

## Correspondence.

## A Correction.

To the Editor of the SCIENTIFIC AMERICAN :

By a slip of the pen—I will not accuse the types—the statement appears, at the end of my article on the "Heavens in December," in the SCIENTIFIC AMERICAN for December 2, that there will be a nearly total eclipse of the sun on the evening of the 16th. Of course, it should read the moon. GARRETT P. SERVISS.

## Krupp and Harvey Armor Compared.

To the Editor of the SCIENTIFIC AMERICAN :

Will you kindly give me the following information: First. How much more efficient is the Krupp armor believed to be than the Harveyized? That is, what thickness of Krupp armor is believed to be the equivalent in resisting qualities of what thickness of Harveyized?

Second. What is the proposed total displacement (a) of the battleships of the "Maine" and "New Jersey" classes, and (b) of the large armored cruisers recently authorized, and what proportion of the total displacement in each of these classes will be taken up by the armor, and is this on the supposition that the armor is to be Harveyized or Krupp?

What I wish to show to a member of Congress, whom I hope to interest in the matter, is just what the increased expense would be of giving one of these vessels Krupp armor over that required for Harveyized armor of the same efficiency, and also what saving in displacement would be gained by this increased expense which could be devoted either to more complete armor protection or to increasing the coal, ammunition or other supplies.

I believe that you have already published these data, or some of them, but I cannot at once lay my hand on the number of your paper containing the article. If you could simply refer me to the number, it would probably answer my purpose.

EDMUND M. PARKER.

89 State Street, Boston.

[Krupp armor is about 20 to 25 per cent more effective than Harveyized; a 6-inch Krupp plate being equivalent to a 7½-inch Harveyized, and a 10-inch Krupp to a 12½-inch Harveyized, and others in same ratio. This is probably more applicable to thick than to thin plates, the difference being less in thin plates.

The displacement of the vessels of the "Maine" class is 12,500 tons, and 20 per cent of the same is allotted for armor, i. e., about 2,500 tons.

The vessels of the "New Jersey" class will have a displacement of 13,500 tons and will be allotted about 2,700 tons of armor each, equivalent to 20 per cent of their displacement. The amount of armor will be the same whether Krupp or Harveyized is used, but, of course, the protection will be considerably better if Krupp armor is used, and the cost will also be greater.

The quantity of armor to be carried by the large armored cruisers authorized by last Congress is not yet definitely settled, but probably it will be 10 to 12 per cent of their displacement of 13,500 tons; that is, between 1,350 and 1,620 tons. It will be the same whether Krupp or Harveyized armor is used.

The armor plan for the "Maine" contemplates the use of Krupp armor for the thicker plates and a small quantity of Harveyized armor for the thin plating. The total amount of armor called for is 2,492 tons, costing at \$545 per ton for Krupp and \$411 per ton for Harvey armor, \$1,333,783. To obtain the same protection using Harveyized armor exclusively would require 3,069 tons, costing \$1,261,972, an increase of 577 tons, which is not admissible. We may say, therefore, that the use of Krupp armor means a saving of 577 tons in displacement, as compared with the use of the Harvey armor, the saving being made at an increased cost of \$71,816.—ED.]

## Passenger Car Lighting.

At the last meeting of the Southern and Southwestern Railway Club, Mr. W. E. Symons, for a committee consisting of himself, R. H. Johnson and T. S. Lloyd, presented an extended report on the comparative value, efficiency, cost and practicability of the various types of artificial lights for passenger cars. The report is taken up with descriptions of storage battery, axle light, direct dynamo, combination dynamo and storage, and Pintsch gas systems. In summing up, says The Railway Master Mechanic, the committee finds that the oil lamp, with its offensive odor, annoying heat in hot weather, damage from fire or explosion, either in train accident or otherwise, is fast becoming obsolete, except on some branch or local runs where it would be impossible to use the electric light, the cost prohibitive, or where, from the lack of storage stations, gas cannot be procured. While on all first-class trains in main line service, it would appear that either gas or electric lighting of some system was the standard.

Electricity has passed the experimental stage, says the committee, both as a power and as an artificial light, "and even if stopped in its development where

it now is, it must be considered as one of, if not the, greatest invention of the age, and certainly one of positive and enduring utility. That the unknown capacity of the American inventive genius will doubtless cheapen the production to a degree that will practically make its adoption universal we all hope for, and feel assured will be realized at a not far distant day. Owing to the development of electric and other means of artificial lights, none of these figures as to the cost should be considered as permanent or fixed, for from the strides that have been made, particularly in the reducing of the cost of production, no doubt the cost of electric and other up-to-date improved methods of artificial light for trains will be still further materially reduced, until they will be equally as cheap as or cheaper than the oil lamp or tallow candle."

The committee gives the following memorandum as to cost of application and maintenance of mineral seal oil lighting on the Plant system: Cost of lamps, two chandeliers of two lamps each to a car, \$172.50; oil consumed for lighting periods of twelve hours, one gallon per car; average cost per light per hour (twelve hour period) 0 025.

It also gives the proportion of the various systems of lighting passenger cars in the United States (Railroad Gazette statistics):

Oil lamps.....	55 per cent.
Gas.....	43 "
Electric light.....	2 "

The following average costs per light per hour are also given by the committee:

System.	Cost per light per hour.
Storage straight.....	0.007
Axle light (Moskowitz).....	0.008
Dynamo straight.....	0.083
Dynamo and storage.....	0.043
Gas acetylene.....	0.02
Gas (Pintsch).....	0.02

Figures as to the axle light and the acetylene gas were not available.

## THE CRIME OF A CENTURY.

BY PROF. CHAS. FREDK. HOLDER.

One of the most extraordinary events that has characterized the last half of the present century is the extermination, the wiping out, of the American bison. There is little use in resorting to invective or endeavoring to stigmatize those who are guilty of this crime, but it would be well if the acts could be held up in a bright light, that those who committed them might be excoriated in the time to come, when a few bones and pictures will alone tell the story of a mighty race swept from the face of the earth by the civilized people of the nineteenth century.

"In 1870, and later," said an army officer to the writer, "the plains were alive with bison, and in crossing at places I had difficulty in avoiding them, so vast were the herds. If any one had told me then that in twenty or thirty years they would have become almost entirely extinct, I should have regarded the statement as that of an insane person." Yet the photographs illustrating the present paper fairly represent the last of the bison or American buffalo, as it is popularly called.

That so many of these animals could have been killed in mere wantonness seems incredible when their vast numbers are realized. We first hear of the bison from Cortez and his followers in 1521. Montezuma had one in a zoological garden, the specimen, in all probability, having been caught in Coahuila. In 1530, Cabeza saw them in Texas; and in 1542, Coronado found a herd in what is now the Indian Territory; one of his officers describing them as horrible beasts that demoralized the horses. In 1612, Sir Samuel Argoll observed herds of bison near the national capital, and, in all probability, two hundred and eighty-seven years ago herds of bison grazed on the site of the capitol building at Washington. In 1678, Father Hennepin observed them in what is now Northern Illinois, and in October, 1729, Col. W. Bird saw herds in North Carolina and Virginia.

These and other facts have provided data by which the early geographical distribution of the bison has been determined, and it is known that this grand animal, that is to-day represented by a few individuals, formerly ranged in millions from the Atlantic seaboard to the Gulf of Mexico, from Texas to the Great Slave Lake, and as far west as Central Nevada. As to their numbers, they were like the sands of the seashore, and the accounts given by those who hunted them twenty or thirty years ago, to-day seem like vagaries of a disordered imagination. Mr. Hornaday, who has hunted in South and Central Africa, where game is remarkably plentiful, states that the bison of this country previous to 1870 exceeded, in all probability, all the African game of every kind. An army officer in service on the plains in 1867 stated to the writer that on one occasion he was surrounded by buffaloes, and that from the top of a small hill he could see nothing but a black mass of their bodies. It was impossible to estimate their numbers, and the party were in great fear lest they should be caught in a stampede, the rush being irresistible. Col. Dodge, in his memoirs,

states that on one occasion he rode twenty-five miles in Arkansas, always being in a herd of buffaloes, or many small herds, with but a small separating strip between them. The animals paid but little attention to him, merely moving slowly out of the way or advancing, bringing the whole herd of thousands down on him with the roar of an avalanche. This he met by standing fast and firing when they came within short range, the shot causing them to divide. In one day Col. Dodge killed twenty-six bison from his wagon; not in sport, but as a protection. Otherwise they would have run him down and crushed man, horses and wagon.

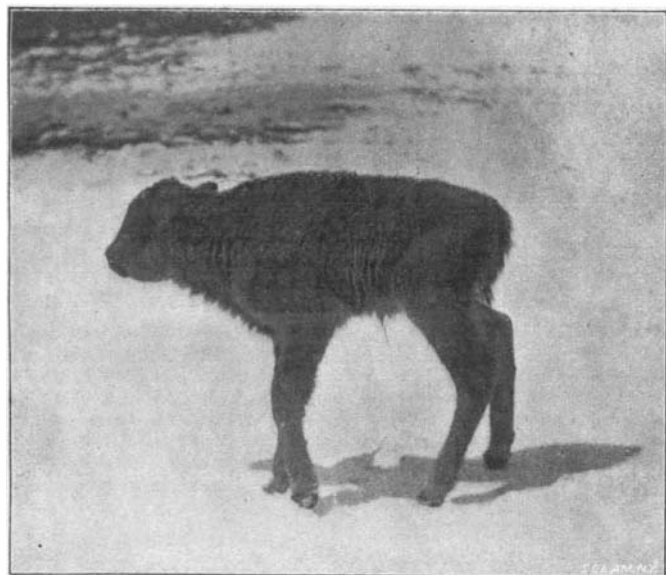
This herd observed by Col. Dodge was later found to be fifty miles wide and to occupy five days in passing a given point on its way north. From a high rock from which points ten miles distant could be seen in every direction, the earth seemed to be covered with bison. To make an accurate estimate of the numbers seen would be impossible, but Mr. Hornaday, by a conservative calculation, estimates that Col. Dodge must have seen four hundred and eighty thousand, and that the herd comprised half a million buffaloes. A train on the Kansas Pacific road in that State in 1868 passed between the towns of Elsworth and Sheridan—one hundred and twenty miles—through a continuous herd of buffaloes. They were packed so that the earth was black, and more than once the train was stopped, the surging mass becoming a menace to human safety.

"You cannot believe the facts as they existed in the days of 1871-72," said an army officer. "I was at that time on duty in the pay department, which made it necessary for me to travel on the Atchison, Topeka and Santa Fé Railroad. One day the train entered a large herd, which scattered and seemed to go wild at the shrieking of the whistle and the ringing of the bell. As we went on the thicker they became, until the very earth appeared to be a rolling mass of humps so far as we could see. Suddenly some of the animals nearest us turned and charged; others fell in behind, and down on us they came like an avalanche. The engineer stopped the engine, let off steam and whistled to stop them, while we fired from the platforms and windows with rifles and revolvers, but it was like trying to stay a tidal wave. We stood in the center of the car to await the crash, some of the men going to the rear. On they came, the earth trembling, and plunged heads down into us. Some were wedged in between the cars, others beneath; and so great was the crush that they toppled three cars over and actually scrambled over them, one buffalo becoming bogged by having his legs caught in the window. Such accidents occurred several times, and twice in one week were trains derailed by charging buffaloes, whose numbers it was impossible to compute.

Hunters have heard the roaring of buffaloes at a distance of from three to five miles, and that the earth trembled when they charged we can well imagine when the large bulls are known to weigh two thousand pounds, the cows twelve hundred pounds. The question of interest to-day is how was it possible to destroy so many animals in so short a time and what methods were employed. The natural fatalities were few compared to the enormous numbers. The cow bison displays little affection for her young, and many calves were lost every year; but all in all, the conditions were extremely favorable to them, and their increase was enormous. Many were destroyed by stampeding over precipices. In 1867, two thousand buffaloes, or half a herd, became entangled in the quicksands of the Platte River. At another time a herd was lost by breaking through the ice of Lac Qui Parle in Minnesota. The cold winters sometimes killed many that remained in the far North; but these dangers were as nothing compared to man. Man soon found that the buffaloes had a value. The Indians slaughtered them by the thousand for their skins, bone and for food; they killed one hundred oftentimes to secure five, and waste and prodigality were the rule. Yet so vast were their numbers that doubtless the Indian inroads upon them had little effect so far as extermination is concerned; but with the white man it was different. Some wished to make records, and killed for sport; some killed for the hides and heads; some became professional buffalo butchers to provide the gangs of railroad men with meat, slaughtering a magnificent animal for its tongue alone. It has been estimated that previous to 1870 nearly three-quarters of a million buffaloes could have been killed yearly and the herds kept intact; how many were killed and wasted will never be known. Each animal, however, had a value at this time estimated by Hornaday at \$5; the robe, \$2.50; the tongue, 25 cents; hindquarter meat, \$2; bones, horn and hoofs, 25 cents; and this was sufficient to attract an army of destroyers. The hides were the greatest feature, and one firm in New York between 1876 and 1884 paid the killers nearly \$1,000,000, or to be exact \$923,070, for the robes and hides, which represents the final extinction of the animal. The government never interfered, owing to protests of interested legislators and the neglect of higher officials. Another firm paid \$216,000 for robes and skins, and there were scores of private traders in the field. The word went out to

kill everything in sight, and from 1876 there was a price on the head of every buffalo.

It is a dark and disagreeable subject to probe, but it is interesting to note some of the methods of these national calamity makers. A band of half-breeds in two hunts, according to Ross, killed 47,770 buffaloes, 620 men being engaged in the sport, out of which about 30,000 animals were wasted or partly eaten. Hornaday estimates that from 1820 to 1825 five buffalo



BUFFALO CALF.

expeditions went out, composed of 610 carts each, killing 118,950 buffaloes. From 1825 to 1830, five expeditions, of 750 carts each, killed 146,250 buffaloes. From 1830 to 1875 six expeditions, of 895 carts, killed 174,528 animals. From 1835 to 1840, fifty-four expeditions, of 1,090 carts each, killed 212,550 buffaloes. Total number killed by the Red River half-breeds alone in twenty years, 652,275, valued at \$3,261,375. An interesting table has been furnished the government by the firm previously mentioned, J. & I. Boskowitz, showing the decline of the buffalo as an article of commerce. It shows that in nine years this firm handled 246,175 skins, costing \$924,790. In 1878, they received 41,268 robes; in 1883, 5,000; in 1884, none. The end had come and the buffalo was a memory. Another dealer, Joseph Ullman, states that in 1881 he handled 41,000 robes valued at \$3 50, and 12,000 at \$7.50. In 1882, he purchased 40,000 hides at \$3.50 and 10,000 robes at \$8.50. The prices hunters received were: Cow hide, \$3; bull hide, \$2.50; yearling, \$1.50; calves, 50 cents. The expense of transportation brought the hide up to \$3.50 in New York. This dealer, in four years, paid out \$310,000 to these men, who killed buffaloes by the tens of thousands for \$2.50 per head. Both of the above mentioned dealers, in eight years, paid out \$1,233,070 to the exterminators.

That the real extermination of the buffalo was caused by the demands of trade there can be no doubt, aided and abetted by sportsmen, Indians, and others; but the blame really lies with the government that in all these years permitted a few ignorant Congressmen to block the legislature in favor of the protection of the bison, so that all the efforts of humanitarians were defeated and the bills when passed pigeon-holed.

There were many methods of extermination that are graphically illustrated by paintings and models in the Smithsonian Institution. The still hunter was the most insidious enemy of the buffalo, and a single man by sneaking upon a herd has been known to kill one thousand in a single season. One Captain Jack Bridges, of Kansas, has the honorable (?) record of having killed

1,149 buffaloes in six weeks. He took the contract to that effect and bagged his game. Up to 1870 there were undoubtedly several millions of buffaloes alive, but the lust for blood was on, and soon came the demand for robes and hides from the dealers, and men who could not make a living at anything else went out to kill buffaloes. In the different States there were regular killing outfits that cost, in rifles, horses, carts, etc., from two thousand to five thousand dollars. Such methods developed some famous characters. Buffalo Bill was one. He contracted with the Kansas Pacific Railroad to furnish them with all the buffalo the men could eat as the road was built; and according to Mr. Cody's statement, they ate 4,280 buffaloes in eighteen months, for which he received \$500 per month, the price he paid for his title.

Many buffaloes were killed by running them down; this was the popular method among the Indians, who shot them with rifle or bow and arrow, or chased them over precipices. The great herds north of the Missouri were mostly exterminated by the Indians of the Manitoba Red River settlement, who hunted them in a regular army. One division of such an army of exterminators consisted of 603 carts, 700 half-breeds, 200 Indians, 600 horses, 200 oxen, 400 dogs. The movements against the buffaloes in Nebraska were often made by three thousand people, and as each man killed at least ten, thirty thousand buffaloes bit the dust. In this way Indians as above killed, it is estimated, 652,000 buffaloes.

The completion of the western railroads divided the buffaloes into two herds, northern and southern. In 1871, the southern herd was composed of an estimated 3,000,000, and from now on the animals dropped away so rapidly that it was estimated that 3,000 or 4,000 a day were killed. It became evident that they were doomed, and appeals were made to the government by hundreds. From 1872 to 1874, there were 1,780,461 buffaloes killed and wasted; 3,158,780 in all killed by white people and the skins shipped east over the Atchison, Topeka and Santa Fé road. During the same time the Indians killed 390,000; besides these settlers and mountain Indians killed 150,000, so that the grand sum total for these years was 3,698,780. In the following year, 1875, the deed was done. The southern herd had been swept from the face of the earth; the northern herd went in the same way. In 1882, it was believed there were 1,000,000 buffaloes alive in the herd, but there were at least 5,000 white hunters in the field shooting them down at every point. Such a merciless war of extermination was never before witnessed in a civilized land. Then came 1883; thousands took the field this year, and Sitting Bull and some whites had the honor of killing the last ten thousand.

There were living at the last government census, made eight years ago, 256 pure-blooded buffaloes in captivity, the last of the untold millions that covered this continent during the past century. Some of them are shown in the accompanying photographs, which tell a pitiful story of the greed of the white man and the extirpation of a mighty race within three decades.

**A Tribute.**

We have received the fourth number of Feilden's Magazine, published in London. Although this handsome periodical has been published only a few months, it is already in the front rank of technical journals, and by the breadth of its scope, the independence of its opinions and the splendid manner in which it is gotten up, it has already obtained honorable distinction among the English technical journals. We notice in the November number a handsome compliment to ourselves; it says, "We are not aware of any weekly newspaper in this country (England) which possesses the eclectic scope together with the editorial authority of the

SCIENTIFIC AMERICAN. In the highest class of technical journalism we are more than able to hold our own; but in journals of a discursive nature as applied to science and mechanics we must look beyond the Atlantic for an example."

**The National Export Exposition.**

It is said that the National Export Exposition has been a creditable, and on the whole, a successful enterprise. Half of the exhibits came from Pennsylvania, and a considerable portion of the remainder came from the States which immediately adjoin it. There were many classes of goods which were conspicuous by their absence, such as textiles and electrical machinery. The amount of running machinery was very small, a 200 horse power gas engine actuating it all. It is stated that during the last few weeks of the Exposition, the average sales were from \$50,000 to \$100,000 a day. If this is the case, it shows that the primary object of the Exposition has been fulfilled.

**A Shower of Biellids.**

A well-marked shower of Biellid meteors was observed at Princeton on the evening of November 24. At ten o'clock the meteors averaged two or three per minute at times. Professor Young counted forty-two in the first half hour between ten and eleven o'clock, and there were many others which he did not see. After eleven o'clock Professor Young saw only three meteors in fifteen minutes. They were mostly small, but a dozen were above the second magnitude and two rivaled Sirius. They all left trains, but these were evanescent, not persistent, like the trains left by Leonids.

**The December Building Edition.**

The December number of the BUILDING EDITION is fully up to the standard of its predecessors, and we are safe in saying that it is one of the most beautiful publications in the world. The houses are admirably selected and the engravings are reproduced with care



BUFFALO IN DEEP SNOW.

and are finely printed. Those of our subscribers who are not familiar with our BUILDING EDITION should send for a sample copy. Each issue contains a number of special features, such as reproductions of European castles, villas, iron work, etc.

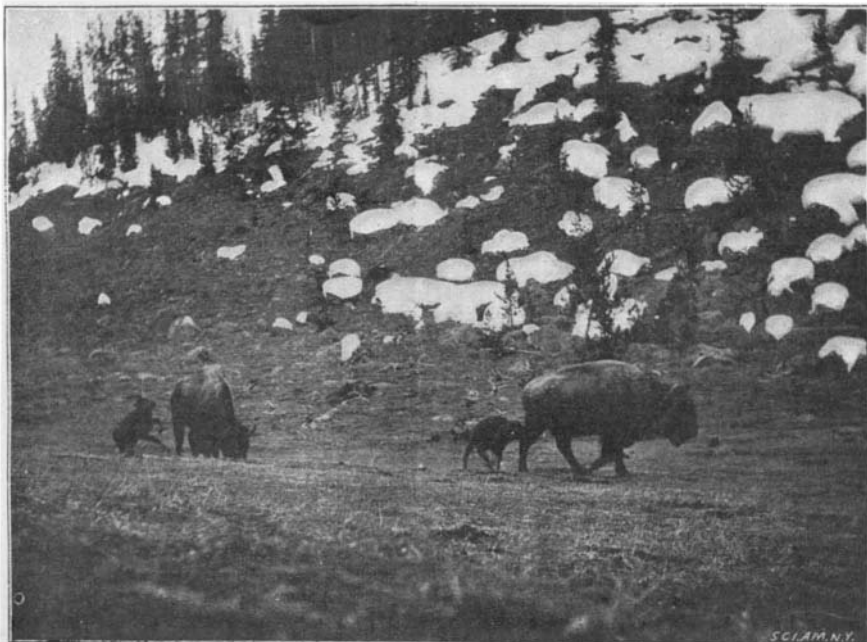
**The Current Supplement.**

The current SUPPLEMENT No. 1249 has many articles of great interest and permanent value. "Engineering in the United States Navy—Its Personnel and Material," is the annual address of Rear-Admiral George W. Melville before the American Society of Mechanical Engineers, of which he is President. "The Modern Armor-Clad" is continued and describes minutely the system of military masts, torpedo tubes, barbettes, etc. "Some Physiological Effects of Hydrocyanic Acid Gas upon Plants" describes some most interesting experiments by Prof. W. G. Johnson, of Maryland Agricultural College, and State Entomologist.

**Contents.**

(Illustrated articles are marked with an asterisk.)

Airship or aeroplane— which? . . . 370	Education by correspondence* . . . 369, 374
Animals, danger from importation . . . 371	Engineering notes . . . 375
Armor-clad "Henri Quatre" . . . 377	Exposition, national export . . . 379
Armor, Krupp or Harvey . . . 378	Habit, dwarf, plants . . . 374
Automobile in Buenos Ayres . . . 371	Insurance, earthquake . . . 372
Automobile news . . . 372	Passenger car lighting . . . 378
Biellids shower . . . 379	Patents and trade marks in Germany . . . 371
Boat, submarine* . . . 376	Railway signals* . . . 373
Building edition, December . . . 379	Reminiscences, marine engine . . . 372
Correction, a . . . 378	Science notes . . . 375
Creusot strikes, end . . . 371	Steel trade, our success in . . . 370
Crime of the century* . . . 378	Supplement, current . . . 379
Dalmeny experiments . . . 370	Switch-locking mechanism* . . . 372
Delusion, X-ray* . . . 372	Tribute, a . . . 379
Diamond productions of Transvaal . . . 377	Wireless telegraphy tests in Switzerland . . . 371
Electrical notes . . . 375	



BISON AND YOUNG.