SCIENTIFIC AMERICAN

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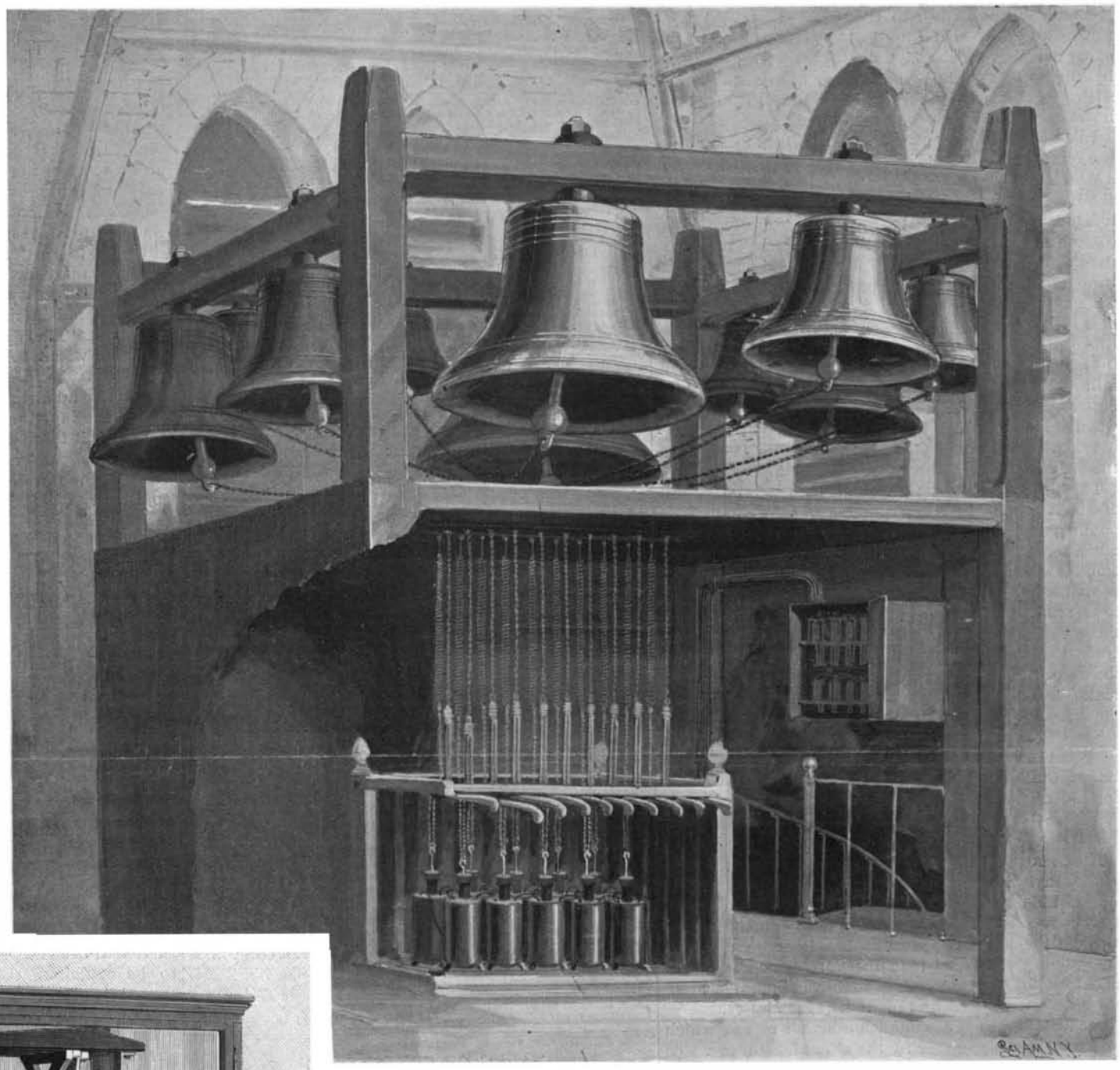
ELECTRIC TOWER CLOCK AND CHIMES, GRACE CHAPEL, NEW YORK.

One of the recent instances of the almost infinite utility of the electric current is to be found far up in the tower of Grace Chapel, New York, where electricity has replaced the weights of the tower clock, and not only turns its wheels, but also strikes the quarters and the hours and plays a curfew hymn at the close of the day.

And here it may be mentioned, in passing, that the Grace Church Settlement, as it is called, with its chapel, its hospital for aged women and children, its club houses and gymnasium, its parish house and clergy house, and its fine assembly room, is one of the most complete religious and philanthropic institutions of its kind. Generous wealth combined with good architecture and engineering have produced an establishment which, from the engine and boiler room in the basement to the electrical clock and chimes in the tower (the latter a gift from the Misses Potter, of Sing Sing, New York), is replete with the latest mechanical and architectural conveniences of the day.

As our readers are well aware, the usual method of running tower clocks is by means of dead weight, the weights being wound up at stated intervals. The improvement in the Grace Chapel clock consists in the replacing of the weights by a small electric motor, thus obviating the necessity of electrical contacts and the mechanical disadvantage of starting and stopping heavy hands, as in the ordinary secondary system of operating clocks. The clock proper, which, with the keyboard, is located in a small room in the tower, is of the ordinary tower clock pattern, and differs from this only in the fact that the barrel on which the weights would ordinarily be wound is empty. The novel feature is a tiny electric motor which is carried upon an extension of the base upon which the "works" are placed. The current is furnished from a storage battery which is charged by the Grace Chapel dynamo, and has sufficient capacity to run the clock for two weeks in case it should be necessary to shut down the dynamo. In clocks of this kind, where an independent plant is not available, current could be taken from the city mains.



THE BELFRY CHIMES SHOWING MAGNETS AND ATTACHMENTS TO CLAPPERS.

ELECTRIC SELF-WINDING CLOCK AND KEYBOARD.

ELECTRIC TOWER CLOCK AND CHIMES, GRACE CHAPEL, NEW YORK.

The motor shaft carries a small grooved pulley from which a coiled wire belt runs to a friction pulley on the arbor or shaft of the escapement gear, which is thus subjected to a steady pull, answering to the pull of the weights in an ordinary clock. Every movement of the escapement allows the shaft to rotate the required amount, and the resulting movements of the clock are transmitted by light hollow shafting to the tower clock dials. A cam on the minute shaft makes an electrical contact once a minute, and sends a current to a contact disk on the hour shaft. The disk is furnished with four contact points, which operate every quarter of an hour, to throw in a magnetic clutch and start the "Westminster Chimes" barrel, which will be noticed in the lower right hand corner of the clock. This barrel is similar to those which are used in a music box, being furnished with a number of pins which operate similarly to those of a music box cylinder. They do not strike the teeth of a comb, however, but

serve to lift a series of small electric keys and pass successive currents through a series of wires which lead up to the chimes in the belfry.

Beneath the ten bells are placed ten powerful solenoid magnets, one to each bell. Each of these consists of an iron armature, which hangs, when the magnet is not charged, just within and above the solenoid coil. When the pins of the rotating barrel below strike a key, a current is passed through the solenoid coil in the tower and the armature is pulled violently down within the coil. The chain by which the armature is hung runs up over a pulley and attaches to the clapper of the bell, which is thus caused to make one stroke for every contact.

A similar mechanism to that above described serves to throw in a wooden cylinder, or barrel, at nine o'clock every evening, which plays what is known as the curfew hymn; and after the hymn is played the clock remains silent through the night, in order that the neighborhood may not be disturbed by the bells.

In addition to the automatic mechanism for striking the quarter chimes, the hour, and playing the curfew, a separate keyboard is provided in the small room at the base of the tower in which the clock mechanism is located. It is carried in a box-like structure, shaped something after the fashion of a reed organ, and it is used every morning at nine o'clock for playing a hymn tune by hand, and also at the regular Sunday services. This keyboard has electrical connection with the magnets in the tower and operates in the same manner as the apparatus already described. In case there should be any breakdown of the electrical connections or failure of the current, each of the connecting chains between the magnets and the bells is furnished with a wooden lever which is hinged to the frame of the magnet box. This arrangement is the same as is used in the ordinary tower chimes for tune playing.

The chime consists of ten Meneely bells, the largest of which weighs about 3,000 pounds and the smallest 250 pounds, and to strike a sufficiently powerful blow on a bell weighing a ton and a half requires a considerable amount of force. As a matter of fact a pull is exerted equivalent to between three and four horse power, and to secure this the main current from the dynamo is thrown on by means of the relay box, which will be noticed attached to the wall of the tower. The cost of the current for running the motor is estimated at $1\frac{6}{10}$ cents per day, and the clock has proved to be a reliable timekeeper.

For the above particulars we are indebted to Mr. George F. Atwood, the designer of the clock, and to Mr. McCullough, the engineer of the Grace Church Settlement plant.

The American Machinist.

The fame of the American machinist extends everywhere, says a contemporary. His ingenuity in planning and his skill in execution are known wherever man uses machines and tools. If there is any one branch of work in which he excels more than in another, it is in the building of special machinery, by which is meant machines not kept in stock or regularly manufactured, but specially devised and made for special uses.

For instance, man designs some article of use which he works up by hand or by the aid of machinery. To produce this article in quantities, at such a cost that it can be sold at a profit, special machinery is required. The designer or inventor takes the article to the builder of machines and says: "Can you make a machine that will make these things, and will you guarantee it to work?" It is altogether probable that the machine builder answers "Yes" to both questions, because there is practically nothing that he cannot do.

Special machinery is built for a wide variety of uses. As the knowledge of American skill in this direction, now long familiar, has spread, orders have come from all over the world, and special machinery is sent from here also for use in enterprises installed or conducted by Americans in foreign countries.

Such machinery, for various uses, is shipped from this country almost everywhere. One big machine shop in this city that is largely engaged in the production of special machinery sends probably a third of its work out of the country. It has sent machines to every land.

A Suspension Bridge of Fence Wire.

A curious suspension bridge of fence wire was recently constructed across the Waukarusa River, in Douglass County, Kan. This stream, like so many other Kansas rivers, swells to a torrent at every large rainfall, so that it was impossible for the children living across the stream to go to the school house. The county engineer was asked to provide a remedy. He bought quantities of fence wire, boards and timber. He used good sized oak logs as piers. Strips of boards three feet long were fastened together with wire and over these strips was run a plank walk two feet wide. Each end of the superstructure was then anchored to the piers; the sides consisting of a network of wire, were then put up. The bridge is two hundred feet long and is sixty feet above the water. It is certainly a daring feat of homemade bridge construction.

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THE EXPANSION OF OUR FOREIGN TRADE.

If there is one fact more than another that is made evident by the events of the past few years of industrial depression, it is that a large extension of our foreign trade is a necessity if we are to have a return of our old-time prosperity. In spite of the rapidity with which the country has grown in population and wealth, and the ever lengthening list of what the average citizen considers to be for him the necessities and conveniences of daily life, the increase in our manufactured products is so rapid that there is always a surplus on hand. The national instinct—it is nothing less—for cheapening the cost of labor, and the ingenuity which has enabled us to lead the world in the production of labor-saving machinery, have enabled us to turn out our manufactured products with a speed and at a price which our old world competitors frankly admit to be entirely beyond their capacity.

The necessary consequence—an overloaded domestic market—was merely a question of time, and there is no doubt that the present so-called depression is largely an evidence of the fact that we have improved, and are continually improving, on our former methods of manufacture. It is not that we consume so much less as that we produce more speedily, more cheaply, and therefore in greater abundance.

The country has reached a point at which it has to choose between two alternatives: it must either curtail its production or find new markets in foreign countries. The day has passed when America can boast, or wishes to boast, of its absolute independence of the outside world, and in regard of our foreign trade it must be admitted that it is destined soon to become one of the supreme questions of the hour.

Why is it that one great section of the English speaking race has such a preponderating share of the foreign trade of the world, while the other has comparatively so little? It is not a sufficient answer to say that Great Britain's widely extended trade is altogether the outcome of her vast navy and mercantile marine, for this would be to mistake cause for effect. Her fleet of ships is as much the outcome of her commercial operations as her markets are the outcome of her omnipresent fleets. Each has served to build up the other, and both have poured wealth into the private purse and the public treasury of the people. The United States, on the other hand, have been so entirely occupied in developing the vast internal resources of the country that they have thought little and cared less for the foreign fields of commerce which were being occupied by British, French and German interests. While Great Britain has been shaping steel and iron into ships and engines, we have been turning them into rails and locomotives; and against the vast ocean fleets of the old world we have to show the 180,000 miles of track with which, mainly in the brief thirty years since the war, we have covered the land. If our ocean carrying trade had not been destroyed by the Confederate cruisers during the civil war, and if at the close of that war there had been no great area of undeveloped country to be exploited, this nation would doubtless have turned its attention to the upbuilding of its merchant marine and the extension of its foreign trade.

The time has come, however, when, if we are to hold our reputation as the most progressive race of the day, we shall be obliged to compete for a proportionate share of the foreign trade of the world. If we are to be successful in the competition, it must be carried out on scientific lines and on a liberal scale. No half measures will suffice; and it may as well be written down at once, that if we are ever to create and control markets on the vast scale that marks the operations of Great Britain, we shall have to adopt her methods, at least to the extent of carrying our goods in American ships. Any scheme for the extension of American foreign trade that contemplates the carrying of that trade in English or German ships may as well be pigeonholed at once. To do this is to pay toll both ways, divert a big share of the profits to an alien people, and carry a foreign yoke which is not the less shameful because it is self-imposed. The advantage of a nation's trade being carried in its own ships is shown by the figures of British trade and shipping. The latter, according to the latest figures, is credited with carrying seven-tenths of the world's ocean-borne commerce, and this includes not only the traffic between England and other foreign countries, but the traffic between these countries themselves. Apart from the great advantage which she thus secures in the matter of her own freights, there is a total annual tribute of about $800,000,000 paid by other nations to the British shipholder.

It is not within our province to discuss the share which the government, in its endeavor to promote foreign trade, should take in the upbuilding of our merchant marine; but we think it would be a wise and far-sighted policy to encourage this moribund industry by every legitimate means that can be devised and carried out. Coupled with this there should be a reform of our consular service, at least as far as the method of selection of our consuls is concerned. These should be chosen rather for their fitness to fill the highly important positions to which they are sent than for any