

ing will be recognized in section the electric valve movement just described. A variation is here introduced by placing the outer bellows below, instead of above, the supporting board. The cable containing the individual wires, insulated from each other, is shown between the keyboard and movement, while above the movement is shown the soundboard, a pipe valve, and a row of pipes.

This arrangement leaves the manual perfectly free from strain. The keys, by being weighted, or by the use of springs, are made to work as easily or stiffly as desired.

What this invention effects is to render possible the playing of any number of organs from the one manual and by one organist, whatever be the distance of the soundboards from the performer. It is the invention of Mr. George Wacker, of 168th Street and Franklin Avenue, New York city, an organ builder of long experience, and, as this invention shows, a competent electrician. The complications and difficulties that beset the simple organ movement have to be allowed for, and here the skill of the organ builder is necessary. An electrician would not be able to cope with these difficulties any more than a mere organist could solve the electrical problems. A combination of the two was required in the solution of the problem.

The Stewart Memorial Cathedral, in Garden City, on Long Island, furnishes a good illustration of the practical application of this invention to the second largest organ in the world. There are an organ with two hundred and forty keys in the manual, thirty pedal keys, one hundred and fifteen stops, and seven thousand pipes, is provided with this instrument. A sectional view of the cathedral accompanies this article.

The organ is divided into five parts. The main organ is in the chancel, immediately back of the manual. In the crypt under the front entrance is what is known as the "chapel organ." High up in the tower are the "tower" and "solo" organs, the latter unprovided as yet with its pipes. Then over the stone ceiling, between it and the roof beams, is the "echo organ." The bellows for the chancel organ are driven by a steam engine under it. A second engine and bellows supply the other four divisions. A small magneto-electric machine, run by a sewing machine belt, generates the electric current. At will the organist plays on one or the other of these organs, producing the most beautiful distance and echo effects.

In the processional hymn with which the service commences, the system is brought into play most effectively. The choir forms in the chapel, and is accompanied by the chapel organ. As they come up into the body of the church, the tower organ is brought into action. Then, as they approach or reach the chancel, the current being shifted from the tower, the chancel organ may take up the strain.

Each of the different divisions has its own manual for the convenience of the tuner. When the chapel organ is played from the chancel manual, the keys of its independent keyboard, the church's length from the organist, move up and down as the notes are sounded, producing a most peculiar effect, as if some invisible performer were seated in front of it, and moving the keys.

In the entire organ there are about four hundred of these magnets. Having no springs and no adjustments, when once in place, they are set forever. The great wind valves, sometimes of fourteen inches area, open and close with absolute certainty. The most beautiful effects of this great organ are due to and depend upon electricity, and it never yet has failed.

As an illustration of the size and range of the organ, it is of interest to note the largest and smallest pipes. The largest is 19 in. by 23 in. in area and 32 ft. long, giving  $16\frac{1}{2}$  vibrations per second (sub-contra C or C<sub>2</sub>); the smallest, rather less than half an inch long, gives 16,896 per second, corresponding to the upper C (C<sub>7</sub>)—a range of ten octaves, and practically covering the musical capacity of the human ear, though Preyer has claimed that from 16 to 41,000 vibrations per second, or an octave and a fraction higher, can be heard by some ears.

#### Tetanus Treated by Rest.

Dr. De Renzi states, in the *Rivista Clinica*, that by treating patients with traumatic tetanus by means of perfect rest, he has been able to restore four out of five to health; whereas, when treated in other ways, these patients usually die in two or three days. He places the case in a special room, where absolute silence reigns. Even in the passages leading to it and in the neighboring wards care is taken to lay down carpets, so that no sound shall penetrate the tetanus ward. The door of the latter is of course well oiled, so as to open and shut noiselessly, and the patient's ears are stuffed with cotton wool, he himself being strictly enjoined not to make the slightest noise. He must, of course, be fed. This has generally been considered impossible, the teeth being clinched and the spasmodic contraction being increased by attempts to masticate.

The obstacle may, however, be easily overcome by parting the jaws and introducing liquid food through a curved sound; swallowing is accomplished without difficulty. This method of treating traumatic tetanus has been tried with success by several Italian practitioners—Drs. Pisani, Maragliano, Ria, etc. The only disadvantage is that the affection is sometimes prolonged for two months. It seems to increase in duration as it diminishes in force.

#### IMPROVED PIPE WRENCH.

This wrench is strong, durable, and very simple in construction, and not liable to get out of order. It is preferably made of cast steel, the serrated block being made of the best tool steel. For its gripping power it does not rely upon the spring, which is applied to hold the block in place when working the wrench in an inverted or overhead position. The gripping power is obtained by placing the serrated block eccentrically in relation to the hook-shaped jaw. To operate the wrench the block is simply closed on the pipe, and to remove it the handle is pushed backward, when the peculiar curve in the jaw will allow the wrench to easily leave the pipe. When using an adjustable wrench, fitting



THE FATKIN PIPE WRENCH.

pipes of various sizes, the pipe is liable to be crushed; but with a wrench such as this, three-fourths of the circumference of the pipe is covered, and that danger is obviated. It is claimed that the several sizes of this wrench can be furnished for the same amount that is now paid for one adjustable wrench.

Further particulars regarding this wrench, which has been patented, can be obtained from Mr. T. O. M. Davis, of Winifrede, W. Va.

#### Corundum and Its Uses.

Corundum in its pure state is composed of the oxide of aluminum, having the formula  $Al_2O_3$ , i. e., it contains two atoms of oxygen in each molecule. It is an exceedingly tough, compact mineral, occurring in a great variety of colors—blue, red, yellow, to nearly white. The pure crystals are translucent, and used as gems. It is one of the hardest known minerals, being placed in the scale of hardness next to the diamond. This quality is the source of its greatest value in the arts. The species is divided into three varieties—sapphire, corundum, and emery.

Sapphire includes the purer kinds of fine colors, transparent or translucent. These stones are used as gems, and are known by names indicating their color. The following well known jewels are forms of this mineral: Ruby, sapphire, oriental emerald, oriental topaz, and oriental amethyst. These gems are found chiefly in the beds of rivers in Ceylon, though some rubies are brought from Syria. The value of these stones was well known to the ancients, who used them under various names now obsolete. The stone called sapphire by Pliny is now known to lapidary as lapis lazuli.

The oriental emerald is perhaps the rarest gem known. A few specimens have been found among the gold sands of the Missouri River near Benton. But few of these jewels are in existence, and these are in the great collections of Europe.

Corundum generally means the dull, untransparent occurrences of the mineral. They vary in color—blue, gray, or brown—but are never clear or capable of being cut; it usually occurs in large, rough crystals, or in massive cleavages.

Emery is granular corundum. It is black or grayish-black in color, and mixed with grains of magnetite. Emery has very much the appearance of fine-grained iron ore, and for a long time was considered to be such. The texture is variable, some specimens being composed of almost impalpable grains, while others are made up of large, rough fragments of crystals.

Until recently the only source of emery was the far East, the island of Naxos, in the Grecian Archipelago, containing the chief mines. The emery was shipped from the port of Smyrna, and was known to commerce as Smyrna emery. Between the years 1835 and 1846 the entire business was in the hands of an English capitalist, who had monopoly obtained from the Greek Government. In 1847 Dr. J. Lawrence Smith, an eminent American scientist employed by the Turkish Government to explore the dominion for valuable mineral deposits, discovered two large deposits of emery, one at Smyrna and the other on the site of ancient Ephesus in Asia Minor. These deposits have since then been worked by companies paying a royalty to Turkey.

Emery and corundum are chiefly used in the arts as abrading and polishing materials. The mineral is ground, and separated by passing through sieves into classes of various dimensions, which are then further prepared in different ways adapted to the purposes for

which they are to be used. For the use of jewelers and opticians, the fine emery is poured into water containing gum, and the coarser particles allowed to settle; the fine, impalpable dust remaining suspended in the liquid is then collected and used in polishing fine lenses, spectacles, and similar articles. The largest amount of emery is used by the manufacturers of plate glass, though great quantities come upon the market prepared in a great many different shapes to suit special purposes. One of the largest of these industries is the manufacture of emery wheels; these are prepared by mixing the powder with glue or cement, and subjecting the paste to great pressure. Mixed with paper pulp and rolled into sheets, it is sold in the form of patent razor strops and knife sharpeners. Spread out on paper and cloth, it forms an excellent substitute for sand paper. Recently it has been discovered that crystallized corundum, when ground, forms a better abrading material than emery, owing to the fact that it breaks into sharp edged fragments, while emery has rather a rounded form. This discovery was followed by the discovery of large deposits of corundum and emery in Massachusetts, North Carolina, and Georgia. All of these localities are being actively worked, and large quantities of American material are being put on the market.

In the near future it is probable that corundum will assume a far more prominent place among the useful minerals as the source of the metal aluminum. The cheap production of this metal has long been the object of experiment to metallurgists; and corundum, furnishing the purest source from which it can be obtained, will probably be

the most valuable ore. Even at present a good deposit of corundum is as valuable a "find" as one could desire to have on his property, there being a steady and regular demand for it. Corundum is generally found associated with crystalline rocks, such as granular limestone, gneiss, granite, or slate. The emery of Asia Minor is associated with granular limestone. The characteristic by which it is most readily distinguished by the prospector is its extreme hardness. A fragment of corundum will scratch any of the constituents of the rocks in which it is found.—*The Milling World*.

#### A Shying Horse.

To the inquiry, "Why does a horse shy?" the *National Live Stock Journal* replies: Because he sees something which he does not understand, and is filled with a greater or less degree of fear, something as the boy feels when he shies at the burying ground, and goes around to keep clear of it. It may be some new or unusual object that the horse sees, or it may be an imperfect view of it. Even a familiar object, if it comes to view suddenly and unexpectedly, will cause a horse to shy or jump, just as an unexpected object or sound causes a nervous person to start. When a person is so startled, how much would it improve the matter to be scolded at or given a cut with a whip? Just as much as the same treatment would in the case of the horse. Harshness only aggravates the matter.

The more the horse is scolded and whipped, the more nervous he gets; and every time he passes the place where the fright and whipping occurred, he will recollect the unpleasant affair, and he will begin to prick up his ears and fidget, ready for another jump. Give him the lines, and he will go by in a hurry. The proper way is never to strike or scold a horse that is startled or frightened. Speak to him coolly, calmly, and kindly; give him time to see and collect his scattered senses, and make him feel that you are his friend and protector. When he sees that all is right, there is an end to all further trouble. We have seen a horse refuse to cross an unsafe-looking bridge; but when the driver took him by the bits and walked ahead, the horse cautiously followed. Next time he required no coaxing or urging to cross the bridge. He might have been whipped into it at first, but was not the milder course, although a little trouble, the better one? The horse showed his confidence in the driver ever afterward.

#### Photometry.

A neat method of indicating the precise rate of consumption of candles, used in photometrical work, has been carried out in Germany. The candle holder is hung in an unequal arm balance, the beam of which has a long pointer hanging down from the fulcrum, for marking the position of the balance on a vernier scale. At the two opposite ends of the scale there are two metallic pins, while a movable pin, in electrical connection with a battery and a bell, is arranged in the middle of the scale. The candles are lighted and weighed until the pointer just swings clear of one stud of the vernier, when a certain weight is placed in a pan provided for the purpose underneath the candles, a clock being started at the same moment. When, owing to the consumption of the candles, the weight placed in the pan is lifted by the weight in the opposite pan, the pointers swing back and touches the pin, which completes the circuit and so rings the bell. By noting the time the candles were burning, the precise rate of consumption of the candles can be easily determined.