adapted for cutting quick curves or keyholes it is named as above.

Hatchet (fig. 38) is a small axe with a hammer head forged on the opposite end. It is very useful to the joiner in making plugs to insert in walls for fastening his work, and the hammer head is then employed in driving them into their holes.

Plugging chisel (fig. 39), a prism of steel, about 9 inches long, with which the joiner forms holes in masonry or brick work into which he drives his wooden plugs to which the work is fastened.

Try-square (fig. 40) consists of a stock and blade. The stock is a rectangular piece of hardwood, generally ebony or rosewood, its inside edge being covered with a brass plate.

Hammer (fig. 41). The modern joiner's hammer is exactly like fig. 41, and is a solid steel casting with a smooth, round face on one side of the head for the purpose of driving in nails by rapid percussive strokes on the nail head. On the other side a double split claw, useful for drawing out old nails by catching the nail in the split and using the handle as a lever and the percussion head as a fulcrum to pull out the nails needed. The handle is of turned ash and wedged into the adze-eye or socket in the head with iron wedges to prevent the head slipping the handle. It usually is made in the shape shown, in this country, and with a straight pene or point in Europe. The adze-eye application was invented by Mr. Maydob, and is now universally in use.—*Builder and Woodworker.*

THE EDUCATION OF AN ELECTRICAL ENGINEER.

The present activity in the electrical world is causing many to adopt the profession of the electrical engineer, as there must be in the near future a great demand for properly qualified men. The field is so new that the precise training required is yet open to discussion, and the different opinions expressed on the subject by those who ought to know are often most bewildering to the would-be beginner. Broadly, there are two methods of training in vogue; the one is to be obtained at the various colleges in the Metropolis, some of which are entirely devoted to the teaching of electrical engineering; the other is that hitherto adopted by mechanical engineers of an apprenticeship to some firm or company actively engaged in manufacturing or installation work. A lad who learns his craft by working side by side with ordinary mechanics undoubtedly gains an insight into one part of his future profession that no amount of mere college training can ever impart. It must be remembered, however, that the steam-engine is so exceedingly simple that most lads have already learnt its action from some popular book before leaving school. Why the piston moves forward with a certain pressure of steam behind it is obvious, and how the motion is transmitted to the fly-wheel can be seen at a glance; but to this day no full explanation of what electricity and magnetism really are has yet been given, and many a University graduate in science is utterly unable to explain why or how a dynamo machine works at all. A youth may be turned loose in an electrical company's workshop, and see every detail of construction, without having the least idea of why the various pieces of apparatus are constructed as they are; why, for instance, if a piece of copper is moved in one way between the poles of a magnet an electrical current flows from it, whilst a slightly different movement produces no effect whatsoever. Before an electrical engineer can hope to be able to be anything more than a mere rule-of-thumb man; indeed, before he can hope to be more than a superior kind of workman, he must know at least the elementary theories of his subject. This theoretical knowledge is unquestionably best acquired in a properly-conducted college, and although it is frequently urged that a student straight from college is of little use in carrying out contracts, and that whilst able to discourse learnedly on what has already been done by others cannot by himself perform some of the most ordinary work, and that, furthermore, in cases of emergency he loses his head and is worse than useless, yet no student will ever be guilty of the egregious blunders daily committed by the so-called practical man. When extreme and contrary views on any subject are held, a good plan of getting at the truth is to strike a average between them. This leads us to believe that the proper training for the embryo electrical engineer is a course of lectures and laboratory work at a college, followed by a short pupilage at a manufactory or central station, where he can see his knowledge practically applied on a large scale. The managing director of a well-known company has recently been advising the boys fresh from school to become practical mechanics first, and then to study electricity. With this we totally disagree. At the age of 16 or 18, when a boy leaves school, his mind is more receptive than at any other period of his life; whatever knowledge he may possess of mathematics, natural philosophy, or chemistry is still fresh in his memory, and to him the discipline of a college and book work in the evening come naturally. We very much doubt if the average lad will take kindly to study again after he has given it up for two or three years, got rusty in everything he ever learnt, and become accustomed to manual labour in the shops. To the question, "What theoretical instruction do you give your apprentices?" the manufacturer always replies: "We expect our apprentices to study at home in the evening." This is simply nonsense. A boy who has begun work, possibly at 6 o'clock in the morning, with the workmen, when he gets home in the evening either wants to go to bed tired out, or to have some amusement. Advocates of the purely theoretical or purely practical training always point to the careers of certain eminent electrical engineers as proving the truth of their advice. To such advocatss we would point out that men of untiring energy and great natural ability will train themselves and become famous under any circumstances. Indeed, one of the most brilliant men, and perhaps the most successful designer of electrical plant of the present day never had any special education at all. Fortunately, as long as colleges charge fees, and firms require premiums, further confusion will not be made by people being advised to follow this example and become electrical engineers without any training at all, either practical or theoretical. Our advice that a judicious combination of both is the right thing may meet the views of both parties.—*The Citizen.*

THE MOST PERFECT PENDULUM.—What is supposed to be the most perfectly acting pendulum, especially in respect to simplicity, is in operation at the University of Glasgow, Scotland. According to this plan a small shot of about $\frac{1}{18}$th of an inch in diameter is suspended by a single silk fibre (half a cocoon fibre) two feet long in a glass tube of three-fourths inch internal diameter, exhausting the latter to about one-tenth of a millionth of an atmosphere. Starting with a vibrational range of one-fourth inch on each side of its middle portion, the vibrations can be easily counted after a lapse of as many as 14 hours, a fact not realised elsewhere.