

Discussion.

MR. SYKES, after proposing a vote of thanks to the author for his interesting paper, also remarked that the subject, as treated that evening, had caused him to change his theory as to the skill and perseverance required in the manufacture of clocks generally. He could now see that they possessed features peculiar to themselves. He would like to know what means were taken for the prevention of injurious sparking at the contacts of the electrical clocks, as he thought that this portion of the mechanism would at least require some attention.

MR. SHIRRA said it gave him great pleasure to second the motion put by Mr. Sykes. From an engineer's point of view, the subject of clocks was an unusual one. Several points put forward in the paper were worthy of note. He would mention the small amount of wear that was said to take place between the hard steel surfaces shown in one of the illustrations of the teeth on the wheels of the timepiece shown. Another feature that he was unaware of until he saw and had the illustrations explained, was that the pendulum drove the clock in the electric timepiece, and not the clock the pendulum, as in the ordinary spring driven type.

MR. DUNCAN MOFFAT said he was greatly interested in the steel referred to by the author, that was used for springs, etc., and he would like to know if the same could be obtained in quantities for commercial use, or whether the price of the same would make it prohibitive in every day engineering construction.

MR. BRAGG (Vice-President) said he would like to ask the author why the pendulum, if attached to a string that had no appreciable weight, did not swing in a true arc of a circle, but to a course that was really a Cycloidal curve.

MR. MURDAY, who was present as a visitor, very ably explained several of his inventions and additions to the clock shown that evening, and his remarks met with heartiest approval of all the members present.

The vote of thanks, on being put to the meeting, was carried unanimously.

MR. TOURNAY-HINDE said that it had given him great pleasure to be able to present to the members a subject that has proved of some interest, and he would give his answer to the questions put by members to the best of his ability. He said, with reference to the question by Mr. Sykes, that the difficulty of the spark at the point of contact had been got over by the use of a non-inductive shunt, put in parallel with the magnets. The use of this shunt permitted the contacts to run for years without attention, as the current used was a remarkably small one.

In reply to a member, who had asked what means were adopted for lubricating the electric time-keepers, he said that the whale oil was the lubricant used, if any was used at all; but it was a source of trouble at any time, and in an electrical clock was never used at all. With regard to the use of the special class of steel that Mr. Moffatt enquired about, he would say that it was a grade of nickel steel, and was known as "Invar" steel. It could be obtained in quantities, but the price was prohibitive. Clock-makers used it largely in the manufacture of pendulums.

He said, in reply to Mr. Bragg's inquiry, that Huyghens clearly demonstrated that unless the bob of the pendulum swung in a cycloidal curve, it was not true. He had referred to this phenomena in the paper. He would say that as long as the arc was constant, the rate would be constant, that is, so long as the weight could describe, not a circle, but a cycloid, of which the cord would be the radius of curvature at the lowest point, all its vibrations, even though they varied in the length of the arc, would be gone over in the same length of time.

He thanked them for the manner in which they had received his paper.