AN ELECTRIC CHIME.

Notwithstanding the fact that much of the music produced by chimes is rendered with discords and a clangor little less than barbarous, most people like this sort of music and are ever ready to listen to it. Possibly one reason for this is that this music is not so common as other kinds; another is that there is a kind of unwritten poetry about bells that appeals to everybody.

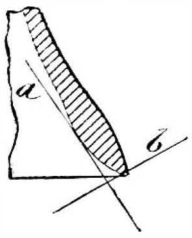


Fig. 1.

Tower chimes are for the public, and rich and poor alike can enjoy them, but smaller chimes are mainly for those who are able to purchase them, in fact, they may be classed among luxuries. However, house clock chimes bring bell music out of the list of the extraordinary and place it within the range of every-day home life. There is no reason why any one with a mechanical turn of mind cannot construct a chime without much expense. All that is needed is a lathe, a few tools and eight or ten ordinary hand bells. The bells are to be tuned so that when struck they will yield the notes of the diatonic scale. Tuning is a comparatively simple matter. If the workman does not happen to have a musical ear, he can procure the assistance of some one who has.

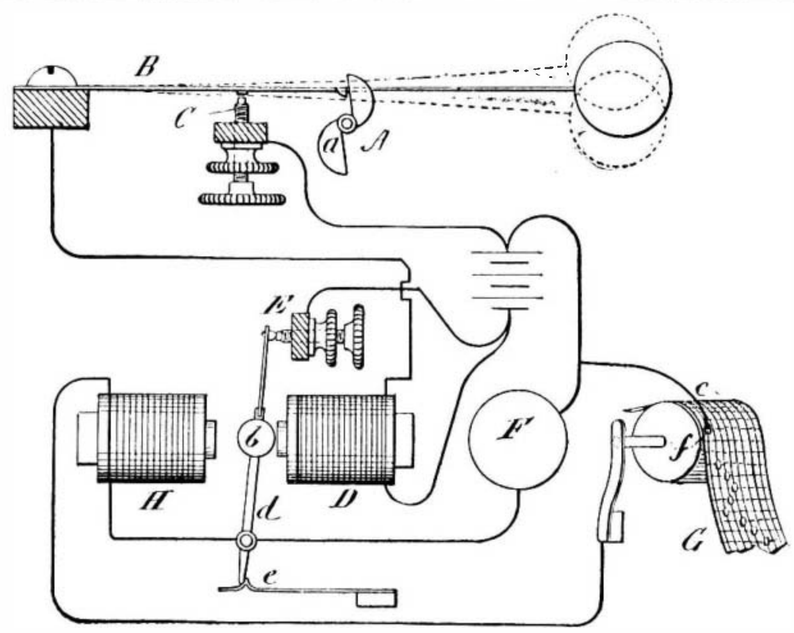


Fig. 4.—LET-OFF MECHANISM.

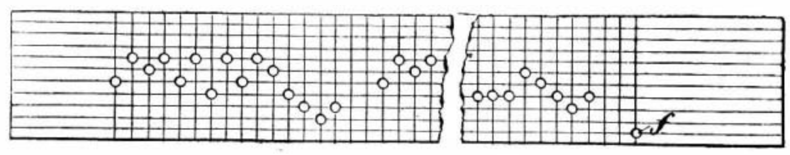


Fig. 5.—THE MUSIC.

A fine bell made of genuine bell metal is one thing, and the ordinary hand bell sold at the hardware and house furnishing goods stores is quite another thing, still the latter afford the most available material for a chime, and withal answer a very good purpose.

The writer had the good fortune to find a dealer who was kind enough to allow him to select from a large number eight bells having approximately the required pitch for an octave, and two additional bells, one above and the other below the octave. These bells first of all had to be tuned to render them useful in a chime. This, although a simple operation mechanically, requires some skill in determining the pitch, as an ordinary bell generally yields two or more discordant notes.

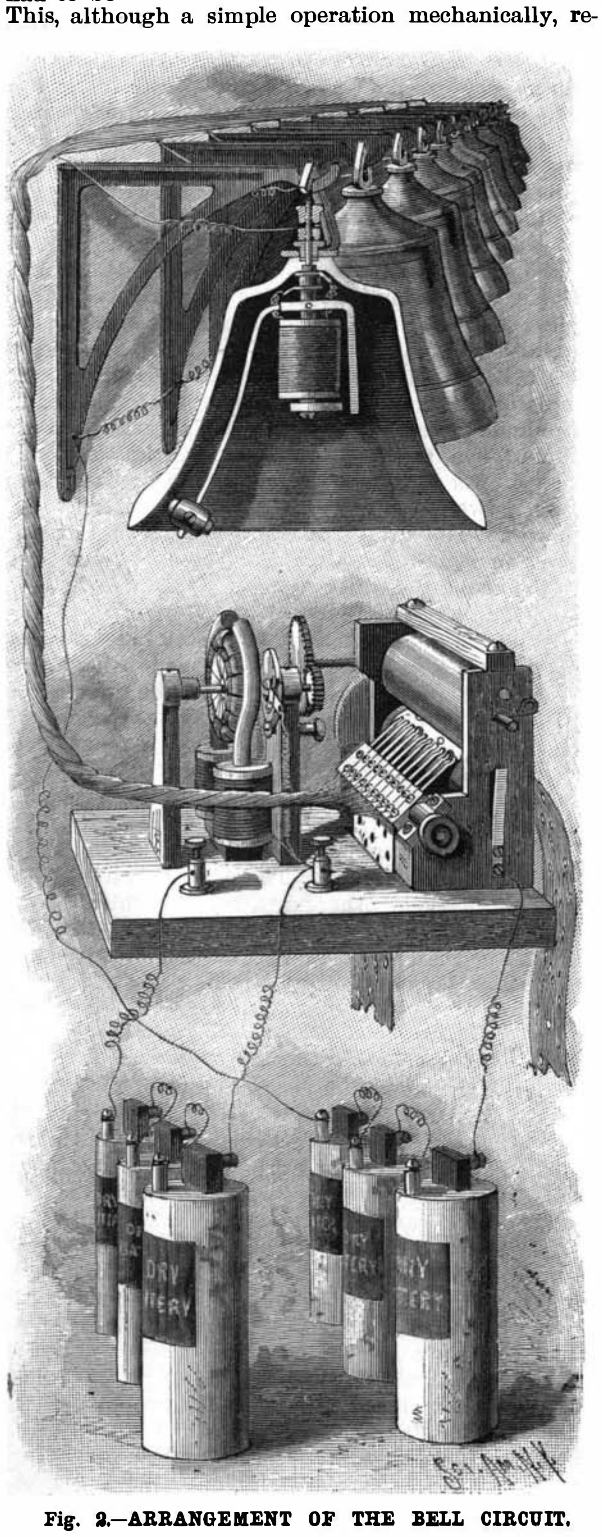


Fig. 2.—ARRANGEMENT OF THE BELL CIRCUIT.

The bell to be tuned is chucked on the lathe by means of a concave wooden chuck secured to the face plate. If the lathe has a hollow mandrel, the bell may be held in place by a long bolt extending through the bell and lathe mandrel. After the bell is centered, so that its rim runs true, a block is fitted to it at a point within the thicker portion of the rim and held in place by the tail stock of the lathe. This prevents vibration and the chattering of the tool; an ordinary hand brass-turning tool is used. If the pitch of the bell is too high, and it is required to lower it, the thick part of the rim is turned off on the line, *a*, as shown in Fig. 1. If, on the other hand, the pitch is too low, it is raised by turning off the edge of the rim on the line, *b*. Whenever it is desired to test the note of the bell, the block is removed and the bell is struck with a small wooden mallet. The note can be compared with that of a piano or other musical instrument, or the proper pitch can be arrived at by comparing the bells with each other. It is scarcely practicable to tune the chime to any particular key unless the majority of the bells are near the required pitch at the start.

After the bells are tuned they are each provided with an electric bell hammer, as shown in the first bell of the series in the upper part of Fig. 2. As this bell hammer is almost identical with that of an electric bell of comparatively recent invention, the writer in justice to himself must say that this electric bell was devised by him long before the bell alluded to was known to the public.

The magnet core is reduced in diameter at its upper end and extends through the aperture at the top of the bell and is threaded to receive two nuts, between which a wire is clamped. These wires from the several bells are connected with the contact springs or keys of the current-controlling mechanism shown at the center of Fig. 2. The core is insulated from the bell, and between the lower nut and the bell is clamped a yoke or loop which is in electrical contact with the bell, but insulated from the core. On the core is placed a bobbin wound with No. 24 wire. To the lower end of core is attached a pole extension, which reaches beyond the periphery of the bobbin and is provided with a short copper stud to prevent the sticking of the armature. To the core above the bobbin is pivoted the armature which extends downward over the side of the bobbin to a point opposite the pole extension. The armature is prolonged beyond its pivot and drilled to receive the hammer wire, which extends downwardly toward the mouth of the bell and carries a hollow metal hammer containing a wooden plug. The hammer is arranged to strike on the thicker portion of the bell rim. One terminal of the bobbin is connected with the magnet core, the other with the bell; each bell is supported by a bracket, the end of which enters the yoke or loop.

The brackets are connected together electrically and communicate through a wire with one pole of the battery, the other pole of which is connected with a spring which presses on the shaft of the metallic drum of the current-distributing machine. The springs before alluded to press on the cylinder through perforations in a strip of paper on which is arranged the music to be played. The springs are attached to a bar which may be turned back so as to remove the springs from the paper strip and the drum to facilitate the introduction of a new paper strip. Above the drum is placed a wooden roller, the gudgeons of which are pressed downward by springs—the roller being designed to insure sufficient friction of the paper to carry it with a positive motion through the machine. A worm wheel secured to the shaft of the metal drum is driven by a worm on a shaft extending at right angles to the drum and carrying a spur wheel which receives its motion from a pinion on the shaft of the electric motor. The motor is of the kind described in SUPPLEMENT, 783, and will therefore require no detailed description here.

When the electric chime is connected with a clock, as shown in Fig. 2, it is necessary to provide a very long perforated paper strip or to employ a perforated endless paper belt, and to provide means for starting the motor at the proper time and stopping it when the piece is finished. The mechanism for doing this is shown diagrammatically in Fig. 4. In this case the let-off mechanism is arranged to operate every half hour, but, of course, it could be made so as to operate every quarter hour.

On the minute hand arbor are secured two cams, *a*, and to the frame of the clock is secured the spring arm, B, furnished with a triangular arm projecting into the path of the cams, *a*. The free end of the spring arm carries a weight, and in an insulating bar, placed between the arbor, A, and support of the spring arm, B, is inserted a contact screw, C. The spring arm, B, is held normally out of contact with the contact screw, C. When the arm, B, is raised by one of the cams, *a*, and released, the momentum of the weight attached to the free end of the arm carries the arm beyond its normal position and momentarily closes the circuit on the contact screw, C. The electrical con-

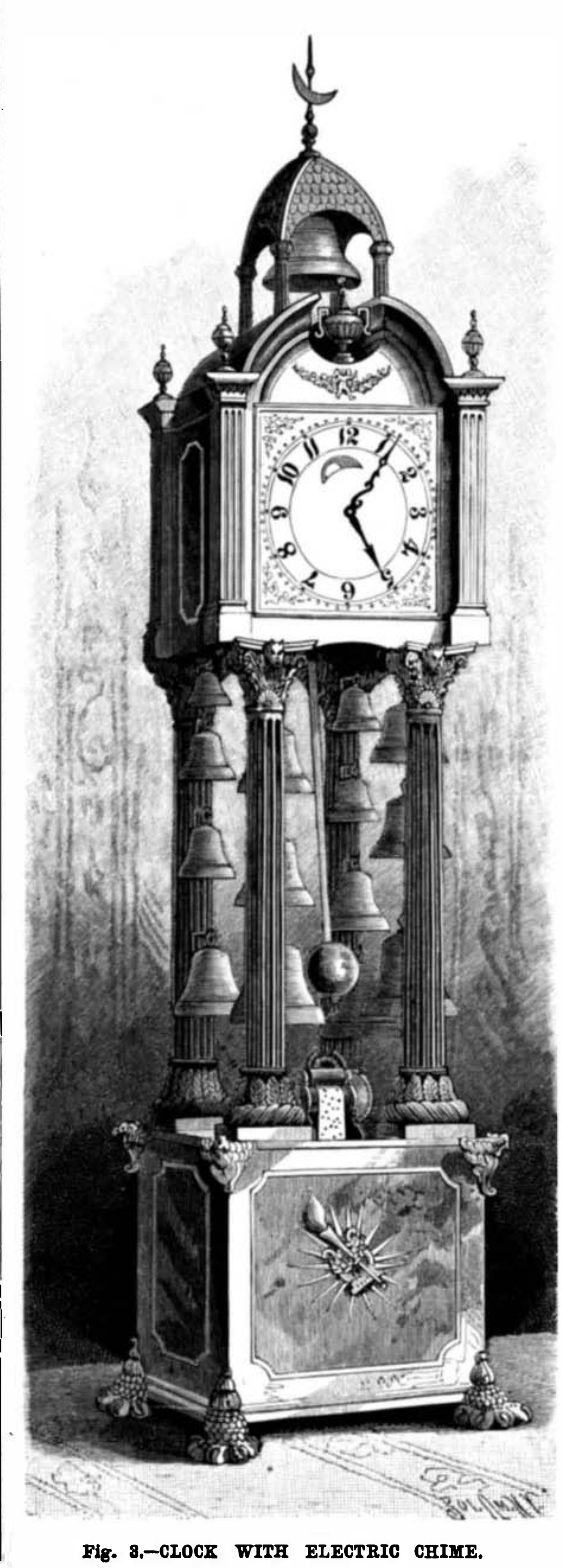


Fig. 3.—CLOCK WITH ELECTRIC CHIME.

tact is prolonged by virtue of the momentum of the weight and the bending of the spring arm.

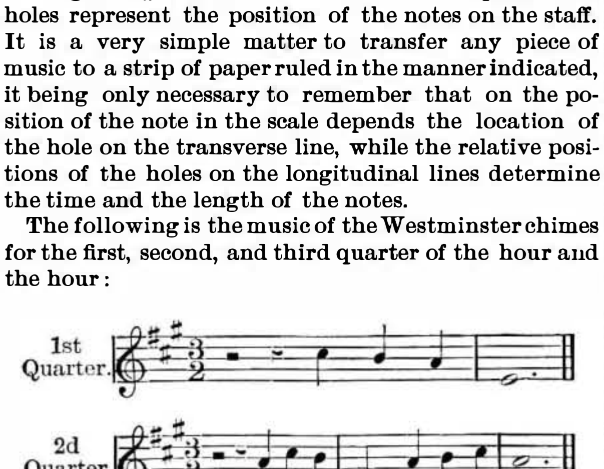
The contact screw, C, is connected with one pole of the battery, and the remaining pole is connected with one terminal of the magnet, D, the other terminal being connected with the spring arm, B. The contact screw, E, is connected with the battery in parallel with the magnet, D, and a wire running from the battery is connected in parallel with the wire leading to the contact screw, C. This wire connects with the motor, F, which drives the paper-carrying drum, and also with the auxiliary contact spring, *c*. The paper strip has a single perforation, *f*, located at the end of the piece of music, through which the spring, *c*, may touch the cylinder. The armature lever, *d*, is pivoted midway between the magnets, H D, and it is held in either of the two positions it may assume by the double-acting spring, *e*.

When one of the cams, *a*, raises the spring arm, B, and allows it to fall, the current from the battery is momentarily sent through the magnet, D, thereby drawing over the armature, *b*, and bringing the contact spring carried by the armature lever into contact with the screw, E; and although the magnet, D, ceases to act when this is done, the spring remains in contact with the screw and the current flows from the battery to the screw, E, thence through the armature lever to the motor, F, and from the motor back to the battery. This starts the motor of the current-distributing mechanism, and the current is sent to the one or the other of the bells, according to the position of the holes in the paper strip.

When the end of the piece is reached, the spring, *c*, forms an electrical contact with the metallic drum through the hole, *f*, in the paper strip, G. The current from the battery then flows through the screw, P, and armature lever, *d*, to the magnet, H (whose resistance is somewhat less than that of the motor), thence through the metallic drum back to the battery. The armature, *b*, is thus drawn over to the magnet, H, and the circuit is broken when the motor stops, but all the parts are ready for another operation and the circuit of the battery is left open.

The contact springs are ¼ inch apart from center to center, consequently the longitudinal lines on the paper on which the holes are punched must be ¼ inch apart. The transverse or time divisions may be ¼ inch or more apart. The distance will depend on the speed of the motor and the character of the music. In the example shown in Fig. 5 the transverse lines are ¼ inch apart; the music being composed entirely of quarter notes permits of this arrangement. This example shows the beginning and the end of the tune Vespers. The holes represent the position of the notes on the staff. It is a very simple matter to transfer any piece of music to a strip of paper ruled in the manner indicated, it being only necessary to remember that on the position of the note in the scale depends the location of the hole on the transverse line, while the relative positions of the holes on the longitudinal lines determine the time and the length of the notes.

The following is the music of the Westminster chimes for the first, second, and third quarter of the hour and the hour:



This music can be readily transferred to a strip of paper like that described. It is necessary to bear in mind that if, on paper divided as shown, one space represents the duration of a quarter note, two spaces would represent a half note, and four spaces a whole note. G. M. H.

Guttaline.

A new preparation for the purpose of replacing India rubber and gutta percha has been brought out and protected by MM. Worms and Zwierchowski. To a quantity of Manila gum tempered with benzine is added 5 per cent of Auvergne bitumen, also mixed with benzine. These are thoroughly mixed together by mechanical means and by hand. By adding 5 per cent of resin oil and allowing 48 to 86 hours to pass between each treatment, a product is obtained having all the suppleness, elasticity, solidity and durability of the best India rubbers. If the product is too fluid, the addition of 4 per cent of sulphur dissolved by means of bisulphide of carbon will remedy this. The addition of 5 per cent of India rubber to this mixture makes an excellent compound for certain purposes. The vulcanization of this product can be carried out in the usual way.

The Florence (Mass.) Brush Industry.

BY H. C. HOVEY.

Long famous for its scenery, historic reminiscences, and educational institutions, Northampton, Mass., has during the past thirty years developed several important manufacturing enterprises. Most of these have been located along the winding course of Mill River, and several thriving villages have thus been created, which, after an era of independence, have finally been incorporated with the city already named. The largest of these suburbs bears the name of Florence, originally given on account of the Nonotuck Silk Works, whose elegant fabrics formerly found their way to market in Italian wrappers and were supposed to be imported from Florence, Italy. Here was also located an industrial community that patiently experimented with raising silk worms, to feed which groves of the Multicaulis mulberry tree were planted. Many other experiments, social, religious, political and educational, were tried in Florence, some of which succeeded while others failed. Among the most successful have been those connected with the manufacture of brushes of various kinds. The buildings used for the purpose, with about 30,000 surface feet of floor space, are not exteriorly remarkable, except for their romantic location on the banks of Mill River, and for their tasteful environs of lawns, ornamental shrubbery and flower beds, offering an agreeable contrast to the old-time dingy and odious structures once thought fit for the occupancy of operatives. By the courtesy of Manager Look and Superintendent Estabrook, the writer recently inspected the factory and obtained permission to give the observed facts to the public.

The enterprise has a unique history. The reader of Victor Hugo's works will remember the hero who, under the name of Father Madeleine, enriched himself and his community by certain ingenious imitations of jet and other "black goods." In 1819 the products of this process figured in the French Industrial Exhibition and gained for the inventor the cross of the Legion of Honor. The secret, which was probably never protected by patent, was brought to America by the late Mr. Critchlow, who afterward disposed of it to Messrs. Littlefield and Parsons, of Florence. A flourishing industry was thus created, the materials being pulverized sawdust and gum shellac, and various kinds of fiber, which formed a plastic dough easily moulded into daguerreotype cases and picture frames. By the addition of proper coloring matter the original "black goods" became red, green or yellow, and finally, in a peculiarly beautiful form known as lionite, a spotless white. The manufactured material accordingly resembled jet, gutta percha, lava or celluloid, as the case might be, and various fancy names were used by the dealers, though the common term at the factory was simply "union goods." The secret process was carried to New Haven, and perhaps other places, where similar factories were established; but the main and original factory in this country has always been at Florence.

About twenty-five years ago the suggestion was made that this plastic material might be well adapted for making the body and handles of brushes of various kinds. Practical difficulties arose, one of the most serious being that of fixing the bristles symmetrically in the dough while undergoing the enormous pressure to which it had to be subjected in the hot steel dies. To Mr. A. C. Estabrook belongs the main credit of overcoming these difficulties, and by his inventive genius and ability achieving the results now visible. Of course these novel processes are properly protected.

In the "blank room" the prepared ingredients in pulverized form are first mixed in suitable pails, scraps and parings being also worked in for the sake of economy, and then fed through hoppers upon pairs of rollers, one heated to 212°, and the other to about 100°, between which the mass is pressed into broad sheets. The sheet clings to the cooler roller, from which it is cut by an attendant, who passes it again between the rollers—cut and roll, cut and roll—until by this mechanical mixing the mass becomes homogeneous, when it is finally rolled out directly on a drawboard about eight feet long, where it is trimmed and cut into sheets of a convenient size for manipulation. Scrupulous cleanliness is insisted on. If the machinery stands idle for but a few minutes every part must be brushed clean before starting again. While the sheets, of whatever color, are yet warm and elastic, the blanks for use are cut from them by foot presses, and assorted in boxes according to size. To some of the blanks a harder degree is imparted than to the others by a certain process. The object of these two degrees of hardness is apparent when we come to see how the bristles are fixed in place. This was done formerly by inserting the tufts in perforated pieces of hard wood or metal, around which the composition was afterward moulded. But now the harder composition is substituted for the wood, the result being that the finished brush appears to be one solid piece, whereas it is really made of two pieces so perfectly united as to show no seam.

The bristles are mostly imported from Germany. Having been washed, combed, and "dragged," as well as this can be done by the eye and the touch, they are cut to exact lengths by a diminutive guillotine. Next they are inserted by hand, in little tufts, into perforated steel plates, at the exact angle and in the precise order in which they are desired to stand in the brush, and they are neatly trimmed by clippers. The ends projecting from the back of the plate are ingeniously singed by a blaze. The effect of this is to put a head on each individual bristle, so that it will always keep in place, even under the roughest usage. A cake of hot cement, of the harder kind, is then applied to the back of the steel plate, into which the heads of the bristles are sunk by pressure. Having been properly cooled and trimmed, the hard cake with its bristles still in the steel plate is ready to be joined to the body and handle of the brush. Preparatory to this the body blanks are made plastic again in small galvanized iron ovens. When sufficiently soft they are laid in steel moulds, upon which are also laid the bristle blocks, the two being clamped together. These moulds are cut by die sinkers with a great variety of ornamental designs, whose minutest features are faithfully reproduced under immense pressure. The moulds during this process are heated to 212°, in order to secure the desired result. From the hot presses the moulds go at once to the coolers, where formerly seventeen minutes were needed to cool them off. But this time is now shortened so that eight brushes can be made in nine minutes.

The means by which this is done is not only original and ingenious, but it actually seems to develop a new principle, the discovery of which is greatly to Mr. Estabrook's credit. The principle is that of *cooling by pressure;* and is correlated to heating by percussion. In other words, the heat is squeezed out. Ten coolers are at present used in the pressing room. Each steel mould containing a brush, mirror frame, or other object made of the plastic material is instantly subjected to a pressure of twenty-two tons. To satisfy myself, I applied a thermometric test. The steel mould was heated to 212° when subjected to pressure, and in eighty seconds it was reduced to a temperature of 60°, no agency except pressure having been employed. The pressure has to be augmented for larger surfaces to get the rapid result desired, as high a pressure as ninety tons being occasionally applied. This novel process may explain familiar phenomena that have had a different interpretation. Pressure pumps often get so cold as to be coated by ice. And, on the other hand, the ignition of punk by the sudden compression of air in a syringe is due to the fact that the punk takes up a portion of the heat squeezed out from the air.

Mr. Estabrook has also invented an hydraulic accumulator. As in use in this factory, it is four and a half feet in diameter and twenty feet high, with a vertical run of five feet. The cylinder carries ten tons of gravel. Its four inch piston gives a pressure of over twenty-two tons on the six inch piston of the cooling presses. The utility of the accumulator is that it gives an equal pressure at all times, without regard to the amount of water under the piston, whether it be half an inch or five feet.

Manicure goods, prophylactic tooth brushes, dental plate brushes, and other kinds of bone brushes are also made by this company, which it is aside from my purpose now to describe. The fact, however, may be mentioned as remarkable that from the four bones in an ox available for making tooth brushes only sixteen handles can be cut. It should be added, concerning all descriptions of the Florence brushes, that, by skillful devices, they are made very strong, as well as light and of graceful patterns. The edges only are polished by hand, while all other parts, being burnished by the steel dies, will retain their finish as long as the goods last. The material being impervious to water, and never absorbing impurities, is admirably adapted for use, from a hygienic point of view.

A California Earthquake.

The earthquake which occurred in central California on April 19 was felt mainly in a district 35 miles long by 25 miles wide. At Vacaville, Woodland, Winters, and Dixon a number of brick buildings were injured and many brick chimneys thrown down.

The shock was in a general north and south direction. It was not violent, but was rather long-continued. The light brick walls common to country buildings were not strong enough in the towns named to withstand the vibrations, and more damage was done near the center of disturbance than has been the case with any shock since that of 1872. No persons were killed and but few injured—none badly. The only building in San Francisco which was damaged was the old Academy of Sciences building, which was being repaired. The front wall, being improperly supported, fell.