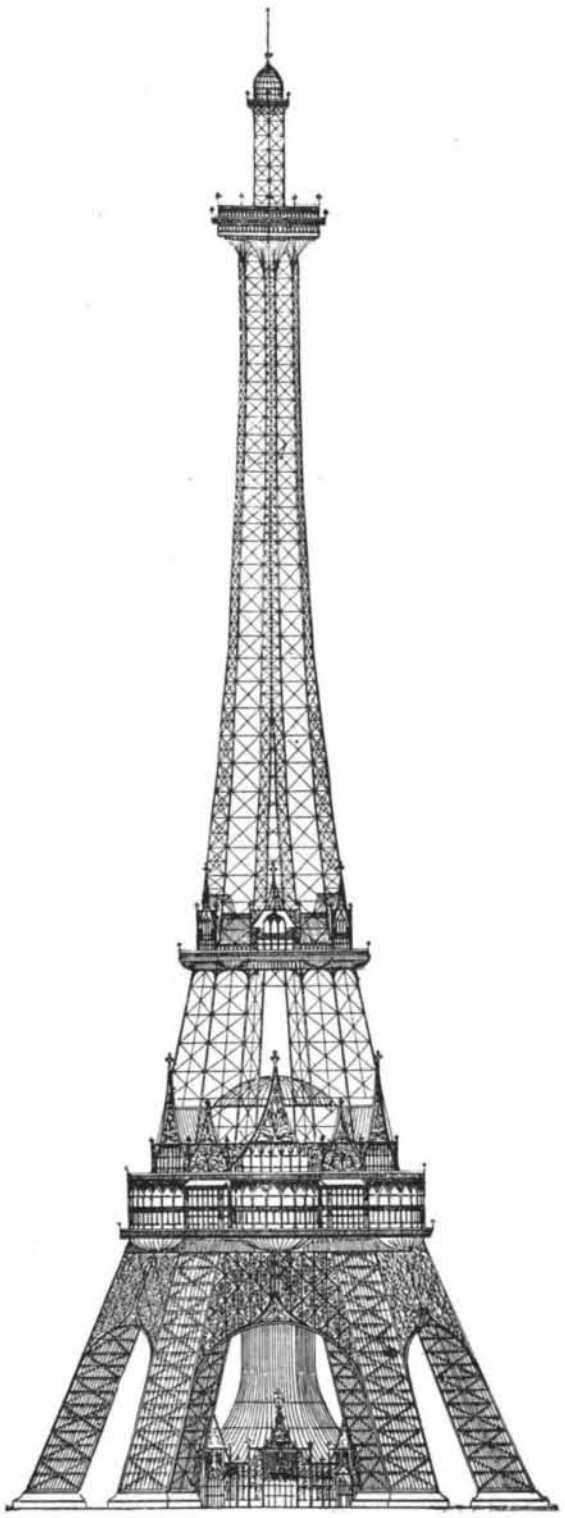
THE PROCTOR TOWER.

The building and grounds committee of the Columbian Exposition have accepted the design for a tower which we illustrate herewith. The tower is to be of steel, 1,100 feet high, surmounted by a tall flagstaff. Ten elevators will carry passengers to the top. Four of these will run to the first landing, 200 feet above the ground; two will run to the second landing, 400 feet above the ground, stopping at the first landing; while two others will run up without stop to the second landing; and from the second and third landings two will shoot up into the dome, 1,000 feet above the ground. The capacity of these elevators is 8,000 people per hour one way, or 16,000 people an hour up and down. The tower will be one glow of electric light from base to dome, the very top being illuminated by powerful search lights, which will throw a brilliant glow over the exposition.

Electricity will be used in numerous ways. Safety devices, telephones, signaling apparatus, ventilating



THE PROCTOR TOWER.

fans, being a few of the necessary things that will be operated by this subtile force.

Hydraulic power, in all probability, will be used for running the elevators in the tower. Motors, however, will be used to operate pressure pumps that supply the water to the hydraulic cylinders.

Messrs. Holabird & Roche, well known architects of Chicago, and Mr. C. T. Purdy, mechanical engineer, have the work of the tower in hand—a fact which is a sufficient guarantee of its perfect construction.—*Electrical Industries.*

Preserve for Binding.

The publishers of the SCIENTIFIC AMERICAN would advise all subscribers to preserve their numbers for binding. One year's issue (52 numbers) contains over 800 pages of illustrations and reading matter. The practical receipts and information contained in the Notes and Queries columns alone make the numbers worth preserving. Persons who have subscribed since the commencement of this year can have the back numbers sent them on signifying such wish. Their subscription will then expire with the year.

The Bone Grafting Experiment.

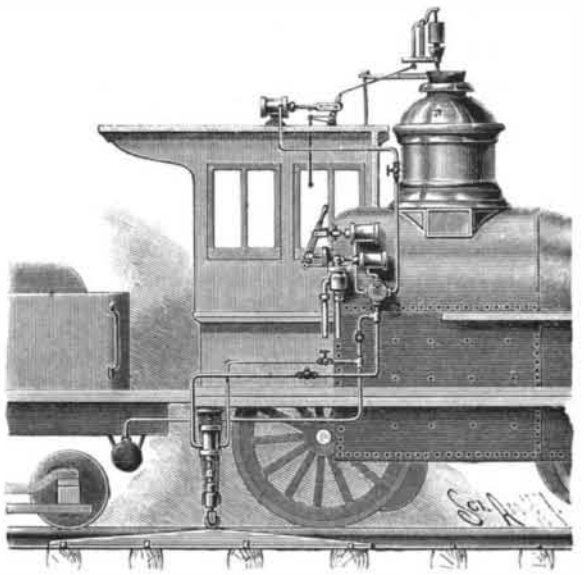
In the New York Charity Hospital, in November last, as described in the SCIENTIFIC AMERICAN of November 29, Dr. A. M. Phelps grafted a bone from a dog's leg in the shin bone of a boy, under circumstances which attracted general attention. Both boy and dog were bound side by side on a cot, where they might be kept as comfortably as possible for several days, anæsthetics were administered but moderately, and a piece of the bone about an inch and a half long was taken from the dog's limb and inserted in that of the boy, where it was ingeniously secured in position, care being taken not to injure the arteries or any important portion of the circulatory system of either. It was designed that the vitality of the dog should contribute to the growth of the bone in place in the boy's leg, which, it was estimated, would require about thirty days, and an artery of the dog was, therefore, conducted to the grafted bone, and muscle was stitched to muscle and skin to skin, to promote, if possible, a mutual growth. After three days the boy and dog became apparently comfortable together, and at the end of six days the wound was naturally healed, but at the end of eleven days there was an apparent shrinkage of the dog in the dressings, allowing of motion, and endangering the pulling of the graft from position, and the bond of union between the boy and the dog was then, on this account, severed. The operation had not been successful, but the bone graft was covered with an irregular new growth, and circulation was shown to have been established between the boy and dog. At the end of five weeks the graft was removed from the boy's leg, but the stimulation it had caused is said to have set up a reparative process, which gives hope that the original fracture may reunite. The boy now walks with the aid of one crutch or a cane, and the dog was carefully treated after the separation. Dr. Phelps is confident that bony union would have taken place with the graft if actual contact could have been maintained for a longer period, and says that "the operation is a success in so far as it establishes the principle that it is possible to grow large masses of tissue from an animal to man, and to establish the circulation until the union takes place between opposite species without danger to either. It also demonstrates that a growth of new bone takes place when a section of bone is transplanted and its nutrition maintained by the artery of the animal. This, if continued for four or five weeks, would probably unite a fracture."

Solutions of Celluloid.

Dr. Charles Ehrmann says: "Alcoholic solution of celluloid has been said to be an exceedingly fine retouching varnish. But celluloid is in reality not more soluble in alcohol than ordinary gun cotton or xyloidine. When small and tiny shreds of celluloid are macerated in alcohol of 95 per cent, the substance swells up like gelatine in water; the alcohol permeates its pores and dissolves the camphor contained, so that the final result is a solution of camphor, nothing else. We do not deny that a thin stratum of camphor upon the gelatine film will assist materially retouching with a graphite pencil, but the medium is by no means celluloid, which has proved to be so excellent to retouch upon. After macerating the celluloid in alcohol, and a thorough dissolution of camphor, washing it in water and drying, it will burn with detonation, exactly like gun cotton—proof enough that the alcohol had no other effect upon it than that above stated."

A STOPPING AND SIGNALING MECHANISM FOR LOCOMOTIVES.

A mechanism designed to automatically stop the locomotive and sound the whistle at or near stations, while not interfering with the operation of the engine by the engineer in the usual way, is shown in the accompanying illustration, and has been patented by Mr. James C. Gross, of No. 617 Adams Avenue, Scranton, Pa. At any station, curve, or switch at which it is designed to operate the mechanism is placed an auxiliary double-inclined track rail, near the main rail. On the under side of the locomotive is a vertical cylinder carrying a piston which is normally pressed downward by a spring, and the downwardly extending piston rod is engaged by a socket on a sliding rod carrying on its lower end a roller adapted to pass over the auxiliary rail. Connected with the lower end of the cylinder is a pipe from a reservoir of compressed air or any fluid under pressure, and the lifting of the piston by the action of the auxiliary rail on the roller admits pressure to the cylinder, from which an oppositely arranged outlet pipe in which is a check valve leads to a small reservoir. From the latter lead a number of pipes, one to a cylinder, with piston and mechanism by which the brakes are automatically applied, another to a mechanism connected with the throttle valve, to shut off steam from the engine, and another to a mechanism for operating the whistle. When the engineer desires to sound a signal, shut off the steam and apply the brakes, at places other than those thus provided for, he shuts off the pipe from the power reservoir to the vertical cylinder, and opens a valve connecting such pipe with the small reservoir, by which the several mechanisms are then simultaneously operated directly, and independently of the vertical cylinder, with its piston operated by the auxiliary



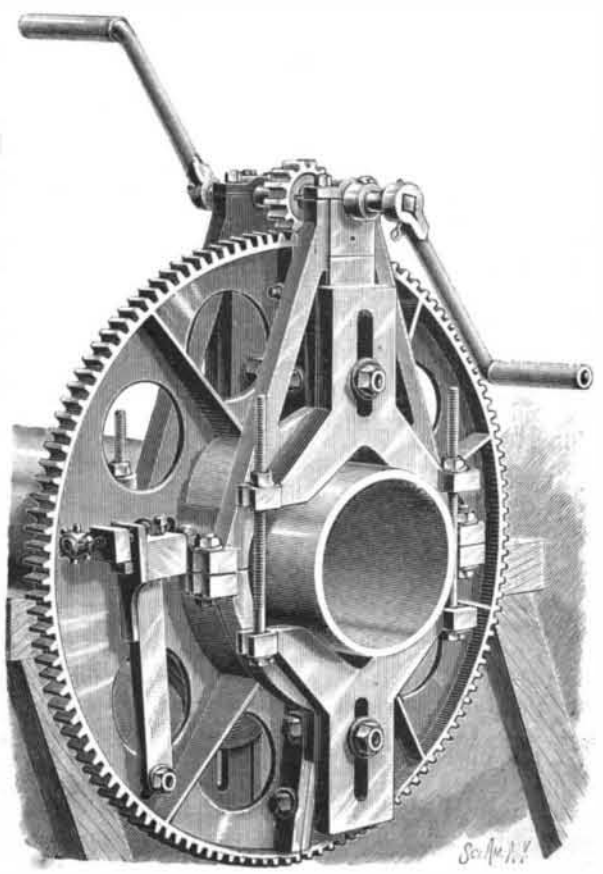
GROSS' LOCOMOTIVE ATTACHMENT.

track rail. To reset the apparatus it is only necessary to open an escape valve releasing the pressure in the small reservoir.

AN EFFICIENT PIPE CUTTING MACHINE.

The illustration shows a machine, patented by Mr. W. H. Garland, of Somerville, Mass., for cutting cast iron water and gas pipes of all sizes, from four to twelve inches in diameter. It has two side plates or frames, each having a circular hole to receive one end of the hub of a large toothed wheel composed of two semicircular parts, with flanges united by bolts. In the upper ends of the side frames are bearings for a shaft on which is a pinion engaging the teeth of the large wheel, the shaft having squared ends on which are suitable crank handles. On the side frames are upper and lower clamps, each having a vertical slot for the reception of a bolt to confine the clamp in proper position upon pipes of different sizes. The upper and lower clamps are connected by screw bolts passed through ears in the clamps, by which the latter may be brought into firm engagement with the pipe. Adjustably secured upon the rotating gear or large wheel is a Slate cutting-off tool, the arrangement being such that the cutting edge of the tool can be always brought into proper central line to cut freely into the pipe, while the feed is automatic, and the tool cuts very fast as it is made to travel about the pipe by the rotation of the gear wheel. This machine can be readily handled by two men and run by from one to four men when at work. The parts are interchangeable, and a particularly important feature of the improvement is that the parts may be separated to attach the machine to running pipe in the trench, whereby a great saving in time is effected, as compared with the methods now usually followed.

For further information relative to this invention address Mr. George A. Lloyd, East Cambridge, Mass.



GARLAND'S PIPE CUTTING MACHINE.

New Electrical Research.

We publish this week one of the most valuable contributions to our knowledge of the properties and possibilities of alternating currents that has appeared for several years. The experiments of Mr. Nikola Tesla on alternating currents of almost transcendental frequency give a deep insight into one of the most extraordinary portions of electrical science. Mr. Tesla has worked with dynamos giving as high as 25,000 alternations per second, and consequently has within his grasp a class of phenomena that are only hinted at so long as experiments are confined to the frequencies in ordinary use. Not only is the work suggestive of practical results in the way of transforming by condensers, which with such frequencies becomes comparatively easy on account of the very small capacity required, but it is rich in suggestiveness as regards the relations between so-called electrical currents and the action that goes on in the dielectric. With a dynamo giving 20,000 or 25,000 alternations per second at an electromotive force of 500 volts, static effects became enormously enhanced. An immense amount of energy is distributed through the medium surrounding the machine, and, in fact, the experimenter may almost be said to be working in the dielectric of a condenser, of which the machine forms one surface and the surrounding walls the other. When incandescent lamps short-circuited by a bit of copper rod glow with intense brilliancy at some distance from the induction coil connected to the machine, Geissler tubes, unprovided with any terminals whatever, spring into brilliant radiance, and even an incandescent lamp grows hot when brought near the coil, the experimenter suddenly awakes from his dream of electrical energy as a thing carried along a wire into the almost appalling consciousness that the energy in the dielectric is really the only thing with which he has to do. We cannot, in the brief space available in these columns, give any adequate idea of the interest and beauty of the results that Mr. Tesla obtained in this novel line of work; the paper itself must be read and carefully re-read to appreciate the importance of the work. But even the striking experiments are of slight importance as compared with the theoretical results that are suggested by them. When displacement currents heretofore sought with almost negative results rise to a magnitude that heats the solid dielectric of the condenser almost to melting, one realizes with startling distinctness the truth of Maxwell's prophetic suggestions. Whatever may be our ultimate conception as to the nature of electricity, we are forced to the conclusion that the energy distributed through the dielectric is the all-important thing in electrical phenomena, and that the surface conditions that we know as electrification and current are comparatively subsidiary. Electrostatic induction and electromagnetic radiation seem simple, almost necessary, facts, when we can work in a medium surcharged by the tremendous electrical stresses that make themselves evident in such a machine as that with which Mr. Teslaexperimented. Even if this research should lead to no results of immediate commercial importance, it at least marks an epoch in scientific investigation by casting a flood of light upon phenomena that until now have existed merely as residual effects sought in vain by the experimenter, or noticed only as the concomitants of other and apparently more important electrical actions.—*Electrical World.*

Mr. Tesla's paper will be found in this week's SUPPLEMENT, No. 792.

The Microbe of Rheumatism.

Dr. Bordas has given in *La Medecine Moderne* the results of some of his researches in acute articular rheumatism, which in his opinion tend to show that the cause of that disease is a pathogenic micro-organism specific in character. He reports that he has been able to isolate and cultivate a microbe which, when injected into the carotid artery of a rabbit, engendered an inflammation of the endocardium with vegetations upon the valves. He believes that acute articular rheumatism with its complications will be proved to be a disease produced by microbes analogous in their production, for example, to the *Micrococcus pyogenes*, and he is convinced that the organism investigated by him will be found by others to be the specific germ of that disease. The investigation was conducted under the supervision of M. Germain See, and will undoubtedly stimulate parallel researches in other laboratories. These, if confirmatory, will be important as an advance, not only in ætiological, but in therapeutical results.

It is only a year or two since the opprobrium was felt by nearly every thoughtful practitioner when the question arose how it was that quinine cured malarial fever; and now this reproach no longer rankles in the mind since the laboratory work of Laveran has shown that the micro-organism of malaria is destroyed by quinine in his test experiments; and thus the old answer of many "green rooms," that quinine is competent to check malarial fevers by reason of the profound impression it makes upon nerve centers, is done away with. The history of this reproach makes it possible that the alleged discovery of Bordas may in the future be the means of explaining away that other enigma—why it is that salicylic acid and the salicylates are able to antagonize the rheumatic enemy in so large a proportion of cases.—*N. Y. Medical Journal.*

Fish Manure.

Peruvian guano, which has so long enjoyed a well deserved reputation, is really nothing but a fish manure. We know that the sea birds, the guanäes, whose droppings give rise to the guano beds, live exclusively on fish. What we see produced in our pigeon cotes and poultry houses is produced on a vast scale on the western coast of South America and on the islands in the neighborhood. The innumerable sea birds which frequent these regions deposit their excreta, which are derived from a strong animal diet, and are therefore very rich in nitrogen and phosphoric acid. Agriculture in making use of Peruvian guano utilizes for the benefit of the continent a substance which originates in the sea.

The rich beds of Peruvian guano being almost exhausted, industry has undertaken to prepare guano by submitting the innumerable riches of the ocean, the enormous shoals of fish which frequent certain seas, to chemical and physical treatment, by means of which they are directly converted into a commercial fertilizer, comparable in all respects with Peruvian guano. The origin of both is the same—the sea; the difference is that the process of preparation has been altered. For the natural digestion of the fish by the birds, a kind of artificial digestion has been substituted, which is purely mechanical, and acts by isolating the oily parts of the fish and leaving a residue composed of flesh and offal which, after various treatments, gives the fish manure now so well known in all agricultural countries.

Fish exist in great abundance on certain coasts; enormous quantities are captured, for example, on the banks of Newfoundland, in the Polar seas, on the coasts of Norway, and even on the ocean coast of France. A large proportion of these fish is intended for nourishment; the cod, the herring, and the sardine are prepared for preservation; but they all leave waste, such as the head, which should be utilized. Often the whole object of the fishing is the manufacture of manure. In America the fish manure industry is in a very flourishing state; the SCIENTIFIC AMERICAN estimates that it supplies agriculturists with 17,000 tons of fish guano per annum. The fish used is the *menhaden*, which frequents the coasts of America from Cape Hatteras to East Point. Since the fishing only lasts from May to November, every possible mechanical assistance is employed to enable the greatest amount of work to be done in the least time.

While in France only damaged fish, such as cannot be used for consumption, is employed for this purpose, on the Atlantic coast of the United States a veritable fleet, made up of large steamers (some of which are of 500 tons burden), is devoted to the fishing, to supply the works at which the manufacture is carried on.

In order to save delay in discharging the vessels, at one of the largest American works, that of Mr. T. Church, of Tiverton, elevators similar to those used for grain are employed to clear out the fish from the hold.

The fish manure industry has also been very largely developed in Norway. The firm of T. Jensen & Co., of London, which has just carried off the highest prize for fish manure, oils, etc., offered at Vienna, occupies the first rank in this branch of commerce. It has established large works, which turn out annually a supply of 5,000 to 7,000 tons of fish guano, 2,000 to 4,000 tons of which are made from cod.

One of the largest works in the world devoted to the utilization of fish and their products is to be found at Brettesnoes (Loffoden Islands), on the northwest coast of Norway.

Brettesnoes, the name of which was scarcely known a few years ago, is now visited by all the tourists who go north to enjoy the spectacle of the midnight sun.

The town consists almost entirely of the establishments of Tensin & Co., whose offices are in London (109 Fenchurch Street). Its harbor, which is more than three miles in extent, can be entered at all times, owing to the great depth of water.

Messrs. Jensen also possess the island of Samoen, and a vast territory situated in the Finmach, whither the cod go after leaving Brettesnoes.

The steamer Louisa (1,000 tons) is continually employed in transporting guano, oil, and dried fish from the island to London, and returns freighted with coal and provisions. Three other small steamers are also in the service of the company.

The question naturally arises whether the supply of fish, the necessary material of the guano, is likely to become exhausted? In reply we quote the opinion of Prof. Huxley, as far as concerns Norway:

"Travelers who have visited the fisheries of the Loffoden Isles relate that the arrival of the shoals of fish in January and February is a most remarkable sight. The cod form what may be almost called a mountain, penetrating the sea to a depth of 36 to 55 meters; these enormous banks of fish are continually arising from the west and south throughout almost two months. Supposing that each fish is 1·25 meters long, and at a distance of say 0·75 centimeter from its neighbor, there would be about 120,000,000 fish per square mile.

"Now, the fisheries of the Loffoden Isles have never yielded more than 30,000,000 fish; the entire number taken in the whole of Norway certainly does not exceed 70,000,000. It appears, therefore, that a single shoal of cod is more than sufficient to supply the whole of the fisheries of Norway for an entire year."

Mr. Huxley points out that the cod preys upon the herring, so that the 120,000,000 cod forming the shoal one mile square, supposing that each fish devoured a herring per diem, would destroy 840,000,000 herrings a week.

These herrings, again, devour smaller fish, so that some idea may be got of the immeasurable riches of the northern seas at the period of the migration of the cod. Huxley concludes that this class of fish, cod, herring, sardines, mackerel, etc., *may be regarded as inexhaustible.*

The principal object of the Loffoden fisheries is the manufacture of cod liver oil.

As soon as the fish has been hoisted into the fishing boat, its head is cut off and the liver and roe extracted, the latter being used as bait for sardine. The only means of obtaining the oil fresh and sweet is to treat the liver immediately upon its removal from the fish. To effect this, and it is in this that Messrs. Jensen have shown their originality.

A special boat, which is itself a complete manufactory, follows the fishing boat in tow of a tug. As soon as the livers have been extracted, they are piled up in small casks on the Trafalgar (the ship just mentioned), and immediately placed in basins heated by steam to extract the oil.

The oil is then refined and purified before being sent into the market. It is free from all putrescible matter, is absolutely pure, and has a bearable taste.

The body of the cod is dried on the rocks to make "Klipfish," which is chiefly sold to Spain and the West Indies, or is salted and packed in casks.

The only portions of the unhappy codfish which are left are the head, backbone, entrails, and various waste portions. These residues, after undergoing several varieties of treatment, furnish the fish guano. Potassium salts are added in order to improve the character of the article. The mean composition of this product is as follows:

Brand.	Organic Ammonia.	Bone Phosphate.	Sulphate of Potassium.
C. P.	6½ to 7½	20 to 22	7 to 8
H. P.	7 " 9	10 " 12	7 " 8
G. P.	5 " 6	10 " 12	7 " 8

The great maritime fisheries of Norway produce annually:

Herring	121,069 cubic meters.
Cod	48,647 " "
Mackerel	7,146,000 " "

A good and efficacious fish guano must contain as little oil as possible, because the fatty matter prevents decomposition in the soil.

The oil is removed by mechanical pressure, and the pressed cakes obtained are again freed from oil by prolonged contact with boiling water. The residues are dried on plates or in retorts, and are then lightly roasted. This makes them brittle, and they are then ground and sieved.

This industry, the aim of which is to exploit the immense reserves of the sea for the benefit of agriculture, cannot be too much encouraged. It forms one way of restoring the mass of fertilizing material which is borne into the sea by the rivers. It is another instance of the fact that in nature nothing is created, nothing is lost, everything undergoes change.—*L'Engrais.*

Robert Mushet.

This well-known metallurgist, the inventor of Mushet's special steel, died on January 29, 1891, in the eightieth year of his age. He had received full recognition from the profession. In 1875 the British Iron and Steel Institute awarded him the Bessemer gold medal "in recognition of his great improvements in the manufacture of iron and steel." It was he who coped successfully with one of the early difficulties with the Bessemer process, suggesting the employment of manganese as a dephosphorizer. He also invented the process of adding spiegel iron to the metal in the converter at the expiration of the blow. This is one of the most important inventions in connection with the Bessemer steel process.

A GOOD rat story comes to us from Michigan. A straw held in the mouths of three rats drew the attention of citizens of Nashville to a strange sight. They were traveling along the road, three abreast, when it was discovered that the two outside rats were thus leading the center one, which was old and blind.