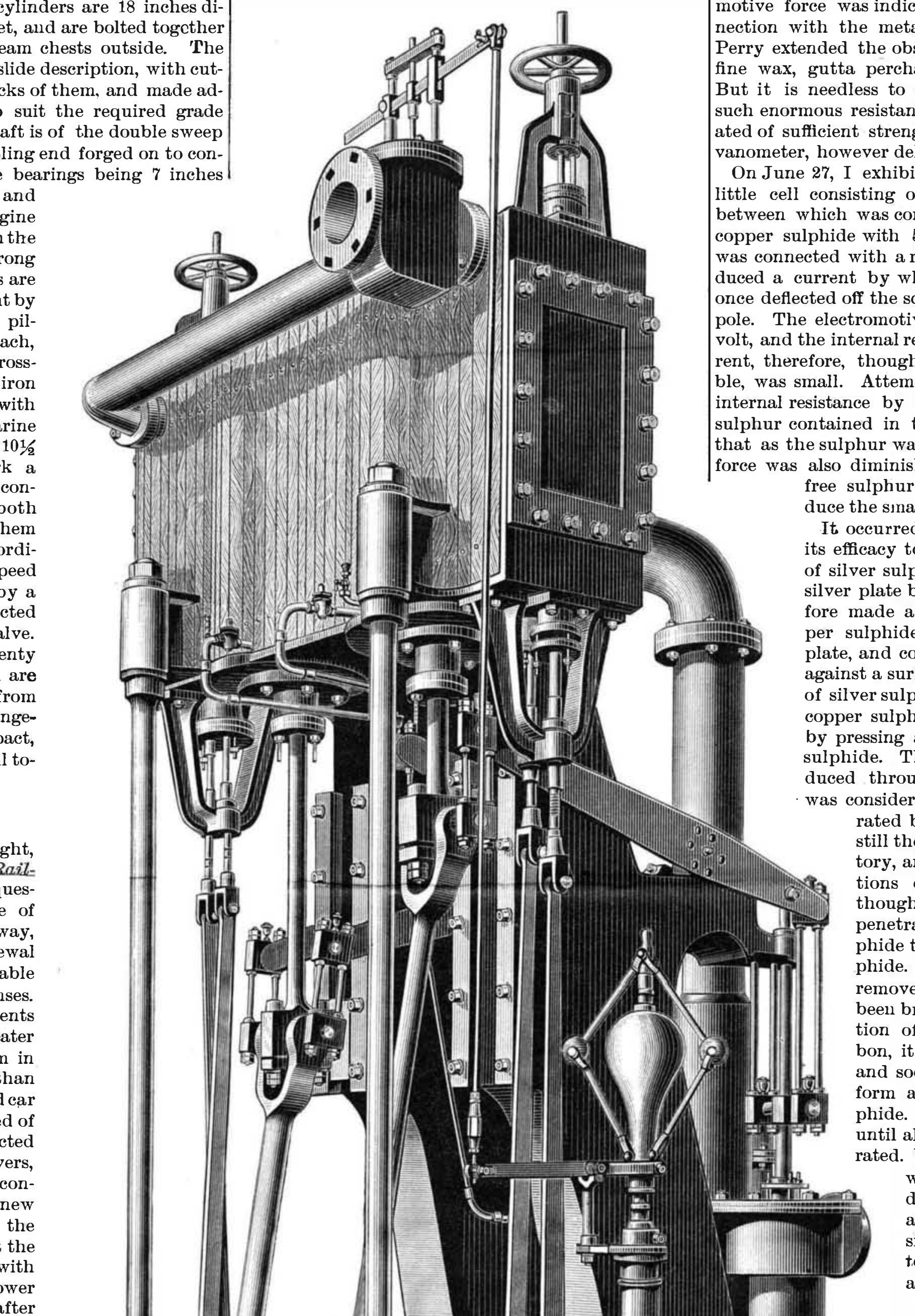
VERTICAL FLOUR MILL ENGINES.

These engines were made for driving a flour mill at Wolverhampton, and the particular design shown in our engraving was, says *Engineering*, adopted to suit the peculiar circumstances of the case, no room being available for engines of the horizontal description. As will be seen, the engines are of the vertical inverted cylinder marine type. The cylinders are 18 inches diameter, with a stroke of 3 feet, and are bolted together in the middle, with the steam chests outside. The valves are of the ordinary slide description, with cut-off plates working on the backs of them, and made adjustable while in motion to suit the required grade of expansion. The crank shaft is of the double sweep marine type, with solid coupling end forged on to connect to the mill shafting, the bearings being 7 inches diameter by 11 inches long, and three in number. The engine bed and the frames on which the cylinders rest are very strong and rigid, and the cylinders are further supported at the front by two wrought iron polished pillars. An air pump is fitted to each, and worked from the main crossheads by means of wrought iron levers, and coupling links with brass blocked ends of the marine type. The pumps are each 10½ inches diameter, and work a stroke of 18 inches. The condenser, which is common to both pumps and placed between them on the engine bed, is of the ordinary jet description. The speed of the engines is regulated by a quick-speed governor connected to an ordinary throttle valve. These engines run at seventy revolutions per minute, and are perfectly steady and free from vibration. The whole arrangement is very neat and compact, the different parts lying well together.



VERTICAL FLOUR MILL ENGINES.

Car Starters.

Mr. Augustine W. Wright, writing to the *American Railroad Journal*, says: The question of car starters is one of interest to every horse railway, for the original cost and renewal of horse flesh is no inconsiderable item of the operating expenses. I made a number of experiments to ascertain how much greater force was exerted by a team in *starting* a loaded street car than was required to keep the said car in motion at an average speed of six miles per hour. I selected steady teams and good drivers, and under these favorable conditions found that upon new steel rail tracks 7·1 times the power was exerted to start the car, and upon old iron rails with low joints 4·1 times the power used to maintain the speed after starting. The power required to keep the car in motion was much less upon the new steel rail tracks, and shows that the better the tracks the greater the relative loss in starting the loaded car. With a poor driver, who allows his team to start quickly, the relative loss is much greater, and no inconsiderable inconvenience is caused the unlucky passengers.

It is chiefly the wear and tear of starting the heavy load of car and passengers which give our horses such brief railway lives. If the pavement in the horse paths consists of any other than well selected cobble stones of suitable size and shape, the horses slip and frequently strain their backs—an injury from which they never recover. To guard against this slipping during unfavorable seasons of the year, their shoes are removed and calks sharpened. When our horses were traveling upon wooden blocks, at times their shoes were removed and sharpened every *third day*. This caused rapid hoof depreciation, but was the only way to keep them upon their feet. The leverage system I believe practicable, but the machinery must be strong and light, so that the energy saved in starting may not be lost in transporting it during the time when it is not in use. It must be cheap and readily applied to existing cars without requiring any cutting of woodwork or changes in their construction. It must be simple, with few wearing surfaces to be cut by the sharp grit arising from the street. It must be automatic, worked by the team without intervention of the driver. We all know that the driver, when out of sight, is not going to trouble himself to assist the horses. Horse railways would undoubtedly welcome such an auxiliary to their horse flesh, for it means a saving of many thousands of dollars in operating expenses.

A Voltaic Cell with a Solid Electrolyte.

I believe that there has never hitherto been made a voltaic cell with a solid electrolyte which was capable of generating the smallest sensible current—at least at ordinary temperatures. Sir William Thomson found that when warm glass was placed between plates of zinc and copper, the existence of an electromotive force was indicated by an electrometer in connection with the metals; and Professors Ayrton and Perry extended the observation to the cases of paraffine wax, gutta percha, India rubber, and shellac. But it is needless to say that with electrolytes of such enormous resistance no current could be generated of sufficient strength to be detected by any galvanometer, however delicate.

On June 27, I exhibited to the Physical Society a little cell consisting of plates of silver and copper, between which was contained a mixture of 1 part of copper sulphide with 5 of sulphur. When this cell was connected with a reflecting galvanometer, it produced a current by which the spot of light was at once deflected off the scale, copper being the positive pole. The electromotive force was found to be 0·07 volt, and the internal resistance 6,537 ohms. The current, therefore, though far more than merely sensible, was small. Attempts were made to reduce the internal resistance by diminishing the proportion of sulphur contained in the mixture, but it appeared that as the sulphur was diminished the electromotive force was also diminished, until, when there was no free sulphur at all, the cell failed to produce the smallest measurable current.

It occurred to me that the sulphur owed its efficacy to the fact that it formed a film of silver sulphide upon the surface of the silver plate by direct combination. I therefore made a cell thus: A thin layer of copper sulphide was spread upon a copper plate, and compressed into a compact mass against a surface of polished steel. A layer of silver sulphide was then spread upon the copper sulphide, and the cell was completed by pressing a silver plate upon the silver sulphide. The current which this cell produced through the shunted galvanometer was considerably stronger than that generated by the cell first described; but still the result was not quite satisfactory, and there seemed to be indications of short circuiting, which I thought might possibly be due to the penetration of particles of copper sulphide through the layer of silver sulphide. The silver plate was therefore removed from the cell, and, having been brushed over with a weak solution of sulphur in bisulphide of carbon, it was heated over a gas flame, and soon became covered with a uniform and continuous coating of sulphide. The heating was continued until all the free sulphur was evaporated. When the cell was reconstructed with this prepared plate, it produced a current of 6,800 microamperes through an external resistance of 0·2 ohm, and was able to deflect the pivoted needle of an ordinary coarse galvanometer.

The dimensions of the cell are as follows: The copper and silver plates measure 2½ inches by 2 inches; the thickness of the two layers of sulphide (strongly compressed) is about one-twentieth inch; the E. M. F. is 0·053 volt, and the internal resistance is therefore about 7 ohms.

This cell seems to be exactly analogous in its action to a Daniell cell, in which plates of copper and zinc are immersed in solutions of copper sulphate and zinc sulphate. Silver is probably the best (or only) possible metal for the positive plate, but some other metal might perhaps be substituted for the copper with advantage.—*Shelford Bidwell, in Nature.*

Death of a Remarkable Man.

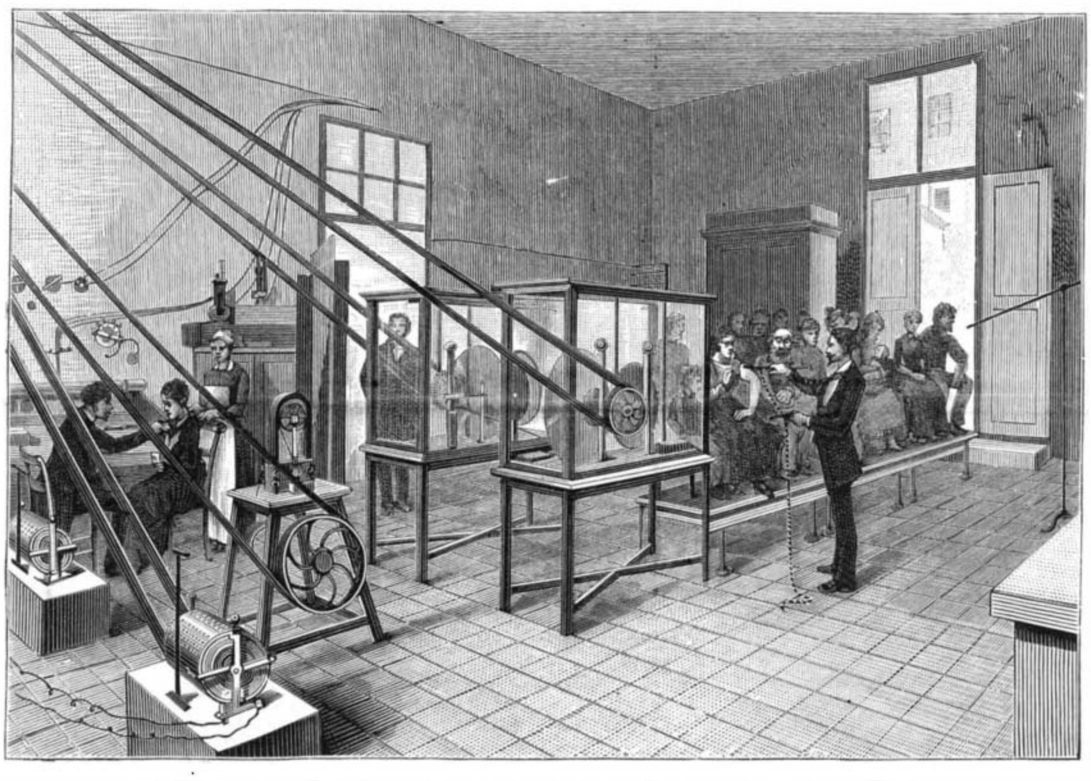
M. J. B. Bailliere, the well known publisher, medical bookseller, and founder of the firm that bears his name, died on the 8th instant, in the eighty-ninth year of his age. He was the senior of the medical publishers of Paris, and although he became blind during the latter part of his life, he was, even to within the last few days of his death, to be found at his post, which he occupied for nearly seventy years, and during which time he published some of the most important French medical works extant.

A Ship Canal from the Baltic to the Ocean.

The project of connecting the waters of the Baltic, the Elbe, and the German Ocean has been under the consideration of the Prussian Government since 1865. The scheme of a ship canal was formerly opposed by Count von Moltke, on the ground that it would be better to invest the immense amount of money required by such an enterprise in building up the Imperial Navy. Now that this work has been completed, and a powerful fleet of ironclads stands ready to plow the waters of the new canal as soon as it can be opened, the Field Marshal of the Empire has changed his views, and declared himself in favor of the work. At a recent meeting of the Bundesrath, a bill for its construction was unanimously approved. It is held by the advocates of the canal that the defense of the German coast must always remain a divided task so long as no waterway connects the Baltic with the German Ocean, and German war vessels are forced to pass from one sea to the other by a route which exposes them to the danger of falling into the enemy's hands. The estimated cost of the work is put at 156,000,000 marks, or about $39,000,000. It will be strongly fortified, and besides its military value will be of much importance to commerce.

ELECTRICITY AT THE SALPETRIERE.

At the Salpetriere, electricity constitutes one of the chief elements in the treatment of the sick. In fact, the service of electrotherapy has existed here for a long time. Its creation, in 1877, was due to the initiative of Professor Charcot, and its organization was the work of Dr. R. Vigouroux, who has continued to direct it ever since its foundation. The patients, as their numbers are called, pass from the reception room into the room for treatment shown in the engraving. Most of them take a seat upon two rows of insulating stools, where they receive electricity from the two machines seen in the middle of the room. They are thus in the first place submitted, for a length of time varying with the case, to what is called an "electric bath." Then the operator, provided with special instruments of various forms, called "exciters," makes such an application to each person as the case requires. As soon as a patient has been thus electrified, he gives way to another. In this way the sixteen stools are constantly occupied. The number of persons electrified at each sitting is 180, on an average. Those who are not to sit upon the stools go over to the electro-therapeutic table (shown to the left), where they receive electric applications of a different kind. The total number of persons treated at each sitting may be estimated as 200.



ROOM FOR ELECTRIC TREATMENT AT THE SALPETRIERE.

There are two categories of patients, viz., the inmates of the Salpetriere, and those from the outside, who come solely for electrical treatment. The inmates, of both sexes, belong for the most part to Professor Charcot's wards. As for the outsiders, many of them come from afar by rail, boat, etc. Numbers of these persons have a more well-to-do appearance than the usual patients of hospitals.

The original and important element of this organization consists in the use of electric machines. These latter, which had nearly ceased being used in medicine, have been very successfully applied by Dr. Vigouroux in the simultaneous treatment of a large number of sick persons. Without them, that is to say, with the ordinary processes of electrotherapeutics, the most active physician cannot treat more than twenty patients per sitting—which is an insufficient number. The electric machine solves the problem of the extension of the benefits of electricity to an indefinite number of patients.

Dr. Vigouroux has been kind enough to inform us as to the results of this electric treatment. They are, according to him, of the most satisfactory character. We believe, with most physicians, that nervous affections are nearly the only ones amenable to electricity. This, according to Dr. Vigouroux, is too narrow a view to take of it. At the Salpetriere almost all complaints are represented in the patients who succeed each other on the stools. In Dr. Vigouroux's opinion, electricity, especially static, must be considered as a stimulant and a regulator of the general nutrition. But it is not our object to write a medical criticism; and we shall confine ourselves to the descriptive side of the subject under consideration. Those persons ignorant of medicine who accompanied us were especially struck by the indifferent attitude of the patients sitting upon the insulating stools. One had unfolded a newspaper, another was doing crocheting, a baby was asleep upon its mother's knees, and, in curious contrast, the hair of each member of this quiet party was standing on end through the effect of the electricity. The calmness diminished slightly when the operator drew some sparks with a metallic ball; but, positively, the treatment appeared to us very mild, and was certainly borne very willingly by all these patients. Several, who were very infirm, were seated in large arm chairs or lying upon stretchers placed upon the insulating supports.

The electric machines are, as shown in the figure, inclosed in glass cases that preserve them against dust and dampness. They are of the Carre system, but arranged horizontally. Dr. Vigouroux is now having others constructed on a new plan. The manner in which they are set in motion merits special mention. A Gramme motor located in the room actuates a shaft, on which there are distinct pulleys that receive two belts for the electric machines and one for a laboratory Gramme machine. The current is furnished by a dynamo situated about 600 yards off, alongside of the large steam engine of the laundry. This transmission of power was put in by the house Breguet.

A small laboratory alongside of the room for electric treatment serves for experiments or researches.—*La Nature.*

High Speed on the Ocean.

The speed of ocean steamers has, as we know, increased very much during the last few years. It is not so long ago that nine days was looked upon as a quick passage in a transatlantic liner, and eight days a remarkable trip. Now, anything over seven days is regarded as a slow trip; the record having been brought down to six days ten hours and ten minutes, reckoned from the moment of losing Sandy Hook lightship to the sighting of Fastnet light. Referring to this and other fast trips made by the Oregon, her designer is reported to have prophesied that the trip would eventually be reduced to six days; and this is probably the best that can be expected, even when the present type shall have been developed to its best. Others have sought for more speed by lessening the draught and increasing the beam, but have not yet found it. All seem to think that higher speed is to be found in a change of lines and distribution of weight. The theory of propulsion, however, has remained unchanged, a propeller operating in the same line as the ship's motion.

Now comes a mechanician who contents himself with the present model, but proposes to increase the speed by a radical change in the principles of propulsion. He gives his views so clearly, and brings to their support such cogent reasoning from a mechanical standpoint, that they seem worthy of serious consideration; and though perhaps failing to convince the naval architect, wedded as he is to certain mechanical theories, in which he has been trained, may at least succeed in interesting him as well as the general public, who have of late been attracted by naval designs in marine construction.

In a pamphlet before us, Capt. John Giles essays to show that a much higher rate of speed can be had by changing the position now given to the propeller at the stern of the ship, as well as its inclination or dip. He would put the propeller under the ship, and, as near as we can judge by his diagram, just forward of the mizzen-mast; giving it an inclination of 45° with the plane of the ship's motion. With a propeller thus situated, he believes he can get forty knots an hour where now only twenty are had. The theory is based upon the manner of propulsion of animals, in which, as we know, the efforts of propelling impulse all radiate at an angle from the line of motion.

He says: "The organs of propulsion obtain their impulse from the reactionary force of the water upon which they operate; and as the motion of the fish creates no current in the lines of the propulsive effort, there is no depreciation of the propelling force by the motion of the body, but the mechanical energy derived from fluid reaction is constant at all velocities. In this case the body is totally immersed in water, and the organs of propulsion are duplicated, so that the propelling forces may balance in the line of motion. How completely this principle is carried out may be seen from the flatness of the fish's head, which, if it were not balanced by the opposing mechanical force of the pectoral fins, would destroy the equilibrium of the fish's motion. In the case of birds that swim the surface or that fly in the air, and of animals that live on the land, they are all subject to the force of gravitation operating in their bodies; and though they all exhibit the same mechanical principles in their structure, yet their propelling organs are not duplicated in adverse directions, as in the fish, but the force of gravitation balances the oblique application of the animal's mechanical impulse, the two forces then uniting in the line of motion in the body. The bird which flies does not expend its force in the line of the body's motion, but upward at an angle to it, and against the weight of its body, and at such a varying angle as the exigencies of flight and the forces resisting it require to secure a forward motion. The power of the horse is not expended in the same line as the motion of the body, but in its maximum effort of draught, in a direct line between the resting point of the hind feet and the animal's center of gravity. It is the same throughout the whole animal kingdom. Every one has doubtless experienced the force with which a fresh cherry stone can be projected by nipping it between the thumb and the finger at such an angle as to impart to it a forward impulse. This simple experiment exhibits the whole principle of animal locomotion, which in all cases is the result of coupled forces, operating at an angle to the line of the body's motion, and uniting their impulses in that line upon the center of gravity of the body. Where the body is immersed in a fluid of the same specific gravity as itself, all the propelling forces are mechanical; but where the weight of the body operates, the mechanical force of the animal is expended against its gravity and at an angle to it."

As another instance in support of Mr. Giles' theory, the reader who can swim will remember that he goes fastest in the water when he kicks out at an angle of about 30° from the line of motion of the body, with the feet inclining downward.

But notwithstanding this and the mathematical and mechanical formulæ as to resistance of water and slip of propeller when in the usual position which Mr. Giles brings forward to sustain him, it is difficult to see how the results he confidently expects from his system are to be obtained. Looking at the diagram of the proposed ship, with its elongated overhang, it seems as if the action of the propeller, with its inclination of 45°, would result in lifting the light after-hull of the ship and in a consequent depression of her bows.

On the other hand, it is easily seen that the propeller would have a deeper average immersion, and that there would be a greater resistance of the water to the screw blades, due to the water of reaction being projected downward—an important advantage certainly.

The Fuel Used at the Mint.

Mr. D. M. Fox, Superintendent of the U.S. Mint, Philadelphia, Pa., says the fuel used exclusively in melting gold and silver is "Council Ridge" anthracite coal, carefully hand picked and screened. He adds: "After many years' experience, and many experiments with other grades of coal, we find the 'Council Ridge' anthracite to be the only fuel really suitable for the pur pose, and we have discarded all others. We use the 'broken' coal size."