CURIOSITIES OF THE CENTENNIAL.--I.

We have collected a number of the most curious and interesting objects, to be seen at the Centennial Exhibition, in the series of sketches herewith given. These articles, as well as those which will follow in future issues, are mostly unique either in value, handiwork, or historical interest, or as representing some unusual phenomenon or occurrence: and hence are, we think, the features likely to remain uppermost in the mind of the visitor, while the rest of the display may be remembered in its immense entirety. The engraving inscribed

SWEDISH BOILER

represents a steam generator of Bessemer steel, which in itself illustrates the great strength of its material in withstanding effects which might, in an ordinary boiler, easily have determined an explosion. The generator was constructed at the Göteburg Engine Works, in the summer of 1869, and, with a 10 horse power engine, was placed in a small steamer. After a year the vessel returned for repairs. On examining the boiler, it was found that the crown sheet had evidently, through lack of water above it, been rendered red hot, possibly repeatedly. The pressure above had forced the plates in, as shown in the two views given, without injuring them or causing the slightest rupture, thus affording proof of the great strength of construction obtained by flanging the edges of the flue joints as well as of the excellence of the material. The plates were rolled from Fagersta (Sweden) Bessemer ingots. The diameter of the box is 2 feet 3 inches, length about 5 feet. The plates are $\frac{3}{8}$ inch in thickness, and the flanges 2 inches in width. There are four depressi ns, the deepest of which is 6 inches, and $\frac{5}{8}$ inches by 1 foot in area. The outline diagram given shows the general construction of the boiler. We also give a sketch of one of the Swedish iron exhibits, a four-stranded rope made of $\frac{3}{4}$ inch round iron and tied into a complicated knot while cold. No fracture is visible. This is but one of many similar objects displayed to show the excellence of Swedish iron. The famous

$72,000 SILVER INGOT,

exhibited in the Mexican section, looks like a huge cake, smooth and rounded beneath and having an irregular surface above. It was produced from 272 tuns of argentiferous lead, and was cupelled in a German cupelling furnace. It weighs 4,002 lbs., and thus averages 235·4 Mexican ounces to the tun of ore. The cost of production was $1.76 per tun. Its diameter is about 6 feet, and thickness at thickest part nearly 5 inches.

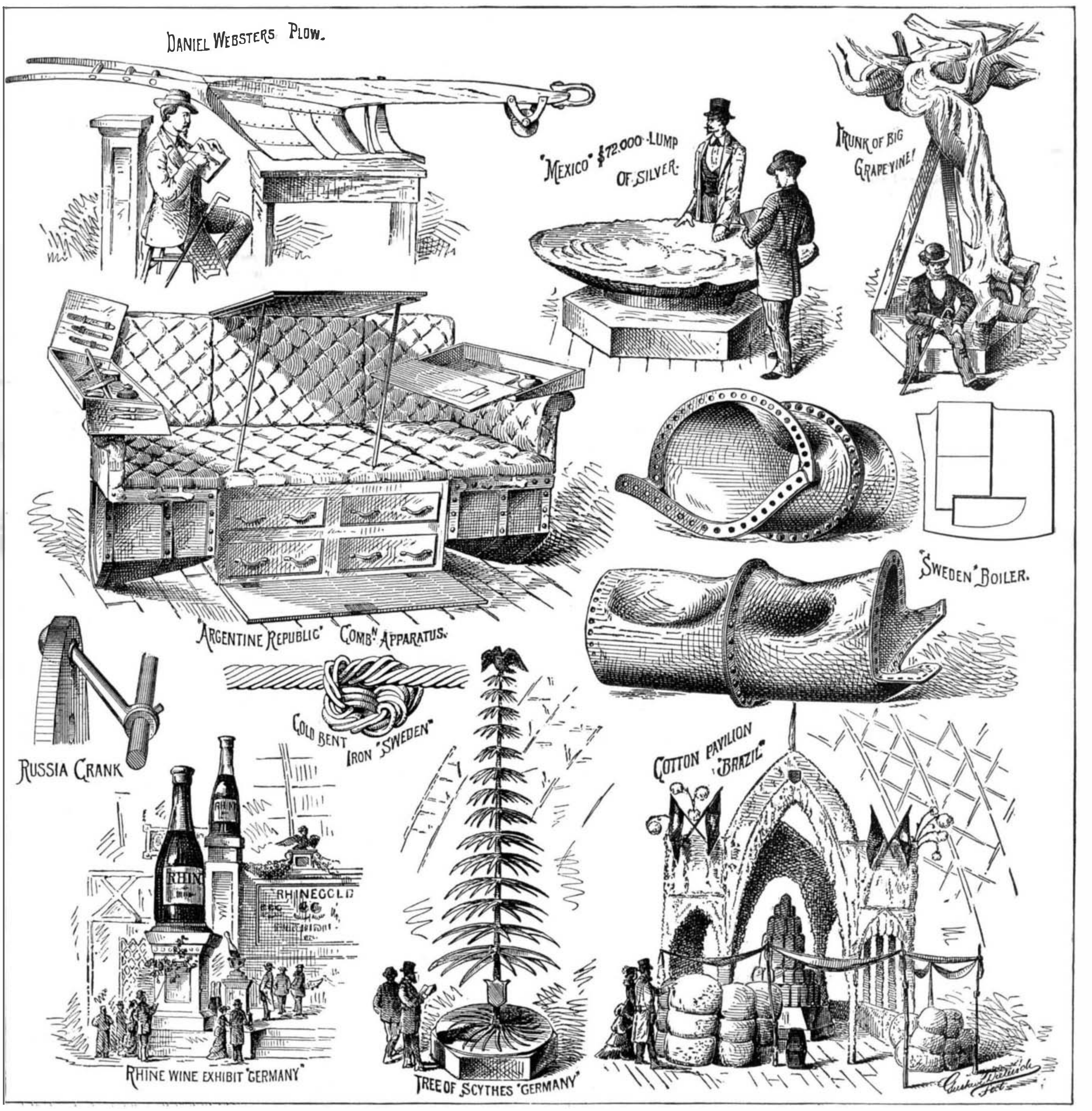
THE BRAZILIAN COTTON PAVILION

and the Rhine wine exhibit, both in Agricultural Hall, are remarkable for tasteful and striking design. The cotton pavilion is a large roofless enclosure having numerous gothic arches. The frame is of light wood, but entirely hidden by masses of pure white cotton which cover every portion. Balls of cotton on stems, to represent flowers, project from the angles, and inside the arches long fragments of the staple hang down in a graceful fringe. At a little distance the structure looks as if made of snow. Inside, arranged upon a pyramidal stand, are glasses filled with samples of fine cotton, and outside are cotton bales and similar packages, tastefully disposed. The Rhine wine exhibit is notable for the four enormous bottles which stand on pedestals at each corner of the platform. They are accurate imitations of the bottle peculiar to the variety of wine displayed, only on a colossal scale. Smaller bottles, perhaps 3 feet in hight (the large ones measure about 10 feet) are placed in huge vases and surrounded by imitation ice. Vines are trailed over the pedestals, and with painted decorations render the exhibit one of the most noticeable in the entire building. Another German exhibitor, a scythe manufacturer, disposes his productions in the form of a tree, so artistically that at first sight the object looks like a leafless pine. The scythes are turned backs up, and placed radially about the trunk. An eagle perched on the apex adds to the illusion.

To agricultural visitors there seems to be no object in the entire Exposition which possesses a greater interest than

DANIEL WEBSTER'S BIG PLOW.

The crowds around this venerable machine are immense; and if it were not for the close watch of the police, the relic hunters would probably carry it off piecemeal. It is a huge affair, 13 feet long, its beam measuring 9 feet 1 inch and its handle 6 feet four inches. The share is 16 inches, and its mold board 20 inches, in width. It was made by the great Webster of colossal brain himself, in 1837; and although rudely constructed and bearing the marks of age in numerous cracks and weather stains, it looks capable of good service yet. That it once did great work we have the famous statesman's own word. In one of his speeches, he says: "When I have hold of the handles of my big plow, with four yoke of oxen to pull it through, and hear the roots crack and see the stumps go under the furrows and out of sight, and observe the clean mellowed surface of the plowed land, I feel more enthusiasm over my achievement than comes from my encounters from public life in Washington." This extract is posted up beside the plow, and we suppose it may be found in a great many more note books than in the 50,000 copies of the present issue of the SCIENTIFIC AMERICAN. We watched one aged and enthusiastic granger study it till he knew it by heart, and then depart, repeating it over to himself, in tones and with gestures doubtless born



SOME REMARKABLE EXHIBITS AT THE CENTENNIAL of a vivid reminiscence of the "Great Expounder's" matchless oratory.

AN INGENIOUS MECHANICAL DEVICE,

whereby the reciprocating of a piston is transformed into rotary motion, and the piston at the same time oscillated on its axis, exists in the Russian valveless engine. As represented in our sketch, there is an arm attached rigidly to the piston rod, and having on its end a ball which enters a socket near the periphery of a disk. The latter answers for a flywheel, and is rotated by the arm as the piston rod reciprocates, while the rod itself is vibrated. The effect of oscillating the piston is to open and close the steam valve passages suitably arranged therein.

We have hitherto labored under the idea that in ingenious combinations of furniture our American inventors excelled the rest of mankind. But now we doubt it. There is an exhibitor from the Argentine Republic from whom our inventors may take lessons. He contrives to stow more utterly diverse articles into a smaller space than any one we ever saw; his furniture is at once a puzzle and succession of surprises. No drawing would do justice to the principal object which he displays. It is a dressing case which contains everything in the housekeeping line, from a coal cellar up. There are places for utensils, for blacking boxes, for cigars, hair brushes, garments, gas stoves, provisions; and the rest a New York *Herald* exploring expedition might profitably be fitted out to discover. If there is a cradle and baby tender also combined, and we dare say there is, the young housekeeper needs nothing more to complete her *ménage*. For people who have no fixed abode, but who "live in trunks," this South American inventor provides a less complicated but none the less ingenious combination, which is depicted in our sketch. To begin with, there is a trunk about as large as the average "Saratoga," presenting nothing remarkable in aspect except an exterior strength calculated to defy the most persistent baggage smasher. You seize the top, throw it over sideways in two portions, lift up and open out the back part, and behold the trunk is a comfortable lounge. Where are the garments? In the drawers under the seat, which the fall of a false front piece reveals. Is a table needed? A flap hung to the back is raised and firmly supported by props. One arm may be developed into a writing case with all the appurtenances, the other into a dressing box containing all the toilet articles. The empty spaces in the lid are to be utilized. Step around to the rear, pull on a couple of knobs, and there are two small tables set with plates, knives, forks, tumblers, napkins, and all the *et ceteras*. That trunk is an exposition by itself.

THE CALIFORNIA MAMMOTH GRAPE VINE

is exhibited in Agricultural Hall, and is probably the largest vine in the world. It has produced yearly 12,000 pounds of the variety known in California as the Mission grape. It was planted by Doña Maria Marcelina de Dominguez, according to the custom of the country, at the birth of a child, some sixty years ago. For several years it has shown signs of decay, and was dug up, sectionized, and boxed for removal to the Exposition. There the sections are bolted together, and the vine is set up as nearly as possible in its natural position. It is, of course, very irregular in shape, so that no definite dimensions can be given. The size of the trunk can, however. be estimated from that of the figure represented beside it.

Correspondence.

Boiler Explosions.

To the Editor of the Scientific American:

In the last number of the SCIENTIFIC AMERICAN I read your notice of a disastrous boiler explosion at Pittsburgh, Pa., in which you state that "no cause is yet assigned for the casualty," and that 'the boilers were inspected some five weeks ago, and were then in good condition." There has been much argument on the subject of boiler explosions; and from an everyday experience of nearly forty years in the construction and management of steam boilers of various kinds, I will venture to give you my opinion on the subject, although I shall differ from many.

In the first place, I think there is one, and only one, cause of boiler explosions. and that is the want of a sufficient quantity of water. But a boiler may be burst from many causes. You will see here that I draw a distinction between the explosion and the bursting of a boiler. An explosion is an expansion with great force, followed by a violent report, and a burst is simply a liberation from confinement, without the great force and violent report of the explosion. Bursting may result from various causes, such as a weak or defective boiler, an over pressure of steam, or water, or air, as the case may be. A boiler may be made defective in several ways. First, by letting dirt and sediment collect on the bottom of the boiler, which is directly over the fire. Boilers can be and are very frequently burnt entirely through in this way. Second, by using inferior qualities of iron in the construction. Third, by poor riveting. Fourth, by injury in testing, by subjecting the boiler to more pressure than the iron is capable of bearing. Fifth, by freezing. Sixth, by the present ruinous practice of blowing the water out of the boiler under a pressure of steam, and while the fire box or bridge wall is still hot. The consequences of this practice are cracked sheets, broken rivets, grooving, etc. Moreover the dirt and sediment dry and adhere firmly to the iron, and form a crust or scale; while if the water was drawn off cold, the sediment would be soft, and the most of it would be drawn off with the water, or at least could be washed off.

A boiler may be burst either by steam pressure or hydrostatic pressure, and the destruction of property be the same; but of course life would be endangered by scalding water and steam. The bursting of a boiler makes little or no report, no more than the opening of a safety valve or a blowing-off valve. But a boiler is seldom allowed to burst, as timely notice is usually given by the leakage of steam and water from the defective part. Not so with an explosion. This agent of destruction never seeks the weak places of a boiler; and the strength and thickness of a boiler has nothing whatever to do with its explosion. In fact the stronger a boiler, the more terrific the explosion, and the more disastrous will be the effects. And as far as boiler inspectors are concerned, they can pronounce a boiler good or bad, and determine its liability to burst, but that can do no good in preventing its explosion. That depends wholly on those having it in charge.

Boiler manufacturers are often and unjustly blamed for the explosion of a boiler which, I repeat, can only occur from the want of a sufficient quantity of water, caused by the carelessness or inexperience of those in charge of it. If employers were more careful to secure competent engineers, there would be fewer explosions. There need be none.

L. B. DAVIES.

[For the Scientific American.]

THE MERITS AND DEMERITS OF LINNÆUS.

To the great Swedish naturalist Linnæus, who was born in the year 1707, belongs the honor of having first originated a system of classification of the vegetable and animal kingdoms, which system (although Linnæus himself remained perfectly orthodox, believing in the theory of special creations) contained in itself the germ of the evolution doctrine, now grown to such mighty proportions. In regard to the account of the creation given in the book of Genesis, we must (with Haeckel) acknowledge that it reveals two grand fundamental ideas, namely, differentiation and progressive development of the matter "created" "in the beginning." Together these form a grand conception. perhaps, far more important to the truth of the narrative than the now ascertained error of considering this little earth as the center of the Universe, around which sun and stars revolve. This error was confuted by Copernicus, Galileo, and their successors. Another important change in the popular ideas of creation, namely with regard to the position of man in the whole scheme, has been effected by Lamarck, Darwin, and others. It is strange that theologians should so frequently, as they do, content themselves with asserting the literal accuracy of so ancient a book as the Bible, which has suffered severely by the course of tradition and the vagaries of translators, in place of confining themselves to the grand moral lessons and the pure religious principles it inculcates. The Bible is not a text book of natural science, nor has it ever pretended to be one.

The great progressive step made by Linnæus was as simple as it was rich in results. It was the designation of each plant and animal by two names. The first, the genus, was given to each family of plants or animals; while the second, the species, gave greater definition and more individuality to each single plant or animal. Thus, for instance, he included all animals resembling the tiger, whether large or small, under the genus *felis*, and he used the name for the whole class; and he added a second name for the species to which the animal belonged. Thus, he called the common tiger *felis tigris*, the lion *felis leo*, the panther *felis pardus*, the jaguar *felis onca*, the wildcat *felis catus*, and the house cat *felis domestica*. This method was perhaps suggested to him by the custom in society of having family names and baptismal names, by which members of the same family may be distinguished. Before the time of Linnæus, the different names of the individual plants and animals formed a perfect chaos; but the dual nomenclature not only necessitated a classification, but became its basis. The two names soon proved the value of the system, as by them attention was drawn to the similarity and relationship between the various plants or animals. Linnæus in fact attempted to complete the whole system, and divided, for instance, the whole vegetable kingdom into 24 classes, which he subdivided into orders, these into genera, and these again into species. He divided the animal kingdom into 6 classes, which were again subdivided into many orders, genera, and species. Notwithstanding that his classification has been modified, and has been based on facts since ascertained to be more fundamental than those on which he grounded his theory, the honor of the reform belongs to him: although he was often in doubt, especially whether some particular animal had to be considered as a separate species, or only as a variety of the same species. He even went so far as to admit that hybrids may constitute the origin of new species, and even that a great number of new species had originated by the interbreeding of other species. This opinion was very remarkable as that of a man who had already accepted the theory of the miraculous creation of every species; and it would have been in direct contradiction to his creed, were it not that he had claimed as an exception to the rule that some species were originated by hybridism or incidental changes: and all that Lamarck and Darwin did was to extend Linnæus' exceptional theory to the origin to all species whatsoever.

In regard to the origin of the distinct species, Linnæus, as before remarked, believed in special acts of miraculous creation, and adhered strictly to the Mosaic account, according to which plants and animals were created by God, "each after its own kind." Linnæus expanded the idea, and went into details, expressing the belief that, originally, either a single individual or a pair of each animal or plant had been created. He believed that "man and wife created He them" of every species which exists in two sexes; however, in those cases where every individual is possessed of both sexual organs, as is the case with many kinds of snails, worms, parasites, and the majority of plants, Linnæus believed that God created only one individual, as this was sufficient. Linnæus further believed that, in the deluge, all the then existing organisms were drowned, except the few individuals of the various species which were saved in Noah's ark, and afterwards put ashore on Mount Ararat. The geographical difficulty of widely differing animals and plants living together when put ashore, he explained by the fact that Ararat, in Armenia, is situated in a warm climate; and being more than 16,000 feet high, it unites in itself all the conditions for affording diversity of climate to suit animals of different zones. The animals accustomed to the climate of the polar regions, such as polar bears, could therefore at once ascend to the cold snow-covered summits; those accustomed to a warm climate could go to the foot; while the inhabitants of the temperate region could remain where they were, half way up. From this mountain, he asserted, the animals distributed themselves afterward again over the whole earth.

Haeckel makes a serious objection to the possibility of existence of a single pair of animals of each kind at the same time. He says that, for the first few days after the creation or after the deluge, the carnivorous animals would have eaten all the herbivorous cattle, the lions and tigers would have eaten the single pairs of sheep and goats in existence; while the herbivorous animals would have eaten as once all the single plants before there was a chance of propagation. Certain it is that the balance in the economy of Nature, such as we see it now, could never have existed if only one single pair of each species had been created at the same time. It is seen, then, that the hypothesis of Linnæus is scarcely worth a serious discussion; and when we consider that he had a clear head and excellent reasoning powers, it is indeed very doubtful if he could believe in it himself.

This hypothesis prevailed, however, for about a century without being disputed; and this was perhaps partially due to the merits of Linnæus as a naturalist, and the great renown he had earned by his systematic description of the works of Nature. This, added to the prevailing idea of considering the Bible to be intended to teach the sciences, retarded the acceptance of sound and correct ideas concerning the institution of the Universe.

In closing this review of the merits and errors of Linnæus, we cannot abstain from expressing our surprise that Professor Huxley, in his recent lectures in this city, selected Milton in place of Linnæus as the defender of the six day miraculous creation. Milton should be considered by every one as drawing on his imagination, and availing himself of poetical license to the fullest extent. He was no scientist, but a poet; and he should on this account not be held responsible for his *quasi* scientific opinions. But Linnæus was a scientist, and his opinions, hypotheses, and theories fall within the pale of scientific criticism: and he was especially scientifically definite in all he said and wrote. If Professor Huxley selected the poet because everybody knows Milton and his works, we may suggest that some information about the great naturalist Linnæus and his services to Science would have served the purpose, of bringing out the truth of the evolution theory, far better than the beautiful poetical dreams of "Paradise Lost."

P. H. VANDER WEYDE.

The Thirty-Eight Ton Gun.

For some little time past a substantial target has been in course of erection on the experimental grounds at Shoeburyness, England. The object of this structure was to ascertain the measure of power of the 38-ton 12½-inch gun at the muzzle. This object was satisfactorily accomplished on Wednesday afternoon in the presence of a large number of officials connected with the War Department, besides officers of both branches of the service. The target was composed of three plates of John Brown and Company's make, each plate being 10 feet wide, 8 feet high, and 6¼ inches thick. Between the plates were 5 inches of teak packing, bringing the total thickness of the target to 20¼ inches. The plates were bolted together in couples, the first to the second and the second to the third, with sixteen 3 inch Palliser bolts. The target was supported in the rear by horizontal and vertical bracing formed of 14 inch square timbers with raking struts abutting upon piles of the same scantling, the latter being stayed against an old target. At the side of the target were placed some old 6 inch armor plates on end strutted with timber, and on the top were some old 8 inch plates tied back to the target with old railway bars. A trial shot was first fired at an old 10 inch armor plate with a charge of 130 lbs. of 1·5 inch cube powder and an 800 lbs. Palliser shell made up to weight with sand. The shell struck the plate with a velocity of 1,436 feet per second, punched a clean hole through it, snapped short a 14 inch pile a couple of feet behind it, and broke up against an old target. The round against the new target was fired with a similar charge to the foregoing, the range being, as before, 70 yards. The shot, which had a striking velocity of 1,421 feet per second, punched a clean hole 13 inches by 12½ inches in the front plates, and passed through the middle into the rear plate, where it broke up. The base of the shot with a portion of the walls was left in the hole, but the point, with 9 inches of solid metal, struck against the rear target some 10 feet off. and rebounded to a distance of 20 feet to the right proper of the target. The rear plate was considerably buckled, but the iron around the shot hole was not cracked or started, the metal showing a fibrous fracture