SCIENTIFIC AMERICAN

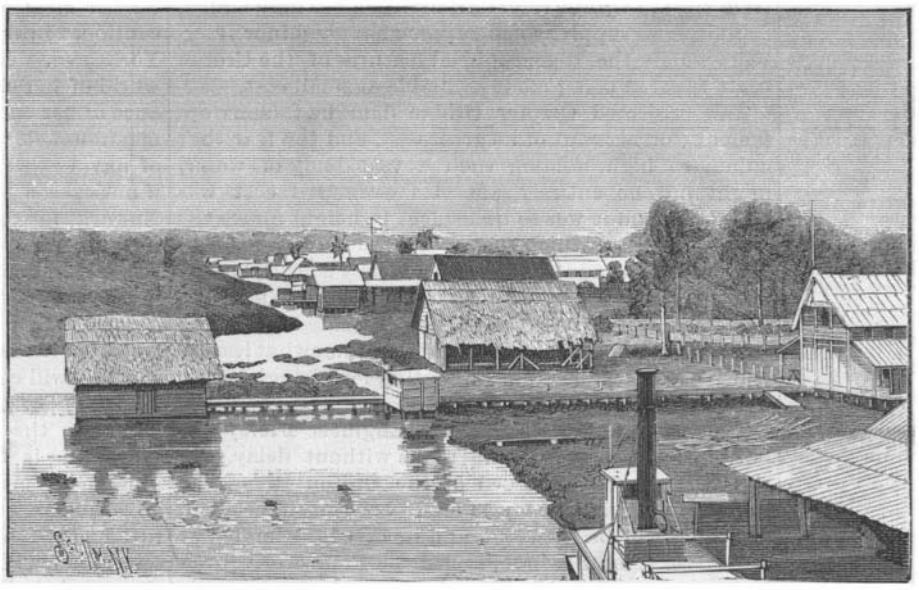
[Entered at the Post Office of New York, N. Y., as Second Class Matter. Copyrighted, 1891, by Munn & Co.]

A WEEKLY JOURNAL OF PRACTICAL INFORMATION, ART, SCIENCE, MECHANICS, CHEMISTRY, AND MANUFACTURES.

Vol. LXIV.—No. 5. ESTABLISHED 1845. NEW YORK, JANUARY 31, 1891. $3.00 A YEAR. WEEKLY.

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

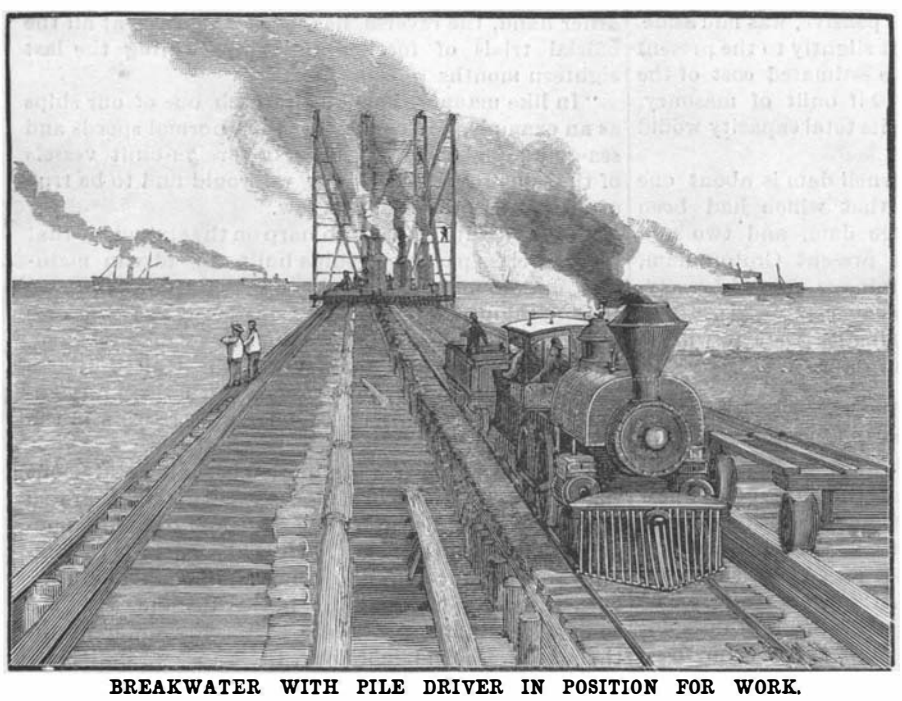


GENERAL VIEW OF GREYTOWN.

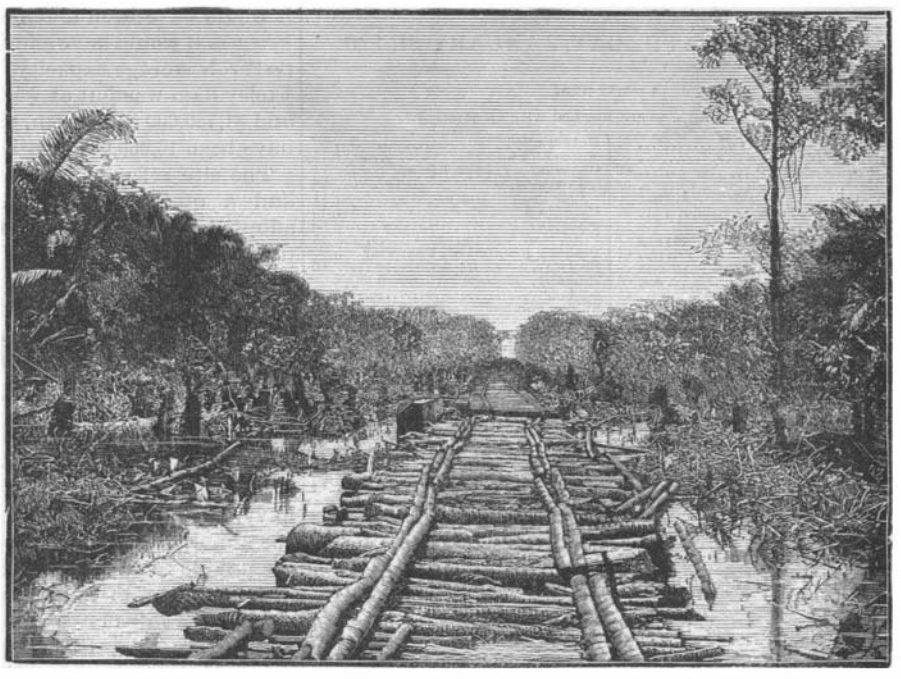
king of Lake Nicaragua. He landed at the Gulf of Nicoya. He here took to pieces one of his vessels, transported it piecemeal overland to Lake Nicaragua, and there reconstructed it. He circumnavigated the lake, found its one outlet, the San Juan River, which he could not descend. In 1523 the same king 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

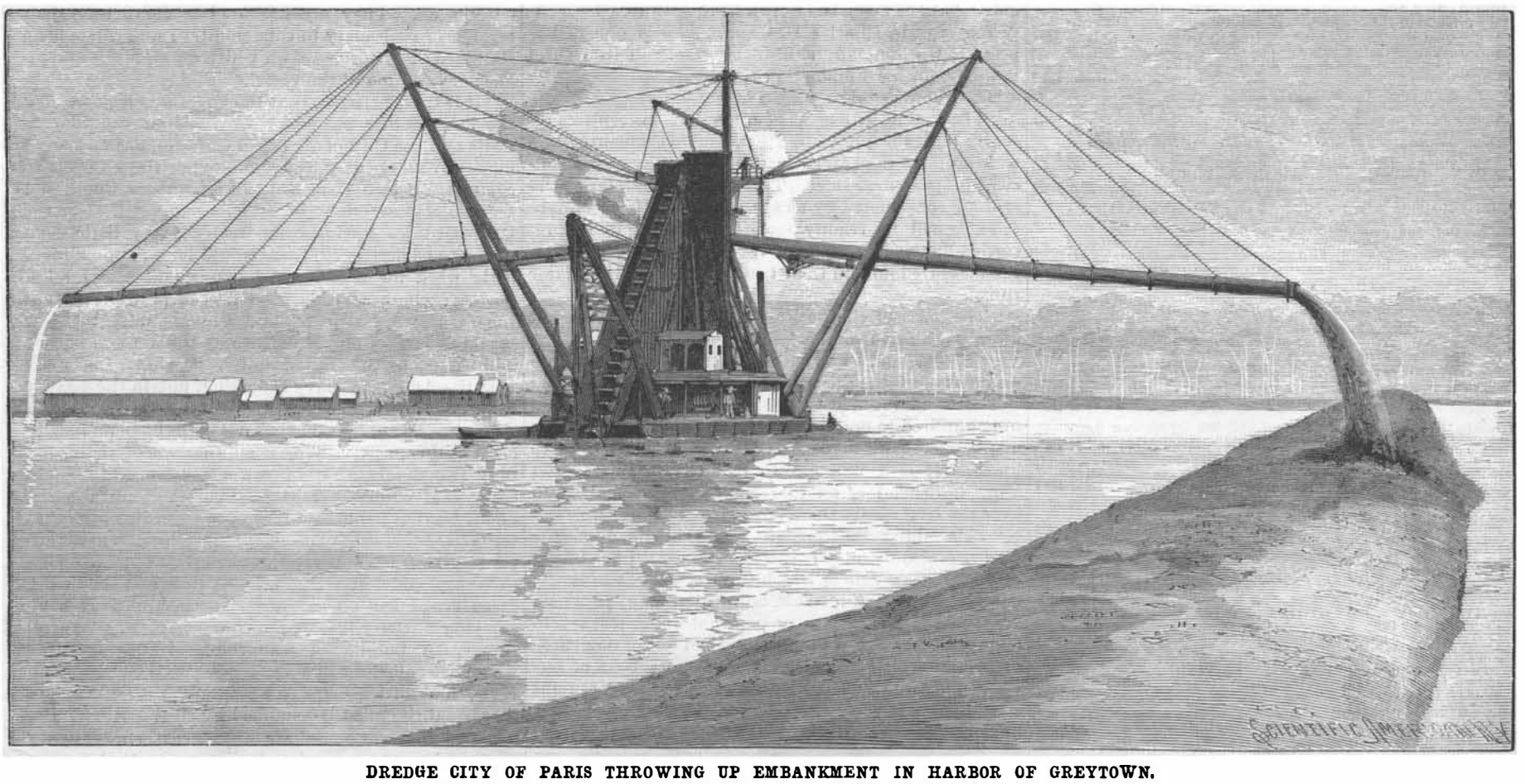
(*Continued on page 72.*)



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.

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 areof ⅝ inch steel, and have a capacity of 1 cubic meter each. The links of the chainare 1⅝ inches by 1 inch steel, and are3 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.

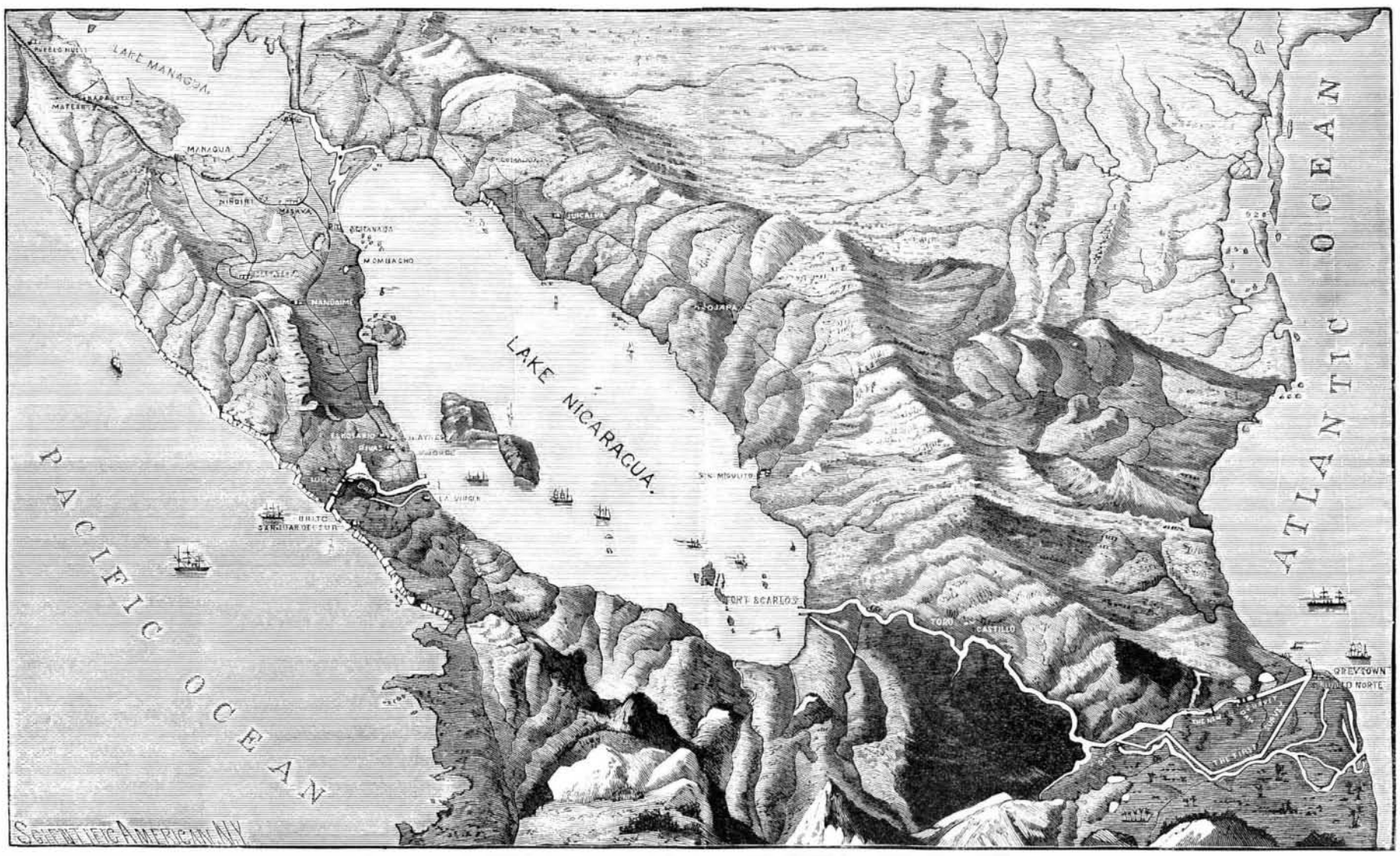
The material as dredged and raised to the top of the tower is emptied into the bell of one of a pair of iron chutes. These are pipes 3 feet in diameter and 185 feet long, which run far out on both sides of the tower. Water is pumped into them along with the solid material. Great banks of sand are built 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 103⅗ 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 head waters 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.

NOTE.—Copies of any of the above patents will be furnished by Munn & Co., for 25 cents each. Please send name of the patentee, title of invention, and date of this paper.