sheets in one piece, and even in the largest sizes are without a joint. A special plant has been laid down by the makers for this purpose, and they now make a large number of various sized and shaped buckets. The arrangement of these on the elevator chains is such that the maximum duty is obtained, as no space is lost in any way. Each machine is arranged to raise 50 tons per hour, but can, if necessary, raise 60 tons. The whole arrangement is most complete, and the machine we inspected worked well and was well constructed.

Our illustration represents a machine constructed for the transference of grain cargoes from large barges to ocean-going ships, weighing it in the process. This machine was made for use at Odessa, the grain arriving at that port by large sailing barges. As will be seen, one elevator leg is sustained at the end of the jibs or derricks, and raises the grain from the barge and delivers it to a conveyer. The latter empties it into a weighing machine placed on the pontoon carrying the elevator, which automatically weighs it, and delivers the grain so that it can be raised to the second elevator, which is carried by the upright frames shown. The second elevator delivers the grain to a conveyer, by which it is dropped into the ship.

The makers are Messrs. S. S. Stott & Co., of Haslingden, near Manchester.—*Industries.*

The Fastest Railroad Train in the World.

Competition between two of the great English lines of railroad has recently taken the form of cutting down the running time. The London and North-Western and the Great Northern, striving against each other for the traffic between London and Edinburgh, have reduced the running time between these points to eight hours. By the first named road the distance is 401 miles, by the other it is 397. For the entire distance the schedule is slightly exceeded by the short B. & O. run between Baltimore and Washington, 40 miles in 45 minutes. But the length of the trip removes it from the comparison. On the North-Western road one run without a halt of 158 miles in three hours is a part of the trip. This exceeds the run from Fort Wayne to Chicago by 12 miles. To realize what this speed means, it may be compared with the trip from New York to Chicago by the Pennsylvania Railroad. The same speed would reduce the time between these points to a little over eighteen and one-half hours. It has been suggested that an afternoon train should leave New York and should reach Chicago in time for business the next day. The above proves the practicability of such a project.

Clouds of Moths.

The city of Reading, Pa., had a remarkable visitation of moths on the evening of August 1. Myriads of them infested the air, resembling at a distance a snow storm. They were first noticed flying around the electric lights about 8 o'clock, and gradually increased to such numbers as to obscure the brilliancy of the lights. Passengers on the street cars, as they passed under the lamps, were covered with the insects, and handkerchiefs, hats, and fans were plied vigorously to keep them off. Fires were built under the lights and heaps of the moths were burned. Penn Street saloon men were compelled to close their front doors to keep out the pests, which were attracted to the barrooms by the bright lights. The doors and windows of dwelling houses had also to be kept closed to keep them out. Local savants pronounced them cotton moths, and they evidently came from the South. They are said to precede a hot wave, and a decided rise in the temperature is predicted.

At Easton, Pa., butterflies by the thousands flew around the sixty-four electric lights, lit on the carbons and then dropped dead in the globes. When the men who renew the carbons visited the lights, they found on an average two quarts of dead butterflies on each globe, a total of four bushels, besides the lot that had fallen on the ground during the night.

Moths Attracted by the Electric Light.

A curious and interesting spectacle is now presenting itself upon Third Avenue, New York. Myriads of moths are circulating around the electric lamps upon the corners of the street, their shadows being projected upon the sidewalks and opposite blank walls, as if upon the screen of a magic lantern. Passers-by are startled at perceiving these apparitions dart across their path, and stand gazing astonished at the novel sight. The moths are barely a half inch long, but appear projected at least two feet, with outstretched wings in proportion.

THOMAS LATHAM.

A $50,000 Horse.

A remarkable auction sale took place on July 31, at Lexington, Ky., on the occasion of the sale of the celebrated three year old stallion Bell Boy. This horse had a record at three years of 2:26, and was bought four months ago for $35,000 by Jefferson & Seaman. To close the partnership, the animal was again sold as above, and brought on the block the large sum of fifty thousand dollars, the largest price every paid for a horse in this country. The purchaser of Bell Boy was C. E. Seaman.

Scientific American.

ESTABLISHED 1845.

MUNN & CO., Editors and Proprietors.

PUBLISHED WEEKLY AT

No. 361 BROADWAY, NEW YORK.

O. D. MUNN. A. E. BEACH.

TERMS FOR THE SCIENTIFIC AMERICAN.

One copy, one year, for the U. S. or Canada........ $3 00
One copy, six months, for the U. S. or Canada........ 1 50
One copy, one year, to any foreign country belonging to Postal Union, 4 00
Remit by postal or express money order.

Australia and New Zealand.—Those who desire to receive the SCIENTIFIC AMERICAN, for a little over one year, may remit £1 in current Colonial bank notes. Address

MUNN & CO., 361 Broadway, corner of Franklin Street, New York.

The Scientific American Supplement

is a distinct paper from the SCIENTIFIC AMERICAN. THE SUPPLEMENT is issued weekly. Every number contains 16 octavo pages, uniform in size with SCIENTIFIC AMERICAN. Terms of subscription for SUPPLEMENT, $5.00 a year, for U. S. and Canada. $6.00 a year to foreign countries belonging to the Postal Union. Single copies, 10 cents. Sold by all newsdealers throughout the country.

Combined Rates.—The SCIENTIFIC AMERICAN and SUPPLEMENT will be sent for one year, to any address in U. S. or Canada, on receipt of *seven dollars*.

The safest way to remit is by draft, postal order, express money order, or registered letter.

Australia and New Zealand.—The SCIENTIFIC AMERICAN and SUPPLEMENT will be sent for a little over one year on receipt of £2 current Colonial bank notes.

Address MUNN & CO., 361 Broadway, corner of Franklin Street, New York.

NEW YORK, SATURDAY, AUGUST 18, 1888.

Contents.

(Illustrated articles are marked with an asterisk.)

TABLE OF CONTENTS OF

SCIENTIFIC AMERICAN SUPPLEMENT

No. 659.

For the Week Ending August 18, 1888.

Price 10 cents. For sale by all newsdealers.

GEN. PHILIP HENRY SHERIDAN.

On August 5, at 10:20 P. M., Gen. Sheridan passed away. His death, following upon the demise of Gen. Grant, removes another of the great leaders of the United States army in the civil war, and acts to still further relegate the conflict to the domain of history.

Gen. Sheridan's parents were natives of Ireland, and emigrated to this country about sixty years ago. He was born March 6, 1831, in Somerset, Perry Co., Ohio, about twelve miles from the birthplace of Gen. Sherman, his companion in war and his survivor. His family were of pure Celtic blood, and many of the characteristics of the race are said to have appeared in Sheridan, especially in early life and during his West Point career. He graduated at West Point in 1853, and was sent to Texas, where he began his experience as a soldier in fighting the Apache Indians. Until 1861 he remained in the West. On the breaking out of the war he was assigned to various duties, principally clerical and in the quartermaster's department, until May 25, 1862. Then he took command of a regiment of cavalry, the Second Michigan, and at once began his brilliant record as one of the most daring commanders on the Northern side. His magnificent achievements at Winchester and elsewhere are matter of song and history.

In 1870–71 he was with the German armies, and witnessed many of the scenes of the Franco-Prussian war. He was often solicited to enter the field of politics, but persistently refused. In June, 1875, he married, and now leaves a wife and four children to mourn his loss. His quiet and retiring disposition serves only to make the memory of his actions in war the more enduring.

THE MECHANISM OF THE COUNTER ATTACK.

With the coming of quick-firing arms and more destructive engines of war, tacticians are looking with more favor upon the feasibility of the counter attack, especially where a small force is operating against a larger one, being, as one might say, upon the defensive, and in this humor, allowed by the enemy to choose its own battle ground. It will be remembered that the French, in the early days of the Franco-German war, occupying this latter position, invariably organized a counter attack and generally after the enemy's ranks had been terribly mangled by the play of the mitrailleuse. But the French, peculiarly fitted as they are for offensive rather than defensive operations, rarely followed up their advantages, and later on, the Germans, adopting the same tactics with better organization, kept a force in reserve to oppose the counter attack, which, had the French been less discouraged, would doubtless have proved tardy, if, indeed, at all availing. At least this is alleged in a recent paper of great interest by Major W. M. Smith, of the Royal Artillery. There is an extreme school of writers on the conduct of war with the new arms who insist that to occupy the "weak intervals" of the battle ground with anything beyond a mere "screen" or outpost line of infantry is a waste of strength needed elsewhere. The element in which lies the source of strength is, according to Major Smith, the extent of the fire-swept glacis in front of the position, and the intensity of the hail of iron and lead that can be poured over its surface. The enemy, he says, must be compelled to cross that zone, and to suffer the utmost penalty in doing so, and for this purpose the frontal fire of infantry must be a maximum in volume and in its lateral extent without a break or even a quaver. All military readers will recall Napoleon's famous plan for "piercing the center"—a system which now has fallen into disuse; the "pivot and interval" system rendering it abortive, though doubtless a Napoleon could still break the line with it, as Epaminondas used to shatter the strongest line with a steel-tipped wedge of warriors.

TORPEDO WARFARE IN PRACTICE AND THEORY.

Captain Greenfell, late of the Royal Navy, having large experience with and little confidence in the locomotive torpedo, recently gave his conclusions to the Royal United Service Institution, where were many with equal experience ready and able to confute his most serious charges. Captain Greenfell thinks the big gun, such as modern ships carry, far more effective than the torpedo, the former having a battering range of from three to four miles, and the torpedo an effective range of only 500 yards. As to accuracy, he says: "Captain Gallway (an authority) speaks of a torpedo as being extremely accurate which showed a mean error at 400 meters of 2·4, say 94 inches, laterally, the depth being always within a small decimal of that at which the torpedo was set to run. Any modern gun will do for comparison. I take the first which comes to hand—the 24 cm. 30 caliber long German gun. At a range of 2,000 meters (five times the other), its mean error is vertically 16 inches, horizontally 8 inches."

But Captain Greenfell admits it were impossible to train big guns on a moving torpedo boat, and with another big ship in sight, belonging to the enemy, the fight would be equal. But the torpedo boat is looked to to take a big ship at a disadvantage, and we quote his own authority. Captain Gallway says that machine guns, which are looked to to beat off torpedo

© 1888 SCIENTIFIC AMERICAN, INC.

boats, are utterly unreliable in quick training. He says: "I know of only one occasion in which they have been tried in actual war. I hear from an officer out in the Min River, that a boat approached the French fleet in the night, the electric lights were turned on to her, and all the Hotchkiss guns of four ships were brought to bear on her, yet, in the end, they had to send two steam pinnaces to bring her alongside, and then they found she was not even hit!"

During the discussion of Captain Greenfell's paper it was shown that a torpedo boat built by Herreshoff, of America, was fired at by one of the big ships in Portsmouth Harbor, England, for a whole day without sinking her. Also that, on the Danube, a boat carrying a spar torpedo was actually discovered and a very heavy fire opened upon her, yet she kept on and delivered her fire. And an instance was cited, where a big ship, with torpedo netting set, in the Mediterranean, and looking for them, did not discover their presence till they were under the netting and against the hull. It was shown that a small explosive force, under or nearly under the ship, has a far more forceful effect than many times its quantity above, having, indeed, the water for a gun; the resistance of the water being greater than that of the ship.

From the great mass of testimony brought out by this discussion, we might fairly sum up as follows:

1. Torpedo boats, to be effective, should be operated in fairly smooth water.

2. The torpedo boat, advancing end on, has little to fear from the machine gun, even in broad day.

3. The discharge must be below rather than alongside the hull.

4. Several torpedo boats should be set to attack a single great ship, instead of leaving it to one.

Experiments in Feeding Sheep.

We have received Bulletin No. 2 of the State agricultural experiment station, Cornell University, Ithaca, N. Y. It gives the results of some experiments in feeding sheep to determine the economic value and the effect on health and digestion of foods rich and poor in nitrogenous compounds. We make a few abstracts:

From a flock of about 100 lambs, six months old, six were chosen with great care with reference to uniformity in size, weight, and shape. They were of mixed Cotswold and Southdown blood.

Their food from weaning to October 10 had been grass alone.

On the above date they were shorn and all placed together in a box stall and prepared for the experiment by being fed hay, and at first a small portion of corn meal and bran, which was gradually increased, until it reached, on November 11—when the experiment began—about ¾ of a pound per head.

From this time on they were divided into two lots of three each, in such a way as to make the total weight of each as nearly equal as possible. They were provided with warm stalls on the ground floor of the barn. In order to make the feeding rations different in character, Lot 1 at the beginning of the experiment was fed daily 1½ pounds of oil meal and 1½ pounds of coarse wheat bran. Later on in the experiment, in order to make the nutritive ratio still narrower, one pound of cotton seed meal was substituted for one of bran. We will call this the nitrogenous lot.

Lot 2—the non-nitrogenous lot—was fed 3 pounds of corn meal daily.

Both lots were fed good mixed timothy and clover hay, great care being taken to give them only so much as they would eat up clean.

All ate their rations with avidity up to near the last of December, when that of Lot 2 had to be reduced for a short time to 2 pounds, and later on for three days they received nothing but hay, as they refused to eat their corn meal; it was not until March first, when 4 pounds of mangolds were added to the rations of both lots, that they could be induced to eat their full ration.

According to the German standards of feeding rations, one to four is the narrowest (that is, *one part* of protein, or muscle producing food, to *four* parts of carbohydrates or heat and fat producing) and one to seven the widest ratio advisable for the purpose of fattening sheep. Since the nutritive ratio of the food of one lot was below the lower of these ratios, and that of the other above the higher, it is natural for us to expect very marked results. These results were noticeable almost from the beginning of the experiment. The lambs of Lot 1 were livelier, more sportive, plumper, and showed far better development and growth than those of Lot 2.

The difference in the amount of water that was drunk as the experiment progressed was very marked. Lot 1 drank 61 pounds in 6 days; Lot 2. 21½ pounds. The solid voidings were of a very different character; those of Lot 1 being soft, while those of Lot 2 were hard and dry up to March 1, when the ration of mangolds was added.

It was evident by March 1 that Lot 2 would not become fat enough or have sufficient development, without some change in the ration, to compare with Lot 1; so a change of ration became imperative. The added root ration not only toned up the digestion of Lot 2, and enabled them to consume more corn meal than they could without it, and to make a gain of 2% more in one month than they had in the two previous months, but it also shows that Lot 1 was greatly benefited by the addition of roots to their food. Their average gain for the four preceding periods was 11¾%. The addition of the roots apparently increased it to 16%.

The average gain of Lot 2 for the same period was 7½%. The addition of the 4 pounds of roots increased this to 13%.

On the 25th of April the lambs were shorn and the wool of each lot weighed. The weight of the wool of Lot 1 was 55% greater than that of Lot 2; moreover, it was of a much finer texture and better quality than that of Lot 2.

The lambs were slaughtered on the morning of the 26th of April by an expert butcher. Each lamb was weighed, then slaughtered, then weighed again to determine the amount of blood in each lot. Then the skin, liver, kidneys, spleen, heart, and several other important internal organs were separately weighed, and finally the dressed weight was taken. The bodies were hung up to stiffen for one day, at the end of which time each one was carefully cut into four sections. All the sections were photographed, and an average set chosen, from which colored plates were made. These are admirably executed, and form a part of the bulletin.

The sections show well the comparative disposition of fat and lean meat on the lambs of both lots. Although the fat of each lot was not dissected out and weighed, it is quite evident from the cuts that the amount found on the lambs fed on nitrogenous food exceeded that produced by those fed on non-nitrogenous food. The lean was also increased to an equal or greater extent. Both these facts are shown especially well in the plates.

The live weight of Lot 1 was 21 per cent greater than that of Lot 2.

The metatarsal bones of Lot 1 were 22 per cent stronger than those of Lot 2.

The tibias of Lot 1 were 24 per cent stronger than those of Lot 2.

It is seen that the valuable parts are proportionately larger in those fed on nitrogenous food. The kidneys and spleen of the nitrogenous Lot 1 are also considerably larger, while all the other important internal organs are larger in those fed on non-nitrogenous food.

Although this experiment is but one of a series to be tried at the experiment station, and needs to be repeated many times before absolutely accurate results can be obtained, yet we may deduce from it that the effect of feeding an undue proportion of non-nitrogenous food to sheep is:

1. To decrease the production of wool by one quarter.

2. To decrease the strength of the bones by one third.

3. To reduce the production of both fat and lean meat.

Not one of these three important effects is desirable in sheep husbandry; hence we may conclude that corn alone is not the best food for sheep.

War Ship Charleston.

The launch of this new war ship was successfully effected at San Francisco on July 19. Over 20,000 spectators were present.

The Charleston is 320 feet long over all; length on load line, 300 feet; beam, 46 feet; draught forward, 17½ feet; aft, 19½ feet; mean draught, 18½ feet; and displacement, 3,730 tons. There are only two short stump masts, with military tops for machine guns. All the steel used in the construction of the hull and all for the engines (except the crank and two line shafts, which were made by Krupp at Essen) is of domestic manufacture, known as mild steel, made by the open hearth process. The beams, outside plating, and protective deck plates were made in the East by Carnegie, Phipps & Co. All the rivets, frames, and engine forgings, and all the steel castings, both for hull and engine, were made by the Pacific Rolling Mills Co., whose works are contiguous to the shipyards of the Union Iron Works. The stem, stern, and rudder pieces are single steel castings, the stem being ram shaped and specially strengthened by braces and other attachments to the steel protective deck. The sternpost was cast on June 22, 1887. There were 30,960 pounds of metal used, and the weight of the sternpost, when delivered complete to the Union Iron Works, was 11,130 pounds. The stem weighs 13,430 pounds, and the rudder frame weighs 9,420 pounds.

The plating of the Charleston is of rolled steel, the outside plating being from 7-16 to ½ inch thick, the inner bottom plating ¼ to 5-16 of an inch, and the sheer strakes ⅝ to ¾ inch. The horizontal plating of the protective deck, which extends from stem to stern, is 2 inches thick, and the sloping sides 3 inches thick. The motive power of the Charleston is furnished by two horizontal compound engines, which are placed in separate water tight compartments. The screws are three bladed, made of manganese bronze, and 14 feet in diameter. There are six main boilers and eighteen furnaces, with a total grate surface of 485 square feet, and 2,578 tubes, with a heating surface of 15,600 square feet. There is a bunker capacity of 800 tons of coal, but the normal draught is 328 tons. On a natural draught there is an indicated horse power of 5,000 horses, and on a forced draught of 7,650 horses, a maximum speed of 18 9 knots being thus attained. At an indicated horse power of 7,650, which requires the consumption of 800 tons of coal, the Charleston is expected to be able to steam 2,013 knots at the maximum speed. At the normal draught of 328 tons of coal, at the hourly consumption of 1·07 tons, and with 1,200 indicated horse power, she can steam 2,990·60 knots at 10 knots an hour; or with a forced draught of 800 tons of coal, 7,476·60 miles at the same speed.

The quarters of the officers and crew are all situated on the berth deck, as usual. Some improvements on the orignal plan, suggested by Naval Constructor Fernald, have greatly improved this deck. Farthest aft are the captain's staterooms, fitted in a sycamore veneering, dead polished, sliding doors, and furnished like the wardroom, which comes next. The steerage is much larger and more comfortable than in most ships. The galleys for officers and crew are situated in the center of the ship, inclosed in a steel bulkhead and specially ventilated, to carry off the odors of cooking. The sick bay and dispensary are placed in the bows, just abaft the paint room, divided from it by a steel bulkhead. The space on this deck from the sick bay to the midship bulkhead is the space where the 308 men who will compose the crew will sling their hammocks and mess. Wire lockers are provided here for the utensils of each mess. Head room on this deck is about 6½ feet, and the ventilation and light are as good as it is possible to make them, two blowers being used of 10,000 cubic feet capacity a minute. The cruiser will be lighted by two incandescent electric plants of 3,200 candle power each. All the most modern appliances for navigating have been provided. The masts are made of half-inch plate, and one of them is used for ventilating the dynamo room. The masts, rigging, and boats are being constructed at the Mare Island Navy Yard. As there is no projecting keel on the cruiser, two bilge keels have been provided to prevent rolling. These stand out 20 inches from the bilge, and are made of wood, plated.

Adverse criticism has been aroused by the failure to provide hydraulic gear for the heavy guns and the substitution of 8 inch for 10 inch rifles, which latter are carried on the Naniwa-Kan. The machinery has been superintended by Chief Engineer W. S. Smith, U. S. N., and Assistant Engineers E. T. Warburton and I. N. Hollis, U. S. N.

The keel plates of the Charleston were laid August 27, 1887, less than one year ago, and the first rivet driven September 1. Her hull weighs upward of 1,350 tons. It is thought that the cruiser will be ready to be turned over to the government in five months' time. By the contract she should be finished by June 28, and a penalty is fixed for delay in delivering her. Her contract price is $1,017,000; that of the English-built ship, the Naniwa-Kan, after which she was modeled, was $938,000 complete. The San Francisco will follow the Charleston on the stocks. Only one steel vessel had been launched from the Union Iron Works previously, the Arago, a 1,100 ton steamer, and the yard was not ready for the construction of a 4,000 ton ship. But when the contract for the Charleston was obtained, a large slip was run out 80 feet broad and 300 feet long, on a foundation of 70 foot piles, calculated to sustain a weight of 1,500 tons. Additional offices and shops were erected, a hydraulic dock completed, and a 100 ton shears constructed.

Curculio and Chinch Bugs.

Bulletin No. 4 of the Ohio Agricultural Experiment Station discusses some elaborate experiments in preventing curculio injury to cherries, and treats in a practical way the best midsummer remedies for the chinch bug, which has lately appeared in destructive numbers in Ohio. In the cherry experiment, which was conducted by the station entomologist, Clarence M. Weed, twenty-two thousand five hundred cherries were individually cut open and examined, and the conclusion reached that three-fourths of the cherries liable to injury by the curculio can be saved, without danger to the user, by spraying with a solution of London purple soon after the blossoms fall.—*Vick's Mag.*

The American Institute Fair, New York.

Large numbers of inventors and manufacturers have for many years found it of interest, and profitable as well, to attend and take part in the annual exhibitions of the American Institute, held in the fall of each year. The fifty-seventh annual exhibition will open October 3, at the hall of the Institute, on Third Avenue, New York City, and promises to be in no way behind any of its predecessors in attractive features. Intending exhibitors should make early application to secure good locations and the space needed.

© 1888 SCIENTIFIC AMERICAN, INC.