

## AMATEUR MECHANICS.

## HINTS ON MODEL MAKING.

It is a simple matter for an experienced instrument maker or machinist to produce a fine model with turned shafts, cut gearing, true pulleys, and smooth working cams, but it is quite another thing for an inventor, without tools or materials, to embody his ideas in a working model even though he may have a mechanical taste.

It is fair to suppose that every mechanical inventor in these days of cheap machinery possesses some sort of a lathe, as these indispensable machines are now made for prices within the reach of almost any one.

It is quite evident, from an inspection of the models of the Patent Office, that most inventors who undertake to make their own models expend a great deal of labor without corresponding results. In the matter of gearing, for instance, one will whittle his wheels in wood, another will borrow his gearing from some defunct clock, while still another will purchase ready-made wheels from one of our well-known firms making a business of furnishing parts of models.

Of the three methods of obtaining the gearing the latter is undoubtedly the best, as all that is necessary to be done, in case of the cast gear wheels, is to bore them and file up the teeth, and as the cut gear wheels are generally bored, the shaft may be fitted without further work on the wheels. It is, however, seldom absolutely necessary to use toothed gearing, as rotary motion may be readily transferred by suitable friction wheels or by grooved or sprocket wheels and a round belt.

Figs. 1 and 2 show a form of friction gearing which is both simple and effective. The larger wheel is simply a disk of sheet brass having rounded edges, and boss spun or soldered on, and a smaller wheel consists of two swaged disks of steel having their convex faces separated by a metal washer a little thinner than the large wheel. These three members are secured to a common boss by spinning the end of the boss partly over one of the disks, as shown in the sectional view, Fig. 2. This form of friction gearing is noiseless and runs strong enough for the requirements of almost any model.

Figs. 3 and 4 show a form of sprocket wheel which is readily made and is almost as positive in its action as gearing. In this case the two wheels are alike; they consist of disks of sheet metal nicked to a uniform depth from the edge, and the arms thus formed are bent alternately in opposite directions, forming a groove for receiving the round belt used in transferring motion from one wheel to the other. It is evident that a belt cannot slip on a wheel of this construction.

Fig. 5 shows a form of friction gearing for transferring motion at right angles, and for imparting a variable speed to a shaft from another shaft running at a uniform rate. The large wheel in this instance is merely a plane disk of metal mounted in the manner already described. The smaller wheel is a grooved metal pulley surrounded by an elastic rubber ring. This is pressed with more or less force against the metallic disk, and its speed may be varied by moving it toward or away from the axis of the disk.

As to the matter of irregular motion usually imparted by cams, it is difficult to make a cam in the ordinary way with the milling machine, and there appears no very simple way of cutting them from solid castings. There is, however, a simple way of building them up from readily obtained materials.

Fig. 6 shows a cam consisting of a cylinder of brass or a short section of brass tubing provided with two heads and mounted on a shaft. The cam groove is laid out on this surface, and two parallel pieces of square brass wire are soldered to the surface of the cylinder, or fastened by means of screws. They are placed uniformly distant throughout the entire circumference of the cylinder.

Fig. 7 shows a cam built up in the same way on the face of a disk.

As to shafts, the model maker may save himself much labor and expense by using Stubb's steel for small shafts, and cold rolled iron for larger ones. Either the steel or iron may be bought in one and three foot lengths.

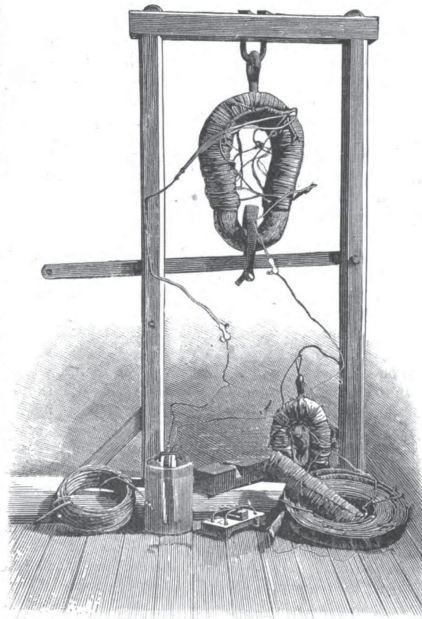
Almost anything in the way of parts of models may be purchased ready for use, so that all the inventor need do is to combine them and mount them on a suitable frame; but even so simple a matter as a wooden frame for a model sometimes proves troublesome.

The small tenons and mortises are difficult to make, and the frame to be strong enough to bear handling must be made so heavy as to be entirely out of proportion. A simple and easy method of securing the joints of small frames is to clamp the parts in the position they are to occupy in relation to each other, and then drill, with a sharp twist drill, two holes through one piece from side to side and into the end of the abutting piece, then inserting two hard wood pins, having previously coated them with glue. This makes a joint far stronger than the mortise and tenon, and it is very quickly done.

M.

## PROFESSOR HENRY'S BIG MAGNET.

In the course of his pioneer work in the investigation of electro-magnetic action, William Sturgeon, of London, discovered in 1825 that soft iron could be rendered temporarily magnetic by surrounding it with a coil of conducting wire connected with a battery. As the result of this discovery he made the first step toward the construction of an electro-magnet. He bent a piece of iron wire into the form of a horseshoe, insulated it by a coating of varnish, and then



PROFESSOR HENRY'S BIG MAGNET.

wound it with copper wire spirally, the spirals being widely separated, so that the current would be compelled to pass round and round the iron core. When the current was on the wire the core was found to be magnetic; when off, the core was not magnetic.

Professor Henry took up the discovery at this point and carried it an important step further. He wound the copper wire with insulating silk, making it possible to cover the core of the magnet with a much greater length of wire in closely wound coils, and also to lay on coil above coil. The compound helix so made developed great power, the same battery yielding with it a hundred times as much magnetic

Henry was called to the chair of Natural Philosophy in the College of New Jersey, at Princeton. Here he made two larger magnets for use in his investigations. One weighing 59½ pounds, and capable of sustaining 2,063 pounds, is now in the cabinet of Yale College. The other, made in 1833, weighed 100 pounds, and could support 3,500 pounds. It was many years before any magnet approaching this in power was constructed.

Through the courtesy of Mr. R. H. Rose, photographer at Princeton, and by permission of Professor Schanck, of the College of New Jersey, we are enabled to present an exact likeness of this historic instrument, as hung in the frame by which the inventor tested its strength. The magnet is deposited in the hall of the School of Science, one of the college buildings erected by the munificence of the late John C. Green. The coil at the right of the engraving represents the original silk-covered ribbon coil used by Professor Henry in his experiments on induction. The wire and battery at the left are modern, to show by contrast the improvement since made in the means for electrical investigation.

In the middle of the foreground is one of the pole-changers made and used by the professor. He was accustomed to delight himself and his classes with this by changing the polarity of the big magnet so quickly that a twenty-eight pound armature could not fall off, but was freed and retracted to its place with a sharp snap.

## Dr. C. O. Crosby.

A characteristically American inventor, Dr. C. O. Crosby, died in Brooklyn, November 15.

Dr. Crosby was born in Simsbury, Conn., and for a number of years practiced dentistry in New Haven. His natural bent was rather for invention, to which he early gave his attention. In connection with Henry Kellogg, of New Haven, he invented a machine for making ruffles and another for making pointed tape trimming, creating thereby a new industry from which he acquired a considerable fortune. Later he invented a machine for making fish hooks, a marvel of ingenuity; and afterwards a machine for making needles. These two formed the basis of a large business still carried on in New Haven. A machine for making pins was another of his notable inventions. Others were, a machine for making shoes, a machine for making tanning, and a machine for making cigarettes; all giving evidence of his wonderful versatility and inventive genius.

From the inquiries conducted by Prof. Hermann Cohn, of Breslau, since 1866, it appears that short-sightedness is rarely or never born with those subject to it, and is almost always the result of strains sustained by the eye during study in early youth. Myopia, as it is called, is seldom found among pupils of village schools, and its frequency increases in proportion to the demand made upon the eye in higher schools and in colleges. A better construction of school desks, an improved typography of text books, and a sufficient lighting of class rooms, are the remedies proposed to abate this malady.

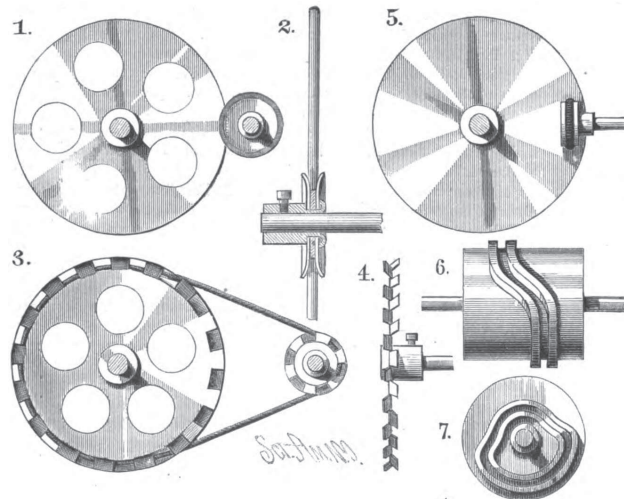
## One Hundred Bushels of Shelled Corn to the Acre.

Mr. Nathan G. Pierce tells the *American Cultivator* how he raises 100 bushels of shelled corn to the acre, having accomplished that feat for the second time this year. He uses for seed an eight-rowed corn which he has improved by careful selection, and believes it to be a good variety to raise in that locality, or, in fact, anywhere between Virginia and the Canada line, or east of the Alleghany Mountains.

The ground selected for planting was a good piece of gravelly loam. It was well plowed last spring, about the first of May, harrowed, treated to a broadcast application of 900 pounds fertilizer to the acre; again harrowed faithfully, rendering the land fine and mellow; rows marked three feet apart, a small amount of fertilizer scattered to each row. May 10th, three kernels of corn planted in each hill, two feet apart in the rows; cultivated and hoed four times, allowing no weeds to grow; passed through the entire piece, cutting each hill down to two stalks; every sucker in each hill cut throughout the field.

During the entire period of growth through the season the field was closely watched, every weed pulled and every ear of smut cut out. At the proper time, after the corn had become hard, it was cut, bound in bundles, and stacked. When dry it was drawn into the barn, where, with the assistance of a hired man, the corn was husked, weighed as husked, and found to yield 110 bushels of shelled corn to the acre, allowing seventy-five pounds of ears to equal one bushel of shelled corn.

When, says the *Polyt. Notizblatt*, a few drops of ether or alcohol are let fall upon a paper equally moistened with cadmium and iodide starch solution, and the volatile liquids are set on fire, the paper will be found, after their evaporation, to be turned blue, owing to the formation of ozone.



## TRANSMITTING AND CONVERTING MOTION.

power as could be obtained with Sturgeon's arrangement. The first magnet on this principle was used by Professor Henry in 1823. It consisted of an iron bar two inches square and twenty inches long, bent, of course, into the form of a U or horseshoe, and wound with 540 feet of insulated copper wire in nine coils. The keeper weighed seven pounds, the core twenty-one pounds, and its lifting power was 750 pounds.

This magnet was used at Albany. In 1832 Professor