A WONDERFUL CLOCK.

William L. Bundy, the inventor of the Bundy time-recorder, has completed a most ingenious clock, on which he has been at work for many years.

The clock stands nine feet high and is inclosed in a case of quartered oak, carved and finished entirely by hand. The hour and minute of the day, day of the week, day of the month, day of the year, and the year, are told by the clock. The phases of the moon are given, and the shape of the moon each day is shown. The clock also gives the seasons of the year, strikes the hour and plays a tune each hour, giving six distinct changes of tune and playing them consecutively.

The mechanism of the clock sets in motion a small steam engine and dynamo machine. It also chimes the bells placed around the dial at a quarter past the hour over and back once; half past, over and back twice; and at three-quarters, over and back three times. The small figures—a band of soldiers—in the "grotto" operate each quarter of the hour, and simultaneously an "old-fashioned sawmill" is set in motion, sawing through a log, the carriage returning ready for another cut. The water can be seen running down the flume. At the same time a bell in the dome at the top of the clock will toll, calling attention to the mill in operation. Beneath the mill is an artificial pond, containing fish of different kinds, frogs, turtles, shells, etc. There is also a boat floating among the logs on the surface of the pond.

The entire mechanism is built in skeleton form, and every part is visible from the front and sides. The mechanism is driven wholly by the clock movement, operating the various sets of complicated levers and cams. It has to be wound up once a week in five different places. The wheels revolve at a rate of speed varying from six hundred revolutions a minute to a revolution once in ten thousand years. These wheels are operated in such a way as to make the calendar perpetual, giving each month at its proper time and the correct number of days to each month, including leap year; and the year changes correctly at leap year, when an extra day is added.

That the sound of the music and chimes may be heard, a panel is automatically opened at the bottom of the upper case when the music starts to play, and is closed when the music ceases. Although the music, the chimes and the sawmill operate all automatically on the quarter of the hour, they may be set in motion at will by buttons on the outside of the case.

Mr. Bundy began work on the clock in 1878, when he was in the jewelry business in Auburn. He completed the upper part of it without the sawmill and pond and placed it on exhibition in his store window. Then it was considered so much of a curiosity that for a long time it was necessary to have a special detail of police to keep the crowd moving. Since then he has entirely remodeled the clock and added the sawmill and pond.

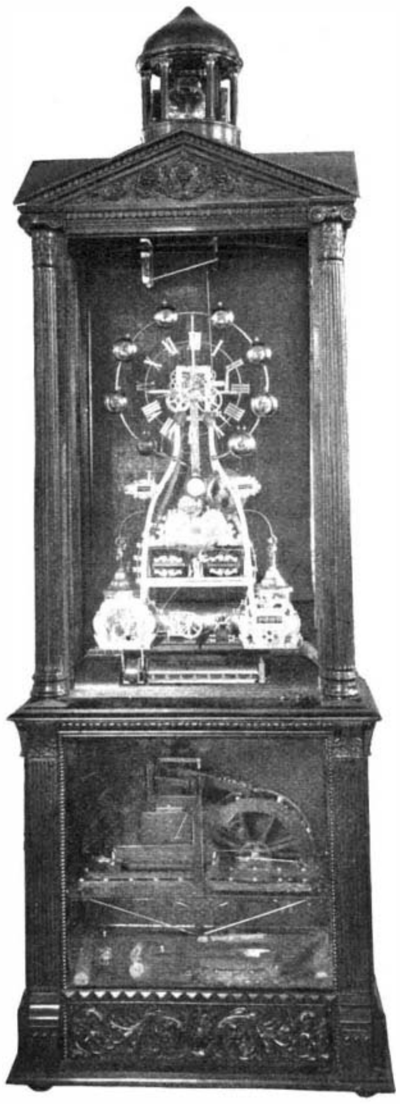
A NEW INDUCTION COIL.

BY PROF. W. C. PECKHAM.

When the discovery of the Roentgen rays was announced five years ago, the induction coil was in the condition in which it had been for many years. There had been no demand for its development. It was regarded as an instrument for the display of certain striking and beautiful electrical effects, but of little value even for purposes of instruction. All that was very quickly changed. It was the good fortune of the writer to have, at that time, in the cabinet of apparatus belonging to his department of instruction, a very fine coil made by the son-in-law and successor of the famous Ruhmkorff in Paris. He had also a very excellent series of Crookes tubes recently purchased to exhibit their beautiful phenomena, so that he could go immediately to work to investigate in the new field. The induction coil is the best means of generating the X-ray and is indispensable for transmitting messages by wireless telegraphy. Its importance is greater now than it ever was before.

Up to the time above alluded to, coils had been limited to a spark length of about 15 inches. There had been one remarkable exception, the coil made by Mr. Apps, and usually spoken of as the Spottiswoode coil. The total length of this coil is 4 feet; its external diameter is 20 inches. The core of the primary is 44 inches long, 3·56 inches in diameter, and its weight is 67 pounds. The primary was of copper wire nearly $\frac{1}{10}$ inch in thickness. It had 1,344 turns and was wound in six layers 42 inches long. There was another smaller primary, but it was not used for long sparks.

The secondary coil contained no less than 280 miles of fine copper wire wound in four sections, and forming a cylinder 37½ inches long and 20 inches in diameter. Two sizes of wire were used in the secondary, the outer sections at each end being of thicker wire than the inner sections. The secondary contained 341,850 turns. With 30 cells of Grove battery it gave a spark of 42½ inches, by far the largest spark of electricity artificially obtained up to that time. This coil was made about twenty-five years ago, and is said to be greatly deteriorated at the present time. Its proportions have been given for the sake of comparison with those of the coils described below. They are very different from the best practice now.



AN INGENIOUS CLOCK.

Some seven years ago Prof. Elihu Thomson published an account* of his high frequency apparatus, by which, with an alternating current dynamo as an exciter, he produced a spark 64 inches in length. The work of Prof. Trowbridge at Harvard University with his enormous battery has been described in these columns. Both these experimenters employ an extraordinary source of power and obtain results which have not been equaled elsewhere.

There have recently been exhibited in New York city two new and very remarkable induction coils. They are of the old pattern, but of new proportions, and give results which seem to demonstrate the claim of their designers that they are a very great advance upon their predecessors. Our illustration shows the external appearance of the coils, for they are made exactly alike. They have been made by Queen & Company, of Philadelphia, for the Japanese government, and are to be used for wireless telegraphy. The largest coil which this firm has hitherto built has been one of a spark length of 25 inches. Considerable experimental work was necessary to determine the proper proportion of the various parts of the new coils.

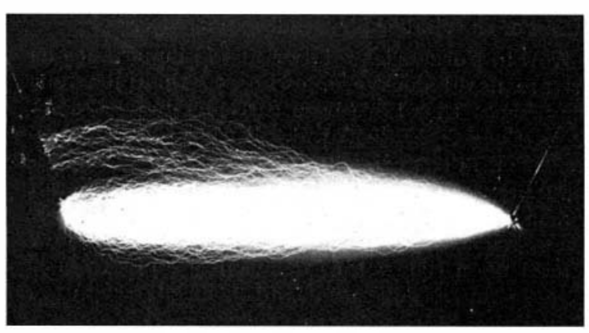
In these coils the core of the primary is as usual composed of iron wire wrapped into a bundle about 5 inches in diameter and 4 feet long, weighing over 200 pounds, or almost five times as much as that of the Spottiswoode coil. The general method of mounting may be easily made out from the engraving. The secondary contains about 100 miles of fine insulated copper wire, wound in a very great number of small sections. It will be seen that the secondary is divided in the center, making two distinct and separate parts on separate spools. This is done simply for convenience in handling, since each part is easily removable for transportation.

The form of the secondary is very unlike that of its great predecessor. The proper position and size of the coils of the secondary were carefully determined by experiment and measurement of the magnetic flux, and as a result of this investigation these coils will give a spark of 45 inches in length with 100 pounds of secondary wire, as against 280 pounds in the Spottiswoode coil. It will be observed that the iron core extends nearly a foot beyond the secondary spools. These spools are about 15 inches in external diameter. The exact shape of the secondary winding is not stated, but it may be stated that it is not cylindrical, and is deeper toward the center.

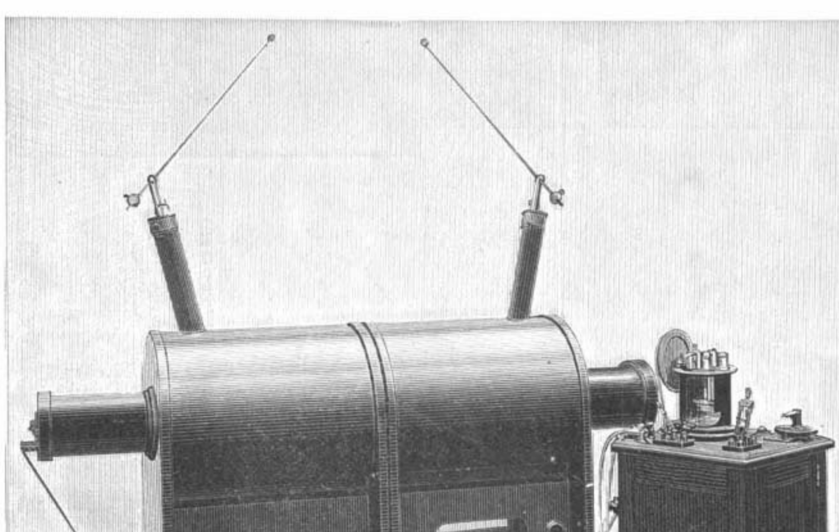
The circuit breaker and condenser are placed in an auxiliary piece of apparatus, seen to the right of the coil. The break is accomplished by an electric motor moving very heavy pieces of platinum, which separate under the surface of a liquid. The speed of the circuit breaker may be varied through wide limits. The condenser is divided, so that it may be adjusted to the capacity of the circuit. By grounding the center of the secondary upon the primary, the potential between the primary and the secondary cannot rise higher at any point than is represented by a spark of 20 inches. The poles of the secondary are heavily insulated, and are inclosed in hard rubber tubes which extend to a safe distance above the coil.

When used in connection with a storage battery giving 25 volts and 20 amperes, a very heavy secondary spark, representing hundreds of thousands of volts, is produced between the terminals when they are separated 45 inches. When used to give sparks between 25 and 35 inches in length, and when the circuit breaker is run at comparatively high speeds, a great number of sparks will pass between the terminals, and this is clearly seen in the small engraving, which shows the spark points separated about 32 inches.

The results which will be obtained in connection with wireless telegraphy experiments can only be conjectured, inasmuch as no such spark length has been heretofore obtainable for use in connection with this work. It is thought, however, that owing to the peculiar nature of the long spark produced by these coils, the distances over which messages can be sent will be greatly increased.



SPARKS 32 INCHES LONG.



INDUCTION COIL MANUFACTURED IN PHILADELPHIA FOR THE JAPANESE GOVERNMENT.

THE export of British rails has considerably diminished during the first nine months of the present year, since the aggregate quantity dispatched abroad is only 277,809 tons, as compared with 354,737 tons for the corresponding period of last year, a decrease of 76,925 tons. The most serious reductions are those of British India, where the demand has fallen by 48,248 tons; Norway and Sweden, by 40,703 tons; Canada, by 16,759 tons; China, by 8,915 tons; Brazil, by 6,358 tons; Egypt, by 4,672 tons. On the other hand, the exports to the Argentine Republic have increased by 17,052 tons; Australasia by 11,268 tons; British South Africa by 10,111 tons; Japan by 9,000 tons; and Mexico by 7,078 tons.

*See SCIENTIFIC AMERICAN SUPPLEMENT, No. 927.