an ox drawing a heavy load, he had nearly freed himself when the little spider again advanced to the attack, winding his threads with astonishing rapidity.

The beetle now seemed to realize that the "'possum" act was not the best thing for that particular emergency, and struggled harder than ever to get away. The spider, also, seemed to understand that something different would have to be done or he would lose his prize, for the threads were snapping as fast as he could wind them. He paused a moment, and I thought he had given up the contest. But I greatly underestimated the resources of the little giant. He was only *thinking!* He saw wherein the beetle had the advantage of him, and devised a scheme to overcome that advantage. The problem was to get his big antagonist off the board into the middle of the web—not an easy matter one would think, considering the relative size of the two insects. But the plan was made and executed with a rapidity that puts to shame our sluggish human thoughts and actions. The beetle was in the edge of the web, about two inches from the corner of the building. Fastening a thread to the beetle's back, the spider ran across the corner and made it fast to the wall on the opposite side of the web, in such a position that it tended to lift the beetle off his feet. Repeating the operation again and again, he soon had a number of threads stretched across the angle, all drawn as tightly as possible.

As this work proceeded, the beetle soon found himself obliged to cease his struggles and use all his strength in holding on. The spider again retiring, "Old Line Back" tried once more to move off, but at the first step he was jerked entirely off his feet by the elasticity of the threads, and left dangling in the air. In this situation he was easily wound up and dispatched by his smart little enemy.

Columbus, Ohio. CHARLES B. PALMER.

Miscellaneous Notes.

At Lynn, Mass., the electric lighting station caught fire, and the wires carrying the current were burnt off. Relieved of the work of producing the current, the 700 horse power engine started off at such a rate of speed that the flywheel broke in fragments, causing much damage to the building. In the settlement of the loss an interesting point was brought out. The company claims that the bursting of the large flywheel was due primarily to the fire, and, therefore, entitles the company to the insurance money. The insurance company, however, assumes that the breaking of the flywheel was due to defect in the machinery. Consequently the company is not responsible for the loss.

In 1778 a great chain was stretched across the Hudson River at West Point to prevent the passage of British vessels. Lossing, in his "Field Book of the Revolution," gives a very interesting account of this work, of which we can quote only the leading facts. The iron of which this chain was constructed was wrought from ore of equal parts from the Sterling and Long mines, in Orange County. The chain was manufactured by Peter Townsend, of Chester, at the Sterling Iron Works, in the same county, which were situated about 25 miles back of West Point. "It is buoyed up," says Dr. Thacher, writing in 1780, "by very large logs, about 16 feet long, pointed at the ends, to lessen their opposition to the force of the current at flood and ebb tides. The logs were placed at short distances from each other, the chain carried over them and made fast to each by staples. There are also a number of anchors dropped at proper distances, with cables made fast to the chain to give it greater stability." The total weight of this chain was 180 tons. Mr. Lossing visited West Point in 1848 and saw a portion of this famous chain, and he tells us that "there are 12 links, two clevises, and a portion of a link remaining. The links, some of which are in the museum at West Point, are made of iron bars, 2½ inches square, and average in length a little over 2 feet and weigh about 100 pounds each."

A new rolling mill in the Krupp Works at Essen, Germany, is probably larger than any other in the world. It will roll plate about 28 inches thick and nearly 12 feet wide. The rolls are of steel. Each pair in their rough state weighed 100,000 pounds.

10,250,000 tons is the grand total of the production of pig iron in the United States for the year 1890, an increase of 1,750,000, or more than 20 per cent over the product of 1889, which was 8,516,079, an increase of 1,247,572 tons over 1888, or 17 per cent. The production in 1890 was more than 40 per cent greater than that in 1888.

The production of steel ingots in the year 1890 was 4,900,000 net tons, and of steel rails 2,200,000 net tons.

The production of copper in the United States in 1890 amounted to 278,610,000 pounds, far exceeding any previous record.

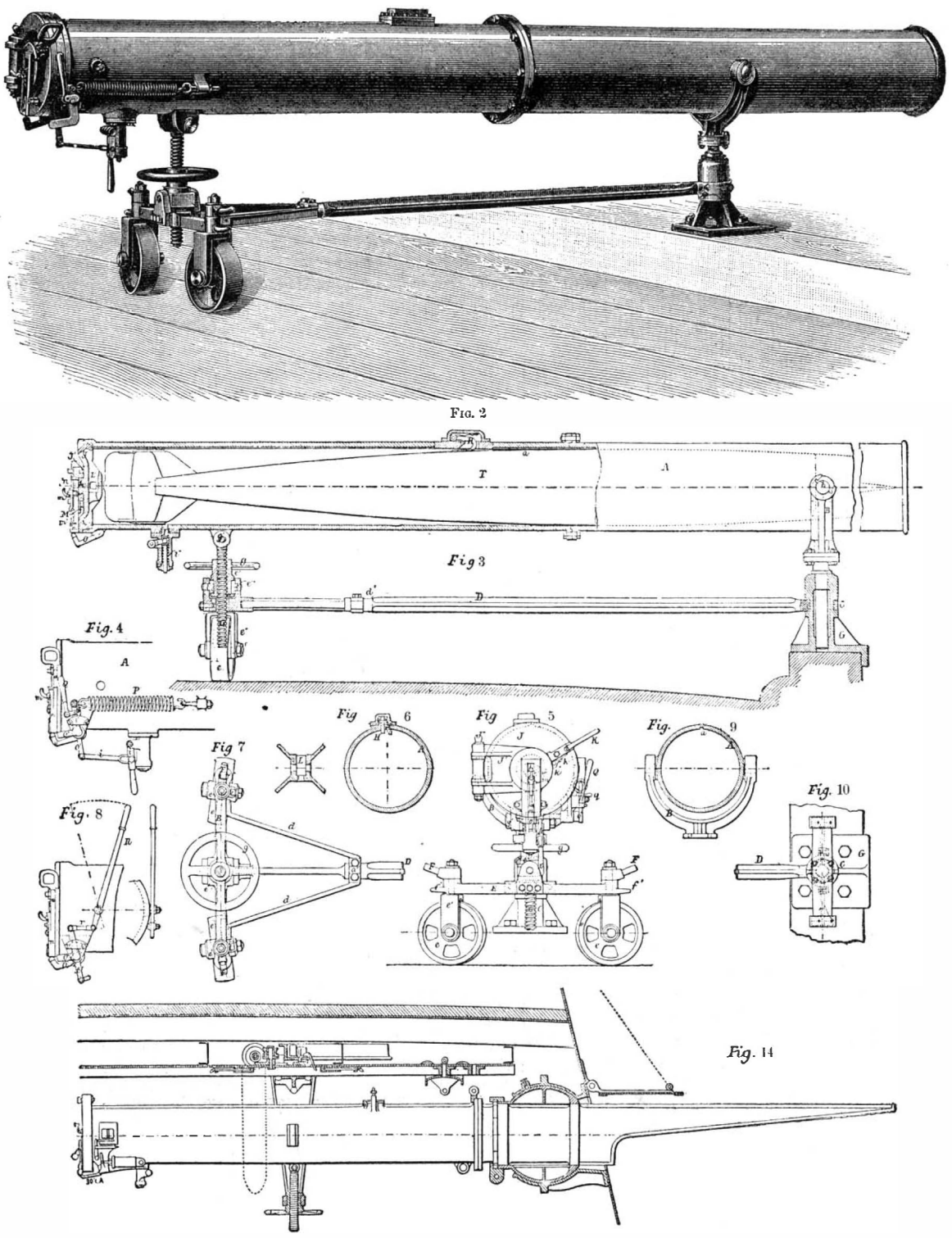
Lead in the United States amounted to 187,000 tons of 2,000 pounds, or a little less than in 1880.

Of spelter 68,000 tons were produced in the United States in 1890, an increase of 15 per cent.

Forty-three vessels were built last year in San Francisco, of which 17 were schooners, 15 propellers, 6 sloops, 3 steamers, 1 barkentine, and 1 ship. The total tonnage was 11,671·47 net, which is largely in excess of the previous year.

THE CANET SYSTEM OF FIRING TORPEDOES.

The efficient method of firing torpedoes, either from large vessels or from torpedo boats, is too important a part of modern naval armament to have been overlooked by the Forges et Chantiers de la Mediterranée. This class of ordnance—for it can be fairly classified under the general head of artillery—is chiefly made at the company's works at Le Havre and La Seyne, from the designs of M. Canet. The problem to be solved is not an easy one, as important causes for disturbing the direction to be given to the torpedo have to be reckoned with and overcome. Once free from such influences, the motive power of the torpedo carries it forward with more or less accuracy to the object aimed at. The causes of deviation are of course more serious on large vessels than in torpedo boats, because in the latter the most favorable position can be chosen for discharging the missile, and the surrounding body of water affected by the boat moving rapidly has not so great a mass as that set in motion by a large ship traveling at a high speed. If the torpedo be discharged within this zone of disturbing influence, it is evident that its course will be diverted to a greater or less extent. Torpedoes fired from a moving ship at an angle to its line of advance will of necessity participate in the movement, which introduces another cause of error. The first difficulty can be overcome by projecting the torpedo beyond the belt of troubled water surrounding the ship; when it is not possible to discharge it parallel to the axis of the boat, the general practice is to allow the torpedo to fall upon the water either flat or to enter it at a slight angle, so that it may at once penetrate under the surface waves and so escape any deviating influence they may exert. Both systems are employed in the French navy, and the method is well illustrated by our engraving, which is taken from an instantaneous photograph of a torpedo being discharged from the French war ship Condor, and reproduced in a recent number of *Engineering*, to which we are indebted for our illustrations and the following particulars:



TORPEDO-FIRING APPARATUS, CANET SYSTEM.

Fig. 2 is a perspective view of the complete gun ready for service; Fig. 3 is a longitudinal section of the breech end of the tube and the back part of carriage, and also a side view of fore part of tube and longitudinal section of front part of carriage; Fig. 5 is a back elevation of the breech end of tube and carriage; Fig. 7 is a plan of the fore part of carriage; Fig. 10 is a plan of back part of carriage; Fig. 4 is a side elevation of firing mechanism; Fig. 8 shows another combination of discharging mechanism; Fig. 9 is a cross section of tube at the trunnion of the fore carriage; Fig. 6 is a cross section of tube showing the starting catch H; Fig. 11 is a section through M N of the powder chamber.

The discharging mechanism consists of a system of

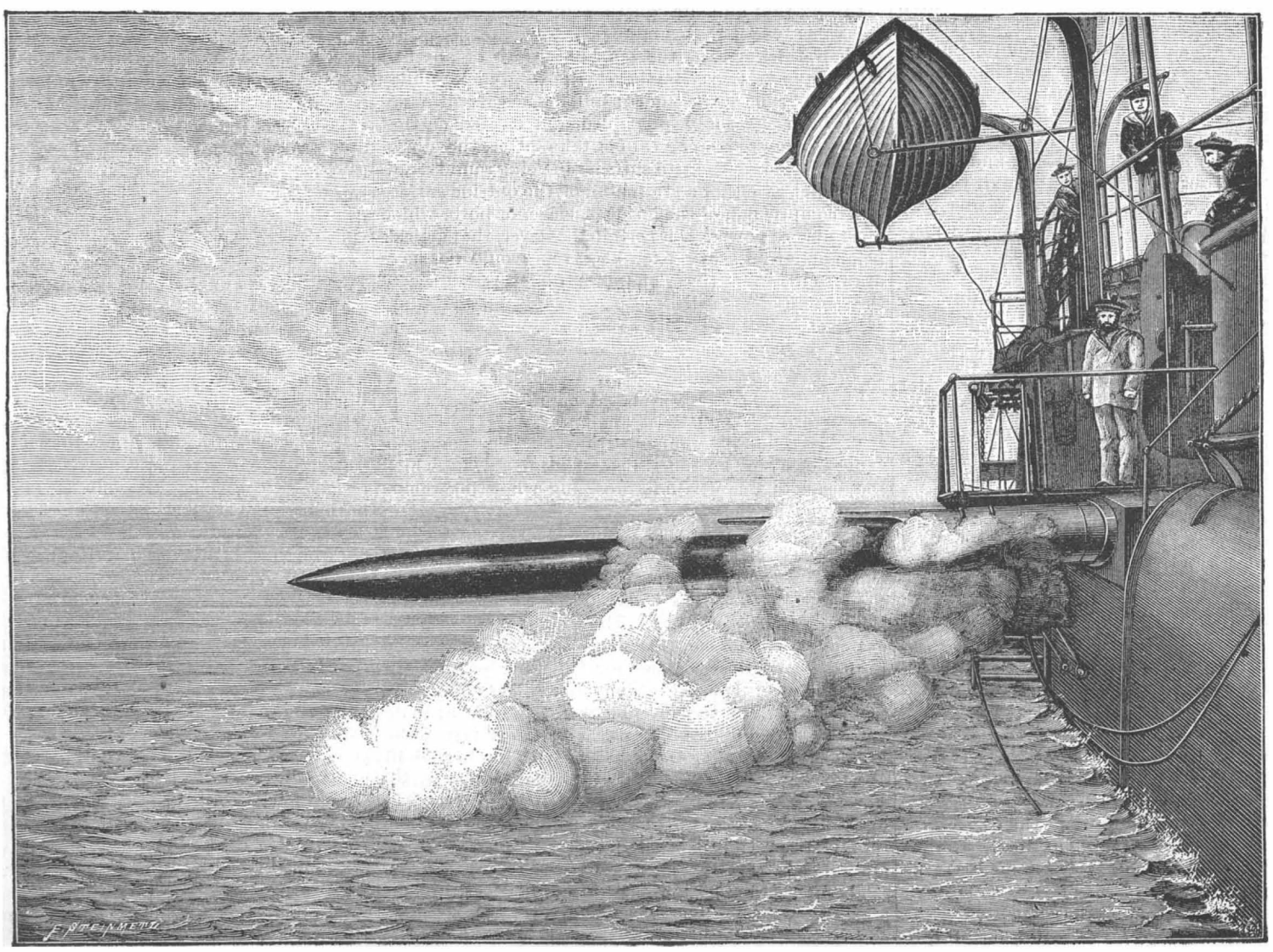


Fig. 1.—FIRING A TORPEDO FROM THE FRENCH GUNBOAT CONDOR.

levers and a spiral spring P that is tightened by acting on the crank lever O″ by means of a hand spike that fits one of the extremities. This lever O^2 is kept cocked by the catch lever Q, the safety pin *q* preventing any sudden release of the mechanism. On the same axis on which is keyed the crank lever O^2 are fixed two other levers; one the lever O^1 that releases the torpedo inside the tube, and the other the lever O that works the firing mechanism.

The actual working of the whole arrangement for launching is as follows:

We will suppose that a torpedo has just been discharged. The gunner, by means of a hand spike fixed at the end of the crank lever O″, Fig. 4, tightens the spring P; he also puts in the safety pin *q*, and then, to open the breech, he catches hold of the small hand lever K, and gives one-sixth of a turn to the screw that closes the breech. The threads of this screw are partly cut away like those of an ordinary breech block, then, on pulling the lever K toward him, the whole of the breech swings round the hinge J″, Fig. 4, and the gun is ready to receive a torpedo, which is introduced carefully into the tube, while the stop bolt I, Figs. 3 and 4, inside the tube, is lowered by means of the hand lever *i* until the torpedo is well home; when the man lets go the hand lever *i*, the spring *i*″ is liberated, and the bolt I maintains the torpedo inside the tube.

The charge of gunpowder or any other explosive is then put into the powder chamber or cup L; this chamber is pierced with holes radiating from its center, so that the gases rush against the inner surface of the tube, thus preventing any damage to the torpedo.

The breech is closed by swinging it round the hinge J″ till it is home, then by the handle K the screw of the breech is turned one-sixth round, care being taken to release the catch K′ in pressing with the thumb on the spring.

To prevent the escape of gases the breech presses a ring of leather or asbestos let into the internal face of the breech. In order to introduce a new fuse, the hammer *m*, Figs. 3 and 4, must be pulled out and pushed down the inclined planes, and the fuse is then put in. The gun so loaded is ready for a new discharge. If the breech is not well closed, the end of the lever O will not enter into the slot of the hammer, and the fuse could not be exploded. This mechanism is therefore also a safety arrangement. To fire, the gunner pulls out the safety pin *q*, and by exerting a slight effort toward him with the handle of the catch lever Q, he releases the spiral spring P. The rotary motion imparted to the axis that carries the three-crank levers before described removes first the stop bolt I, inside the tube, and immediately afterward explodes the fuse. The exploding of the fuse is produced as follows: On the slide piece *m*′, Fig. 5, is fixed the hammer *m*, which carries on each side a stud. The slide piece is pushed upward by the lever *o*. This tightens the spring *m*″, and when the studs are at the summit of the inclined planes the hammer is released, and strikes the fuse, which explodes. Inside the tube, and fixed at a proper distance, is the usual spring catch H, Fig. 6, which acts on the starting valve of the engines inside the torpedo itself as it is shot from the tube. The above arrangement has been described for a percussion fuse. In some cases an electric fuse is used, and it is by the sliding up of the piece *m* that the circuit is closed and the charge exploded. The construction of the carriage is as follows:

The front part of the carriage consists of a crosshead B, bearing the trunnions B, Figs. 3 to 9; this crosshead turns round on a pivot resting on a strong bracket C, so that it can be fixed for firing either at the fore or aft part of the ship or broadside.

The hind part or breech end of the carriage consists of a V-shaped frame E *d d*, Figs. 3 to 7, which rests on two rollers *e*, that may turn when required in any vertical position. The front beam E of this frame has a hole in its center to let the elevating screw G pass through it.

This screw G is fastened to a lug under the tube, and it is worked up and down by the nut *e*″, cast with the handwheel *g*. The nut itself turns in two half bearings *e*″, provided with horizontal trunnions working in the front beam E.

The front and rear parts of the carriage are kept together by means of the connecting rod D. This rod at its front end turns horizontally round the bracket C, and is attached to it by means of the collar *c*. At its rear end the rod is attached to the V-shaped frame by means of the collar d^2, and the extreme end of the connecting rod turns in a socket provided in the beam E.

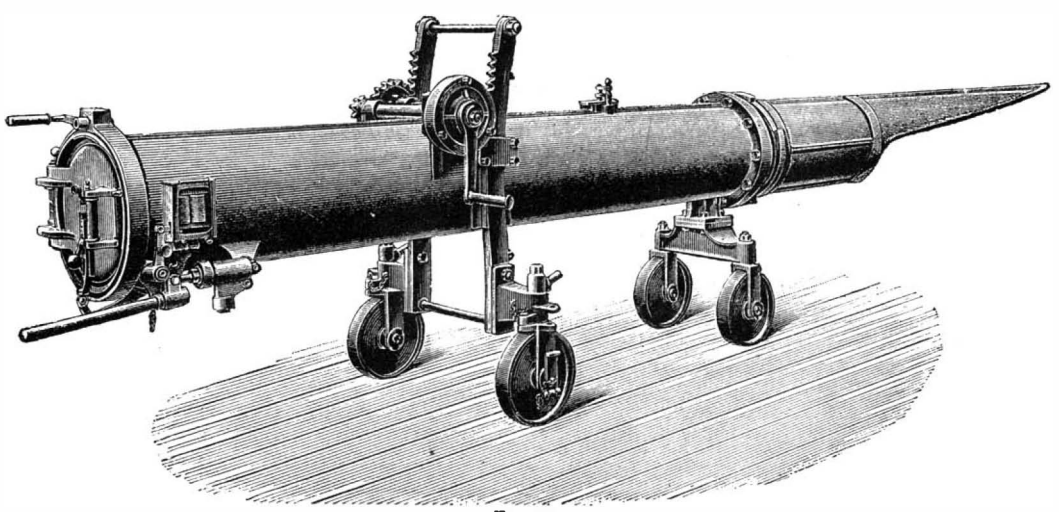


FIG. 11.

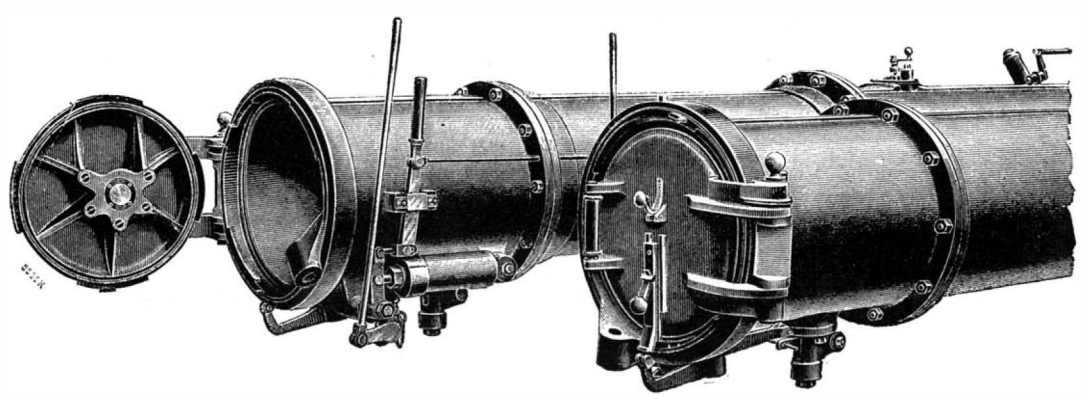


FIG. 12.

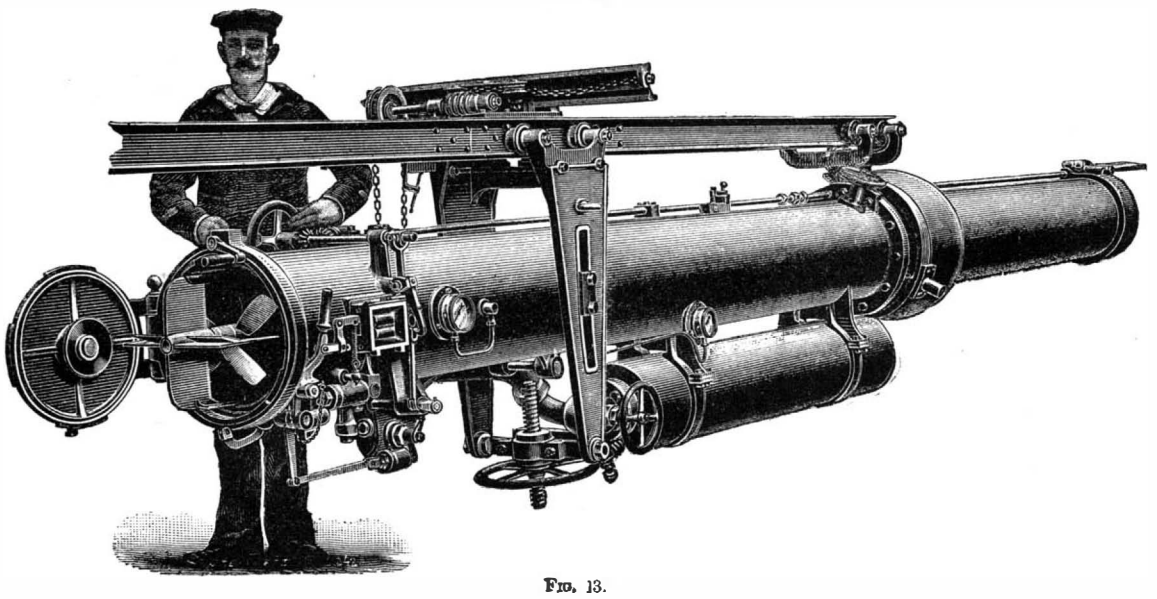


FIG. 13.

TORPEDO-FIRING APPARATUS, CANET SYSTEM.

This mode of connecting the rod to the rear part of the carriage allows the V frame and rollers to follow the slope of the deck without interfering with the laying of the tube.

Figs. 11 to 14 illustrate the latest types of the Canet torpedo-firing tubes; Figs. 11 and 14 are elevations of that form of tube designed with the special object of forcing the projected missile to fall flat on the surface of the water, instead of at an angle. The firing tube, which is of light section and made of either bronze or steel, is prolonged above with a spoon-shaped extension. A T-shaped groove is made in the top of the bore, for the greater part of its length, and in this groove slides a projection formed in the upper side of the torpedo. The groove is made of such a length that when the projection is free from it, the torpedo is guided only by the extension of the tube, and is in a horizontal position; it is then free to fall flat on the water.

A PATENT has been taken out in France for an electric furnace for the rapid incineration of human remains.

Illusion of Woodpeckers and Bears.

Mr. J. D. Pasteur, Inspector of the Post and Telegraph Service at Java, communicated to Dr. F. A. Jentink, in July last, the following very curious and interesting facts about woodpeckers, who, under the illusion that the buzzing sound so apparent on applying the ear to telegraph poles is caused by the vigorous efforts of gnawing or boring insects, make large holes in the timber, on a hopeless chase after such. He incloses a piece of telegraph pole made of teak wood, with two woodpeckers (*Picus analis*), from the Kediri Residency, Java. The wood, which is of iron hardness, is perforated with rather large holes near the place where the insulators had been attached. Although Inspector Pasteur passes thousands of telegraph poles under view each year, only in a very few cases has he found any damage done to them by woodpeckers, and, until now, the damage done has always been on the living kapok trees (*Eriodendron anfractuosum*), which are used in Java for this purpose. The piece of telegraph pole now sent is the only instance known to him of damage being done to the sound and very hard poles of the teak (*Tectona grandis*). Besides the above mentioned woodpecker, from time to time the rare little *Picus moluccensis* was seen also among the others at work. Mr. Pasteur remarks on the great rarity of such a phenomenon; in the Paris electrical exhibition of 1881 there was exhibited, as a great curiosity, a telegraph pole sent from Norway, which was perforated by a hole of 7 centimeters in diameter. The Norwegian administration was for a long time uncertain to what cause to ascribe this damage done to poles which were otherwise quite sound, till a mere chance at last revealed woodpeckers at work. In Norway, too, another equally remarkable case of damage had been noted as done to telegraph poles by the large stones, which are heaped round their base to insure their stability in the ground, being removed and scattered, apparently without any reason. This, which was for a length of time inexplicable, was at last found to be the work of bears, who apparently mistook the sound in the timber for the buzzing of a swarm of bees. It is too much to expect of either bears or woodpeckers that they should be versed in the ways of modern science.—*Leyden Museum Notes.*

Foreign Honors to Professor Newcomb.

The Copley medal of the Royal Society, London, has been awarded to Professor Simon Newcomb, Superintendent of the American Ephemeris, Washington, D. C., for his contributions to gravitational astronomy. The medal was first given by the society in 1753, to Dr. Benjamin Franklin. The University of Tokio, Japan, also has presented Professor Newcomb with two fine, large bronze vases, finished specimens of Japanese art, in recognition of his aid in selecting a suitable person to construct a photo-heliograph for the University.

A present from Russia by order of the Czar is also tendered to Professor Newcomb on account of esteemed services rendered in procuring, for the government, the great 30 inch telescope, a few years ago mounted at Pulkowa. This gift is a large jasper vase on a marble base.

A GERMAN statistician says that there are 3,985 paper mills in the world, and that of the 1,904,000,000 pounds of paper turned out annually, half is used for printing, 600,000,000 pounds being required for newspapers alone, the consumption of which has risen by 200,000,000 pounds in the last decade. He alleges that on an average an Englishman uses annually 11½ pounds of paper, an American 10¼, a German 8, a Frenchman 7½, an Italian or an Austrian 3½, a Spaniard 1½, a Russian 1⅛, and a Mexican 2.

THE NICARAGUA CANAL.

(*Continued from first page.*)

project of establishing an artificial route across the barrier was taken up also at an early date. In 1550 Antonio Galvao, a Portuguese navigator, proposed four routes, including the Lake Nicaragua route, for reaching the Pacific. The history of the successive attempts after this date becomes a long one. Many projects were advanced, and numerous surveys, more or less authentic, were made. But little or nothing practical was done beyond surveying for and constructing the Panama railroad in 1850–51. This was built on a line surveyed by Col. G. W. Hughes and J. C. Trautwine, both well known engineers.

The United States government has always taken an interest in the project of excavating a canal. The Monroe doctrine indicates the propriety of the federal authorities taking some part in any work of international character executed on this continent. The Nicaragua route is distinctly American. It was surveyed in 1872 by an American expedition under Commander Alex. F. Crossman of the United States navy. On May 2, 1872, he found the water of Lake Nicaragua to stand at an elevation of 107·63 feet above the mean tide, while land rising but 49·38 feet above the lake level intervened between it and the Pacific Ocean. Other surveys and reports were made subsequently upon this route. A treaty next was drafted between the United States and Nicaragua, which in December, 1884, was submitted to the United States Senate, and rejected by that body. It was soon after withdrawn. Finally, by act of Congress of February 20, 1889, the Maritime Canal Company of Nicaragua was incorporated by the United States government, and on May 4th the company was formally organized. On May 26th a construction party including forty-seven engineers started for Nicaragua. This was the first step of actual work on the Nicaragua canal.

The general features of the proposed route of the canal are very clearly shown in the accompanying bird's eye view (reproduced from the SCIENTIFIC AMERICAN, February 16, 1889). It extends from San Juan del Norte (Greytown) on the Atlantic side to Brito on the Pacific coast. Of this distance, 26·783 miles are to be excavated canal, with 142·659 miles free navigation through Lake Nicaragua, the San Juan River, and through basins in the valleys of the streams Deseado, San Francisco, and Tola. Lake Nicaragua marks the summit level of the canal. It will connect with the Pacific by two sections of canal in excavation, and by the Tola basin. On the other side slack water navigation is to be provided in the valley of the San Juan River, and a series of basins connected by short lengths of canal are to be constructed in the Deseado and San Francisco valleys. On each side of this summit level there are three locks. One set is within 3½ miles from Brito, the other set is within 12¾ miles from Greytown. This gives a clear, unimpeded summit level of 153¼ miles, and allows the locks an average lift of 36⅔ feet. The smallest lift is in the lock nearest the Pacific, which varies from 21 to 29 feet according to time. The greatest lift, 45 feet, is on the Atlantic side, in the lock next to the lake. A uniform size of lock has been selected, 650 feet long and 70 feet wide. This will accommodate any steamship afloat.

We illustrate some of the features of the work now in hand. Greytown harbor, the Atlantic terminus of the canal, has been of little use for many years past on account of its shallowness. When the canal is in operation, it will have to be open to the largest ships. We give a general view of the place as it appeared some years ago. Work upon dredging the harbor and constructing a breakwater is now in active progress. The dredge City of Paris is shown in operation, dredging and at the same time throwing up an embankment far to one side of the channel it is establishing. This dredge was originally employed in the Panama Canal. Six similar machines have been purchased by the company.

The typical American dredge, represented by the City of Paris, is provided with a composite hull 115 feet long and 65 feet wide. In the forward end of the dredge is a slot, through which the lower section of the ladder, 36 feet long and 7 feet wide, descends. An endless chain of buckets travels up and down the ladder, cutting away the bottom wherever directed, and delivering the material to the discharger on top of the tower. The upper section of the ladder for this purpose is carried up to the top on an incline. A joint is provided between the sections, so that the lower portion can be raised and lowered. The upper section is 73 feet 10 inches long. The buckets are of ⅝ inch steel, and have a capacity of 1 cubic meter each. The links of the chain are 1⅝ inches by 1 inch steel, and are 3 feet long. The shaft at the top of the tower, around which the chain and buckets travel, is 14 inches in diameter.

The chain is driven by double cylinder engines, 16 by 24 inches, with 10 foot driving pulley with 38 inch face. The dredge is anchored by wooden spuds or heavy vertical beams, 25 inches diameter, with 1,800 pound iron shoes upon their lower ends. These ends are lowered to the bottom, and sinking through the earth anchor the machine securely. Besides the main engine, there are several auxiliary engines for working the spuds, raising the ladder, etc.

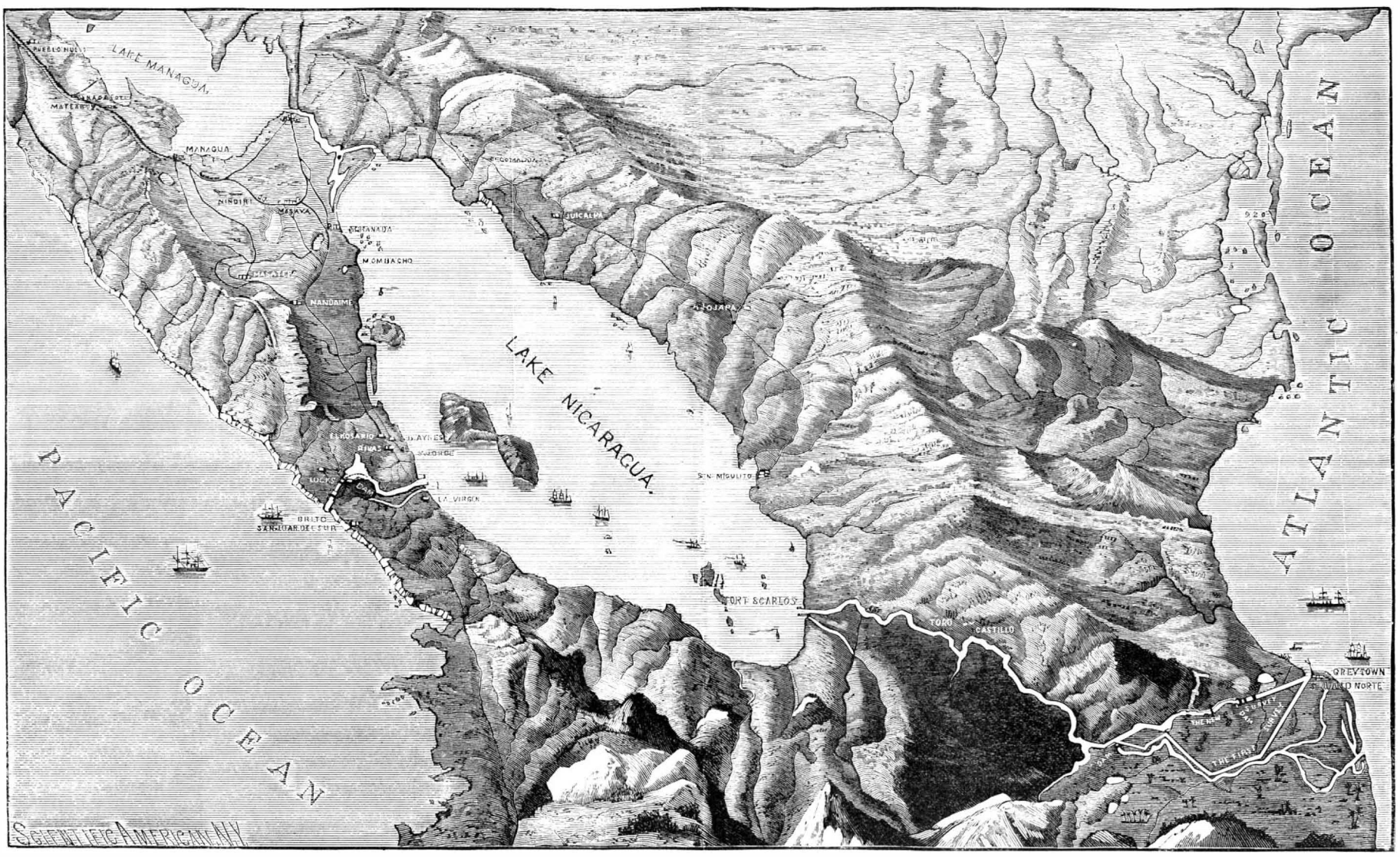
The material as dredged and raised to the top of the tower is emptied into the bell of one of a pair of iron chutes. These are pipes 3 feet in diameter and 185 feet long, which run far out on both sides of the tower. Water is pumped into them along with the solid material. Great banks of sand are built up by its operations. In practice, one man stationed on the bow controls the main operations of the machine. The capacity is put at 100,000 cubic yards per month. This is more than doubled under favorable conditions, as the nature of the earth determines the speed at which the engine can be driven. Twenty buckets a minute represent a fair speed, each bucket being partially filled. Some material expands as much as 30 per cent in the separation from its bed, other much less.

The double ladder is to be noted as an American feature of construction, and in the spud system of anchorage a great advantage over guy ropes is found. The whole machine can be swung around one spud as a center of rotation, so as to dredge in great arcs of circles. The dredges were built in this country, various contractors and works being concerned in their production.

We also show the progress of work upon the Greytown breakwater, the observer looking seaward. It is now 930 feet long. This in connection with the dredging has already greatly improved Greytown harbor, so that Nicaragua will soon have a first-class deep-water port. Last December it was announced that a three-masted schooner drawing 10½ feet of water had been towed into the harbor, the first time a large vessel had entered for 25 years. At present the minimum depth is 14½ feet. To realize what this means it should be noted that 30 years ago the largest ships could find a harbor at Greytown, while only six months ago the former bay was a fresh water lagoon separated from the sea by a sand strip six feet high. The breakwater or jetty is to be carried out a distance of 2,000 feet to the windward of the proposed entrance canal, so as to create a natural sand bank. The sand has already begun to accumulate back of the jetty. The first portion is built of creosoted timber, fascinage or basket work and stone. As a tendency to form a shoal is developed at its end, the jetty will be from time to time extended, until practically a new and permanent coast line will be formed back of it. The deep water portion of the jetty is to be of rubble. The entrance channel thus provided is to be 500 feet wide at the bottom, with a depth of 30 feet, and will lead to a 206 acre anchorage basin inshore. The enlarged section of the canal up to lock 1 must be added to this basin, giving 341 acres of water 28 feet deep, with large additional area of less depth, available for many smaller vessels.

At Brito a harbor has also to be made. A breakwater 900 feet long and a jetty 830 feet long are proposed. These alone will make a small harbor. It is to be extended in area by dredging inland and cutting out the alluvial plain at the outlet of the Rio Grande valley, and by making the canal of enlarged section for 3,000 feet inland to the first or tidal lock. This will give a total area of 103⅔ acres of water 30 feet deep.

The construction of a railroad through swamp land is illustrated in one view. Timber is cut and laid so as to form a rough corduroy. Upon this longitudinal timbers are laid, and these receive the cross ties. The rails are then laid. On this structure, which naturally is very imperfect, ballast trains are run out and earth is dumped upon the line. As earth accumulates it is tamped under the sleepers, which with the rails are gradually raised and brought into alignment and to a true slope. In this way bad ground is overcome, and



BIRD'S EYE VIEW OF NICARAGUA, SHOWING PATH OF CANAL.

the road, to be used at present for construction purposes, is rapidly penetrating the forest.

The general aspect of the work at present is as follows: The railroad track on the Atlantic side is laid between 8 and 9 miles, and the grade is half completed 4 miles further. At this distance from Greytown is the nearest deposit of rock, and it is desired to obtain access to it, that the material may be used in filling in the breakwater at Greytown. This stone quarry is the first objective point of the railroad.

The equipment for the railroad consists of 4 locomotives, and 80 cars of different types, steam shovels, railroad steam pile driver, wrecking crane, etc.

Along the line of the railroad a water pipe will be laid, bringing water from La Paz Creek, also 14 miles from Greytown, where water is obtained from a mountain stream at an elevation of 115 feet.

The dredges Paris and M. A. Slaven are at work in the harbor, one deepening the sea entrance, and the other working on the canal line. The other dredges are being repaired and made ready for active operations.

The machine shop and blacksmith building are equipped with the best type of modern machinery and tools, and are in active use. The foundry for casting the minor parts of machinery is also under construction.

A hospital has been established, and has ample accommodation for the sick of a working force of 2,500 men. Storehouses and many other structures for the protection of property have been erected. The railroad wharf has been completed and has an extension of 265 feet, where vessels of the largest size that can enter the harbor can load and discharge their cargoes.

The canal line is cleared for the first ten miles of its eastern extremity, and has a width of 350 feet.

The clearing of the canal on the west side has just been commenced. The final surveys for the railroad west of the lake have been completed.

Besides the dredging plant from Colon and the plant of the North American Dredging Co., now at Greytown, the company owns two large tug boats and a half dozen smaller ones, with eight river steamers, and a steamer of large size, in use on Lake Nicaragua. This vessel was built a few years since at Wilmington, Del., and proceeded to Greytown under her own steam. She draws ten feet of water, and with the same motive power she ascended the San Juan River to Lake Nicaragua.

All the timber used in the piers and wharves is of creosoted piling, containing 16 lb. of dead oil to the cubic foot.

The United States government, wishing to prevent the ownership going abroad, has of its own motion taken steps looking to the acquirement of a controlling interest, and in execution of this intention and desire offers by guaranteeing the bonds of the company to the extent of an issue of $100,000,000. Definite action has not yet been taken by Congress. A unanimously favorable report has been made by the Senate Committee of Foreign Relations, having the bill in charge.

Artificial Ivory.

The invention of Alexandre de Pont and Silvius de Pont, citizens of Switzerland and residents of Paris, relates to a new or improved method by which they construct artificially an ivory having the same properties, component parts, and appearance as the natural product.

In carrying out the invention, caustic lime (CaO) is first treated with water sufficient to hydrate it, and before the hydration is completed and while the lime still remains caustic or retains some of its causticity we carefully pour over it an aqueous solution of phosphoric acid, (H_3PO_4), and mix the two well together for the purpose of forming phosphate of lime. During this mixing there is added gradually a small quantity each of carbonate of lime ($CaCO_3$), magnesia (MgO) and alumina (Al_2O_3), and then an admixture of gelatine and albumen (dissolved together in water) or their chemical equivalents, such as fibrine, caseine, or vegetable fibrine, albumen or caseine.

The proportions of the several materials, by weight, are about as follows to produce a substance closely resembling in properties the tusk of an old elephant: Caustic lime (CaO), one hundred parts; water (H_2O), three hundred parts; aqueous solution, phosphoric acid, specific gravity 1·05 to 1·07 (H_3PO_4), seventy-five parts; carbonate of lime, ($CaCO_3$), sixteen parts; magnesia (MgO), one to two parts; alumina (precipitated or hydrated), five parts; albumen, twenty parts; gelatine, fifteen parts.

The mass formed of these is mixed until the component parts are thoroughly incorporated together, and the whole is thoroughly kneaded until it assumes a plastic condition of the consistency of stiff dough. In this state it is allowed to stand for a few hours, during which the continued action of the phosphoric acid upon the other materials converts the whole into a fine tenacious, white, insoluble, and uninflammable body similar in its constituent parts to the natural ivory. The compound while still in a plastic state is placed into shapes or moulds and removed to a slow-drying room (heated to a temperature of about 60° to 70° Fahrenheit, or with a current of air passing through it), where it remains one or two days until sufficiently desiccated.

Care should be taken not to remove all traces of moisture at this stage. When desiccated, it may be taken from the drying room and placed direct into moulds of a suitably constructed hydraulic or other press or may be first finely ground and then placed in the moulds. But we prefer the former method.

The moulds into which the substance is placed are constructed so that it may be subjected to a high temperature and a great pressure. The heat may be produced either by gas or steam acting upon the walls of the mould, the latter being what we prefer.

In the heated moulds the dried substance is subjected to pressure in a hydraulic or other press amounting to one, two or more tons per square inch, according to the density of the product to be obtained, and the pressure is maintained thereon from one to two hours, more or less, according to the quantity of material under operation. The greater the bulk of material, the longer time must the pressure be applied. The heat and pressure may be varied according to the quality and density of the ivory required to be produced.

We find that blocks closely resembling in physical properties the tusks of an old elephant may be produced from the materials in the proportions hereinbefore stated by applying a heat of about 270° Fahrenheit, with a pressure of two tons per square inch applied for about an hour. By altering the heat, pressure or duration of pressure, the density or specific gravity of the resultant product may be varied as may be desired to render it more adaptable or serviceable for particular purposes. The substance, when taken from the moulds, should be allowed to mature and season for three or four weeks, when it may be cut, turned, and polished in the ordinary way.

We are aware that the product can be obtained without the application of heat during the compressing stage of the process by increasing the pressure or the duration of the pressure, or both, and other details of the process may be varied without departing from our invention, which is essentially to synthetically construct or manufacture ivory having the same properties, chemical and physical, as the natural tusks, with or without the addition of any foreign matter to render the product more adaptable for any special purpose.

While we prefer to use only the materials herein before enumerated as producing a substance more nearly like natural ivory, we find that other materials may be added thereto, such as baryta as a substitute for or in addition to magnesia acetate, or carbonate of lead instead of or in addition to the carbonate of lime, to increase the specific gravity; oxide or sulphate of zinc to increase the bulk or as an adulterant; and cellulose and certain oils or gums—such as animi mastic, shellac, oil of turpentine, and castor oil—to render the product more plastic or elastic, if so desired. When colors are to be imparted to the product, aniline, alizarine, logwood, Brazil wood, fustic, or madder extracts, or other well known coloring agents—such as pigments—may be incorporated with the mass in the earlier stages of the process in such quantities or proportions as will give the required color or tint.

Life at the Lick Observatory.

So many articles have been written on the scientific equipment of the Lick Observatory, and upon the discoveries the instruments are capable of making and are making, that I think, says a writer in the Boston *Journal*, a sort of description of the personal life of the observers on that mountain, and the difficulties encountered, will be of interest. The following description is taken from an address by the director of the observatory, Professor Edward S. Holden, before the Astronomical Society of the Pacific.

To those who visit Mount Hamilton in summer, says Professor Holden, nothing can seem easier or more delightful than to plan and execute investigations with the instruments at hand. A short visit there, however, would at once show the almost insurmountable difficulties that attend an attempt to live at such an elevation. As soon as winter sets in, storms that here in Massachusetts we would call cyclones sweep over the mountain, and drift the snow about the astronomers' dwellings more than ten feet deep. Three or four times during each of the winter months the wind blows at the rate of more than sixty miles an hour. Many of the stronger gusts, which must exceed seventy-five or eighty miles an hour, have never yet been measured, for no instrument can be found that will stand the test. Although the windmill which supplies the observatory with water is carefully furled before each storm and held in position by iron braces, nearly two inches in diameter, once a year it is torn from its mounting and destroyed.

During five days of February, 1890, absolutely no communication with the outside world was possible. The snow fell in enormous quantities, and a fierce blizzard was blowing, which could not be faced. On the sixth day of our imprisonment three men started together for Smith Creek and returned the same night, bringing the mail and thirty pounds of much-needed provisions, after a journey of fourteen miles, which had taken something like eight or nine hours of hard work.

In such a climate we should naturally expect to find whatever was necessary for warmth and comfort indoors. How different, however, is the account Professor Holden gives us.

There is nothing to be had nearer than San Jose, 26 miles away, and it is necessary to transport everything by stage. Frequently the stage has no room for our parcels, and very frequently has no passengers for the observatory, and stops at the foot of the mountain. In such a case we must send our men over the road 14 or 15 miles to Smith Creek. Very often the road has been impassable to wagons (on account of snow), and all our supplies have been brought in the mail bag on horseback. Whatever was too large or too heavy for the bag was not brought and had to be done without. During the 112 days from November 15 to March 8 the stage came to the observatory only thirty-six times. The difficulties in this matter can be met by a kind of "forehandedness," but when we come to the strictly scientific side of our difficulties, they are more serious. For example, a bit of colored glass is wanted to moderate the brightness of Mars, so that the satellites can be seen. Where is it to be found? There is not so much as a square millimeter of such glass west of the Alleghany Mountains. One of the prisms of our spectroscope is stained and yellow. It cannot be replaced nearer than Pittsburg. If it is sent away, we lose its use for a month or more. The negatives of the solar eclipse of December 21 remained at the foot of the mountain from February 16 to March 5 from lack of some way to bring them up.

Fuel seems to be no exception to other articles in regard to the difficulty of getting it up the mountain. It is the present policy not to cut any wood on the reservation, and hence it must be found where best it may, and its delivery hastened as much as possible. During the winter of 1888 and 1889 the only wood available for the observatory and for the various households was from my private stores, which had been ordered in May, but which were not all delivered until the following February. The procrastination of our immediate neighbors has ceased to be annoying. It is majestic—colossal—like a great feature of nature. It must be reckoned with like the inexorable forces of heat, magnetism, and gravitation.

During the severe winter of 1886 and 1887 the Lick trustees were obliged to collect wood along the stage road, and it was delivered in small parcels like express packages. Even so it was impossible to keep the houses warm, and the water froze on the very dining tables. The photographic lens of the great telescope was washed by Mr. Clark in water so cold that it froze where it was not immediately under his hands, and this because no room in the observatory could be heated above the freezing point.

The difficulty, aside from the scanty supply of fuel, rests with the chimneys, which were not properly constructed for the peculiar currents on the mountain top. The wind blows up the deep canons on either side and sweeps almost vertically down the flues. In consequence the flames are driven two or three feet out into the room. In vain every kind of chimney top has been tried. Nothing can remedy the difficulty but to rebuild the chimneys.

When summer comes there is constant communication between the observatory and the outside world, and the troubles of winter disappear. A new difficulty, however, now arises to tax the patience of the astronomers to the utmost—the water supply gives out. Two reservoirs on neighboring peaks are fed from springs by means of the windmill and a steam engine. A third just below the summit acts as a reserve in the summer droughts, and is filled with rain water. The frequent slight earthquakes that occur in California seriously injure the walls, so that a daily inspection has to be made, and the slightest leak stopped at once.

All these difficulties, of course, call for extra work on the part of the astronomers, for their regular routine duty that has been assigned them must be done every day. Each piece of extra work is written on a card and assigned to some person. When the work is accomplished the card is returned. During the last year 2,000 of these cards were made out, including about 3,000 to 4,000 items, or corresponding to 8,000 hours of extra labor. The secretary's letter-press copying book for the same period contains 51,000 pages of letters, which are equivalent to 500 working days. Also, during the last year 650 checks have been issued.

These figures give some idea of the life at the Lick Observatory. But we must not forget that the instruments are in use whenever it is possible, as the large number of observations in every periodical proves.

It has been determined that as far as the danger to ships' compasses from magnetic leakage from the dynamo is concerned, it is equally the same whether the ship is double or singled wired.

To Preserve California's Big Trees.

The Fifty-first Congress, during the closing days of its first session, set apart more than a million acres surrounding the Yosemite valley as a public pleasure ground under national control. By another act of about the same date a tract in California much smaller in area, but covering groves of extraordinary importance, was made a reservation also. To this Second park the name of Sequoia has been given by the Secretary of the Interior, for the reason that the giant trees there were so named by Endlicher, "in honor of a most distinguished Indian or half-breed, the inventor of the Cherokee alphabet."

The origin of this legislation is interesting. Last August Dr. Eisen read before the California Academy of Sciences a paper setting forth that the big tree forests of the Sierra Nevada were in danger of total destruction. This body at once called the attention of Congress to the subject in a memorial, asking that all lands in California containing the Sequoia gigantea should be withdrawn from entry, and also that two canyons of especial beauty and grandeur—one on the south fork of King's River and the other on the Big Kern—should be set apart as national parks. The memorial proceeded to give the reasons:

"These forests, or rather groves of big trees, very limited in extent, are isolated one from the other, and situated near the headwaters of certain streams at an altitude between 4,000 and 7,000 feet. The number of trees in each grove varies from 100 to a few thousand trees. The average size of the big tree is from 15 to 20 feet in diameter at the base and 200 feet in height, but single trees reach 300 feet in height by 30 to 42 feet in diameter. The beauty of these sequoias as well as of the forest surrounding them is indescribable, and superior to any forests elsewhere on this earth. A tree recently cut measured 41⅓ feet in diameter, 250 feet in height, and the rings in its wood numbered 6,126. Allowing one ring for each year, this tree was already 2,000 years old when the pyramid of Cheops was built, and it was over 4,000 years old at the beginning of the Christian era. Only one more tree of this size exists, the largest other tree being little more than 30 feet in diameter.

"The preservation of these trees is of national importance, not only on account of their influence upon the climate and watershed for the irrigation of the land below, but also because of their great beauty, curiosity, and rarity. They are the last remains of a gigantic creation which has now mostly disappeared and which is fast being exterminated from the face of the globe. The sequoia trees are rapidly dying out and few young or medium-sized trees are found in or outside of the old groves. There are few trees which are less than ten feet in diameter.

"At a recent visit to one of the lumber mills we found millions upon millions of feet of lumber rotting on the ground. Generally only a very small part of each tree is used for lumber, the balance is left to rot. Trees from 30 to 40 feet in diameter have been cut for curiosity's sake, in order that a small section might be exhibited and a few hundred dollars gained. Of other trees a small section is cut out for lumber, the balance is fired in order to get it out of the way and make room for new logs more readily managed."

To the special plea for the park was added the possibility of securing at the same time more than fifty imposing peaks from 10,000 to 15,000 feet in altitude, crowned by Mount Whitney; the glaciers on the flanks of Mount Goddard and the Palisades; the Tehipitee Yosemite, on King's River; the Grand Canyon of the South Fork, with the cascades; the stupendous cliffs of the Kern; the extinct volcanoes; the Shagoopa Falls, with their wonderful descent. This appeal was heard by Congress, and the tract constituting the Sequoia National Park was set apart, and therewith another tract in the Fresno region of Sequoias, containing the great tree popularly known as the General Grant.

Kola Nuts.

In the SCIENTIFIC AMERICAN of September 13, 1890, we gave an interesting article, by Consul Pike, on the kola nut, its uses, characteristics, and value. Recently, in London, one of the chief dealers in kola nuts, Mr. Thos. Christy, was sued on a disputed bill for a quantity of the nuts which he had purchased. In the course of his testimony as a witness, Mr. Christy gave the following: I have had nine or ten years' experience in kola nuts. Until a year ago all the kola nuts which came into Europe passed through my hands. I pointed out to the plaintiffs when they offered the nuts for sale that mouldy nuts were useless, and that I must have them fresh. The nuts are used medicinally, also for refining beer. The nuts prevent people going on drinking. (Laughter.) It makes people nauseate. If a man is lying insensibly drunk on the floor, or under the table, and a nut were put into his mouth, in fifteen minutes the man would rise, and one would not know he had drink. He would not even have a headache. Even if within four or five days he went to take spirits again, the effects of the nut would still produce a nausea in his throat and mouth. (Laughter.) This was a well-known scientific fact. As the nuts are used medicinally, it is an important matter not to have them mouldy. A kola nut, when once it becomes mouldy, changes its character and becomes a fungus. They are then of no use.

How to Unite the Ends of Lead Pipe.

What may be found a convenient method of uniting the ends of pipe, the *American Engineer* thus explains: Whatever the size of the pipe may be, procure a block of hard wood, say four or five inches long, and four inches in diameter, bore a hole straight through the center, so nearly the size of the pipe that the block can be driven on the end of the pipe with a light hammer. If one has a set of auger bits, it will not be difficult to select a bit of the proper size to make a watertight fit. Let the block be driven clear on the pipe, so that the end of the pipe will be flush or even with the end of the block. Now place the two ends of the pipe together and drive the block off one pipe on the other, until the joint will be at the middle of the block. If the hole in the block is made of the proper size, the block will fit so closely that the joint will be watertight; and if the ends of the pipe are dressed off true and square the joint will be so strong that it will sustain the pressure of a head or column of water one hundred feet high. Iron pipe may be united in the same manner. Should the joint leak a trifle, let shingle nails be driven into the wood around the pipe so as to press the timber firmly all around the pipe.

ACCORDING to an amendment of the school laws of the State of Michigan, children suffering from consumption or chronic catarrh must be excluded from public schools. The circumstance is interesting as a first step toward the public recognition of a most important truth, the fact, namely, that the disorders of the respiratory organs can be propagated by direct contagion, and that the atmosphere of a consumptive's sick room, unless constantly ventilated, is apt to become a virulent lung poison.

RECENTLY PATENTED INVENTIONS.

Railway Appliances.

LOCOMOTIVE CAB SEAT. — Edward M. Stannard, Appleton, Wis. By this invention a frame is supported yieldingly above a base, with an upholstered seat, and an adjustably connected upholstered back, the whole arranged after a novel plan, to provide a portable, inexpensive, and comfortable seat for the engineer of a locomotive.

RAIL CLEANER AND LUBRICATOR. — Horace T. Currie, Albina, Oregon. This invention consists of nozzles connected with a liquid supply on the locomotive and adapted to be projected within a short distance of the rails, to remove the sand from the rails at the rear of the driving wheels, and to lubricate the rails, to permit the car wheels to run smoothly.

Agricultural.

SHOCK COMPRESSOR.—Joseph C. Vail, Maple's Mill, Ill. This is a device having a pointed shaft to thrust into the body of the grain, with a cross bar handle for turning it, while a cord is connected with the shaft and drawn tightly around the shock as the shaft is turned, to compress and bind the shock ready for tying.

HAY PRESS.—Frank Donald, Denison, Texas. This is a press of novel construction designed to work easily and rapidly, and to operate in such manner that the hay cannot clog it, the plunger or follower being automatically reciprocated by a continuous motion of the main pulley, while the tension is very easily regulated.

Miscellaneous.

WHIFFLETREE COUPLING. — John J. Kocher, Los Angeles, Cal. This invention covers a novel construction and combination of parts by which it is designed to avoid the difficulties incident to the use of the ordinary whiffletree bolt, such as its twisting or breaking and the bolt getting loose, the construction affording interlocking portions which keep the whiffletree snugly in place and yet permit the necessary play.

HAME HOOK.—William J. Dankworth, Gatesville, Texas. This hook is composed of two members hinged together and adapted to be clamped upon a hame staple, one of the members having a pin adapted to project into an opening in the opposite member, the construction being strong and simple and the hook quickly and easily applied to securely hold a trace.

TETHER PIN. — Loris P. Carl, Perris, Cal. This is an adjustable pin with a swivel device for the connection of a tether rope thereto in a manner designed to avoid the fouling of the tether, the device being simple and inexpensive, and affording means for quickly securing the halter or tether rope to the ground at any desired point.

MARTINGALE ATTACHMENT. — Stillman E. Mathews, Fullerville, N. Y. A rigid bar has a fork at one end carrying a bit to be connected to a bridle, a sleeve adjustable on the rod being attachable to a breast collar or strap of the harness, to coact with the ordinary riding or driving bridle and afford means to control the head of the animal and hold it up as desired.

LEGGIN HOLDER. — Alfred Steiner, New York City. This holder consists of radiating limbs with hooks adapted to engage the marginal edge of the foot-covering portion of the leggin, the device being cut or stamped from thin sheet metal, and to be worn on the bottom of the sole, to hold the front portion of the leggin down, and thus afford complete protection to the entire foot.

CARPET OR OIL CLOTH STRETCHER.—Andrew R. Anderson, New York City. The stretcher bar has at its rear end a presser plate and at its forward end a fixed clamping jaw, a relatively moving clamping jaw being pivoted to the stretcher bar, an operating lever being connected by a link with this jaw, making a device which can be quickly and easily adjusted to stretch oil cloths or carpets without injury.

ANTI-FOULING PAINT. — Nicholas B. Dennys, London, England. This is a paint for the protection of ships' bottoms or other submerged surfaces of metal or wood, and is made of sulphate of zinc, sulphate of mercury, oxide of iron, oxide of copper, zinc slag, metallic zinc, tannin and other ingredients, in proportions stated, and mixed and applied in a manner described, being designed to be very effective and durable.

DOOR HANGER.—Johnson B. Flanders and John M. Smith, Toledo, Ohio. This is a device specially adapted for hanging the sliding doors of railroad cars, gates, etc., and is of very simple and inexpensive construction, and not liable to get out of order, or clogged up by ice or snow to bind on the guide rail.

FIRE ESCAPE.—Henry C. Moir, Sydney, New South Wales. Combined with an endless guide rope adapted to run over pulleys on the outside of a building is a basket of asbestos or other fireproof material, connected to one end of a rope whose other end is attached to a spring drum on the inside of the building, with other novel features, to facilitate the escape of the occupants from the upper stories of a burning building.

ENVELOPE. — Herman A. J. Rieckert, New York City. This envelope has openings in its back and cover flap, and a separate flat strip adapted to engage the openings to interlock the back with the covering flap, serving to prevent the opening of the envelope by steaming or otherwise and afterward resealing it, making an article especially designed to safely contain valuable documents, and preclude the contents being meddled with by unauthorized persons.

FISH HOOK.—Joseph Stretch, Newark, N. J. This hook has two jointed hook portions with their barbs concealed when in closed adjustment, but adapted to open and spread when the bait is seized by the fish, whereby the capture of the fish is rendered more certain, while the device is simple in form and inexpensive to manufacture.

ANIMAL TRAP.—Henry H. May, New Albion, Iowa. According to this invention a turnstile contained in the trap is designed to act automatically the moment the platform is pressed, and before the bait is touched, to force the animal from the platform into a cage or prison compartment, the turnstile automatically setting itself for a repetition of the operation with the entrance of the next animal.

THILL COUPLING. — Lorenzo C. Mills, Stony Brook, N. Y. The axle bracket has a head block with a slot the top portion of which forms a pintle, while the thill iron has an extension with a recess on its under face, and a spring on the thill projects through the slot of the bracket, whereby the thills may be readily attached and detached, the construction also forming an anti-rattler.

END GATE FASTENING.—John J. Cook, Columbus Junction, Iowa. Combined with a rocking plate and locking bars pivoted thereto is a lever with opposite cam faces adapted for engagement with the pivoted ends of the locking bars, forming a simple device to be applied to any vehicle, whereby, on the manipulation of a lever, the end gate may be released or locked in position.

ANTI-FRICTION BEARING. — Phineas Arnold, Canal Dover, Ohio. This is an improvement especially designed for use with the axles or shafts of wheeled vehicles, two sets of friction rollers with spherical ends being arranged within the journal box, one set of rollers being separated from the other by a central steel washer, and there being also washers at each end of the box.

HOLDBACK FOR VEHICLE POLES.—Henry W. Roberts, Cheboygan, Mich. The pole iron is made with a racked surface, and the holdback with a corresponding surface, with means for adjustably attaching it to the pole iron, the device being attachable to all sorts of vehicle poles to bring animals of different sizes into the same relation to the load without changing the length of the tugs.

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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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Minerals sent for examination should be distinctly marked or labeled.

(2773) F. C. C. asks: 1. Have any people been killed while riding on electric street cars, or while getting on and off the cars, simply by a "shock" from the motor current? A. No. 2. Is that current strong enough to kill persons should they receive the full force of it through their bodies? A. It is in some systems. 3. Is this system of street car service more dangerous to ride upon than the horse or "grip" systems? A. We think not.

(2774) F. A. B. asks: 1. Why does a telephone buzz when near an electric street car line or after the current is turned on the electric light wires at night? A. The "buzz" is due to an intermittent, variable, or alternating current produced in the telephone wire by induction from contiguous electric wires carrying heavy currents. 2. Is there any remedy for this, any devices to overcome it, and where could these be obtained? A. The only remedy is to work the telephone on a metallic circuit, *i. e.*, use a return wire instead of the ground. The currents induced in the two telephone lines by the light or power lines will be in the same direction in both lines, and will consequently neutralize each other in the telephone.

(2775) D. J. P., Weymouth, asks for the best solution (not paint) to use on wood for the purpose of rendering it fireproof. A. Tungstate of soda is of high value as a fireproof agent. Phosphate of soda is also efficacious. The great point is to secure good absorption by the wood. Such solutions are sometimes used for match splints to prevent them burning with a glowing end after extinction.

(2776) X. Y. Z. asks how to make whiting into a cake, so that by rubbing a cloth on it lightly it will take up enough to polish any substance with, and thereby prevent the waste and dust as when used in the form of powder. A. Use plaster of Paris or dental plaster; mix with water. Do not rub the cake directly on the metal to be polished, as this may wear it or scratch it.

(2777) H. N. M. asks: What is the difference between frictional electricity and dynamic electricity? I mean in quality, or is there any difference? A. None scientifically. Practically, what you call frictional electricity is of vastly higher tension or E. M. F. and of lower average intensity than the other. One is also considered high tension electricity in repose, the other low tension electricity in motion. But there is no real difference between them.

(2778) J. G. W. asks: How best to paste a large paper map on cloth, and have it smooth. A. Stretch the muslin on a flat table, tacking the edges if necessary, spread the paper face downward on another table, and rub it over with perfectly smooth flour paste. If necessary, the paste must be passed through a fine wire sieve. If properly made, this will not be required. Then lift the paper and place it paste side downward on the muslin. Lay another piece over it, and rub it down with the hand.

(2779) B. B. asks: How can drawings or diagrams be cheaply and easily made for lantern use without the aid of photography? A. Take thin transparent sheet zylonite or celluloid and wash thoroughly with water. When dry rub with fine whiting, to remove all grease. Drawings or writing can now be placed on the zylonite as easily as on paper. Tracings can be readily made which are better than those on gelatine. Clamp the finished work between two glasses 3¼ by 4 inches, and bind the edge with paper.

(2780) E. U. S. asks: Will you please inform me the best remedy you know of for catarrh or cold in the head. A. Where the case is an uncomplicated one and the galvano-cautery is not needed, the following prescription, used as a gargle, and for snuffing up the nose, will be found efficacious. Equal parts of salt, soda bicarbonate, and borax; mix thoroughly and use a salt spoon of the mixture to a cup of warm water. *Never use the solution cold*, and not more than three times *daily*.

(2781) L. A. C. asks: 1. Would the exact center of a perfectly revolving shaft remain stationary or revolve? A. All material parts of the shaft revolve. The axis—a purely hypothetical thing—does not revolve. 2. Is there truth in the often-heard statement that one part of a carriage wheel revolves faster than the other part? If so, explain. A. All parts of the carriage wheel revolve with the same angular velocity. The forward motion of the top of the wheel is twice that of the axle. 3. Please explain why it is necessary for the pendulum of a clock to be lengthened as the clock approaches the earth's poles, in order to make its vibrations similar to those of a like clock at the equator. A. The earth being flattened at the poles, allows the pendulum to come nearer the earth's center than it could at the equator; in consequence of this and the absence of centrifugal force at the pole, the earth has greater power over the pendulum, and accelerates its vibration, thus causing the clock to gain time. The remedy for this is to lengthen the pendulum. 4. Is it possible to speak into one telephone and hear your own words through another telephone at approximately the same time? If possible, under what conditions? I tried speaking into one telephone and holding my ear to another at the same time, but I could not hear anything. The instruments were not placed very far apart on the circuit. A. The direct effect of the voice upon the ear is so great as to drown out the sounds from the telephone.

(2782) E. M. H. asks: 1. Would two one quart cells of Bunsen battery develop enough power in the motor described in the SCIENTIFIC AMERICAN SUPPLEMENT, No. 767, to run a small fan, say 15 inches diameter, in the summer time, and if so, about how many hours would it run before becoming exhausted? A. It would probably require four or six such cells to run the fan successfully. The battery would run its motor for 24 or 30 hours. 2. Would the above named cells develop sufficient power in the motor described in SCIENTIFIC AMERICAN SUPPLEMENT, No. 783, to do the same work, and would the battery run it as long as it would motor above named? Would like to have run all night. A. The motor described in SUPPLEMENT, No. 783, would run a very small fan with two cells of Bunsen battery. 3. What size wire should be used for the winding of the field magnet of the motor described in No. 783 of the SCIENTIFIC AMERICAN SUPPLEMENT? A. No. 24.

(2783) A. G. asks: I recently saw in a printing office a new process of making newspaper cuts. The material consisted of a dark steel plate coated with a white composition, through which the drawing was scratched with a sharp steel point, thus forming a matrix for the stereotyper. Can you give us a recipe for the white coating used? A. The composition is essentially flour paste and whiting. The surface of the plate should be slightly roughened with sandpaper and rubbed over with the white of an egg first. Other formulas are used, but are generally kept secret. Sometimes silicate of soda is used instead of paste. Also see SCIENTIFIC AMERICAN SUPPLEMENT, No. 720.

(2784) A. N. asks: What is the composition of the size used by the book binder to make his gold leaf adhere to the leather before applying his heated lettering type. A. The size used is albumen; the white of an egg beaten, allowed to settle, and diluted with water. The portion heated by the type or stamp becomes insoluble. The portion of the size not subjected to heat may be washed off with a moist cloth or sponge.

(2785) W. H. asks which is the finer gold—a ring of eighteen carat or a gold coin. A. 18 karat is ¾ gold and ¼ alloy. United States gold and silver coin is nine-tenths gold and one-tenth alloy. The gold coin is much finer than the ring in question.

(2786) W. S. C. writes: I have been making some Leyden jars according to directions given in Hopkins' "Experimental Science," and have had trouble owing to the conductivity of the glass, caused, I presume, by the metallic oxides used in their manufacture; some of them conduct so freely as to discharge the electroscope. Could you advise me what kind of glass to use and where it could be procured? A. Use jars made of soda glass. A jar can be tested by temporarily wrapping it with tinfoil, and placing tinfoil scraps or metal filings within it. If it is found to leak rapidly after charging, it must be rejected.

(2787) P. M. writes: I have a barrel of vinegar, partly made of cider and partly of whisky, which has turned into an iron-like black color. Will you be kind enough to let me know if it can be clarified to look white again? A. If it does not clarify on standing, try filtering through boneblack. Or add a little solution of pure gelatine. Experiment with a small portion first.

(2788) J. D. B. asks: Can you give me a receipt for treating oleine so as to make it suitable for paint oil? Have tried ammonia, borax, soda, alum with muriatic acid, which clarifies it nicely, but it will not dry; to be used for barn paint. A. Oleine will only dry with great slowness, if at all. Heating with litharge will bring it to the condition of lead soap, when it will dry more easily. This, however, will change its nature and appearance. We doubt if you will succeed.

(2789) J. D. asks: 1. What is the meaning of Fahrenheit? A. Degrees of the Fahrenheit thermometer; each one indicates 1-180 of the difference between the temperature of melting ice and that of condensing steam at atmospheric pressure. 2. Pounds by or to the square inch as used in the case of steam boilers. A. The pressure of the steam above that of the atmosphere, as exercised on each square inch of the boiler.

(2790) M. S. G. asks for recipes for making: 1. A tooth wash. A. Camphor ½ ounce, tincture of myrrh 2 ounces, tincture of Peru balsam 2 ounces. Rectified spirit 1 pint, oil of spearmint 10 drops. 2. A tooth soap. A. Precipitated chalk 1 pound, powdered orris ¼ pound, powdered myrrh 2 ounces, powdered white soap 3 ounces, powdered saffron 1 ounce, oil of lavender 2 drachms. Or following: Air dried Castile soap in powder and cuttle fish bone, also in powder, of each 2 ounces, honey 4 or 5 ounces, aromatics and perfumes to suit. 3. A tooth powder. A. Precipitated chalk 1½ pound, powdered white sugar ¼ pound, powdered orris root ¼ pound, powdered cuttle fish bone 2 ounces, carmine ½ ounce, oil of rose ½ drachm, oil of bergamot ½ drachm, tincture of musk ¼ drachm. There are numerous formulas for tooth preparations. We can supply books giving many receipts. Also consult query 2477.

(2791) A. W. H. asks how the bronzing of plaster casts is done. I have a natural size plaster cast of Shakespeare's face and I want to bronze it. A. The following is given as a process used in France for this purpose. Linseed oil soap is made by saponifying the oil with caustic soda and precipitating the soap with salt. It is separated, dissolved in rain water and a mixture in solution of 4 parts blue vitriol and 1 part copperas, is added as long as a precipitate forms. This is filtered out washed and dried and 8¾ ounces, are applied with 1 pound quick drying varnish, and 5¼ ounces white wax. This is applied to the surface previously heated, and is baked in if necessary. The high parts are touched up with a bronze powder. As a simpler process, shellac the bust and then gild it with bronze powder and varnish. The varnish is sold with the powder.

(2792) H. R. asks for the simplest method for preparing and moulding gutta percha and hard rubber. A. Use heat and pressure. 2. Is there anything similar that can be cast in moulds without using any great amount of pressure? A. Nothing satisfactory can be recommended. Possibly some of the manufacturers of paper pails, etc., would make up articles to suit you.

Replies to Enquiries.

The following replies relate to enquiries recently published in SCIENTIFIC AMERICAN, and to the numbers therein given:

(2655) I would say, if I were to answer Mr. E. P. H. in regard to heating burnisher, that it will burnish best at about 250° or 260°. My burnisher has a thermometer attached, and will do best work at above heat.—A. H. M.

M. E. C. says: The crusts in the tea kettle can be softened and easily rinsed out by boiling sweet fern branches and leaves in the tea kettle for awhile. Eat a few cloves for hay fever or cold in the head.

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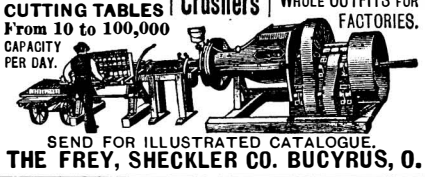

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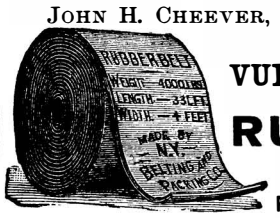

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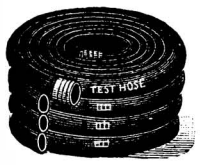

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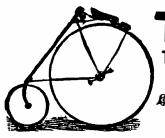

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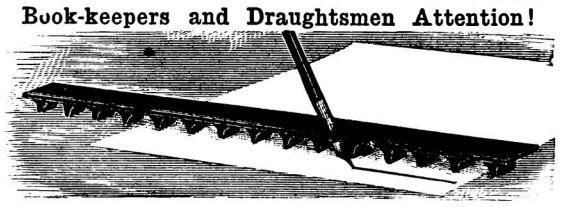

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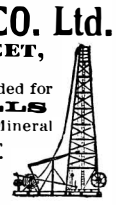

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