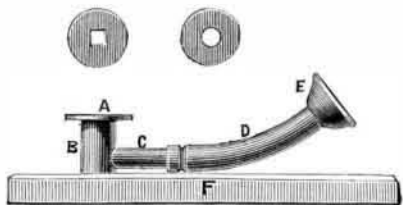


THE PHONEIDOSCOPE.

VARIOUS suggestions have from time to time been made as to the manner in which the iron disk in the telephone vibrates when it receives impressions of sound, and especially that of the human voice. We are certain that the metal plates do take up these sounds in their completeness, both with respect to pitch, quality and relative intensity, for without the last two we could have no articulate, and without the first no musical, transmissions. The subject, however, has not yet been fully worked out, nor has any really satisfactory explanation of the phenomena in question been given. With a view to elucidating the matter, and affording a means of making these intricate plate vibrations apparent to the eye, Mr. Sedley Taylor devised his phoneidoscope. In this instrument a film of soap bubble solution, when in a state of tenuity sufficient to show interference colors by reflected light, is brought under the influence of the aerial disturbance resulting from vocal or other sounds. Definite figures then form themselves in the film corresponding to each different sound as it is presented. Such figures consist of colored bands and circles, symmetrically placed, and varying in arrangement according to the shape and size of the orifice used, but constant in form for a sound of given pitch and quality with the same orifice.



The instrument is shown in the sketch. A brass cylinder, B, has inserted at its lower end the tube, C, and carries at its upper end the circular and horizontal plate, A, which is annular, its perforation corresponding to the diameter of B. C communicates with the conical mouthpiece, E, by means of the India rubber tube, D. The whole for convenience is mounted on a stand, F. The purpose of A is to support disks of sheet brass, through which apertures of various shapes and sizes have been cut. When the phoneidoscope is in use these apertures are made to contain the film of soap bubble solution to be experimented upon. We thus have a plate consisting of an extremely delicate medium, and which, by reason of the fact that the colors reflected from its surface are an indication of its degree of tenuity at any point, affords us a help to realize the state into which it, or, indeed, any plate, is brought under the influence of sonorous vibrations. The figures are infinite in variety, and the results as beautiful as their origin is simple. So sensitive are these films that they readily distinguish sounds of the same pitch but of different timbre. Thus, if the vowel sounds of the human voice be sung into the instrument, each one will be represented by its own distinct color figure, although they may all have been intoned on the same note.—*English Mechanic*.

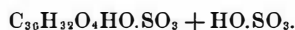
MORDANT FOR TURKEY-REDS.

By DR. A. MULLER-JACOBS.

THE invention relates to the preparation of a peculiar oil, named Turkey-red mordant, for the production of Turkey-red in dyeing, and printing upon yarns and tissues of all kinds, with madder, and all preparations of madder, including artificial alizarine, purpurine, and all analogous coloring matters. A single passage through this oil along with a proper addition to the color-baths supersedes in printing and dyeing the usual and oft-repeated white baths, and yields a color not inferior to ordinary Turkey-red in beauty and fixity, and if applied to common madder colors imparts to them a peculiar luster. The Turkey-red oil is a mixture of the sulpho-ricinoleate of soda and the sulpho-pyrotterebate of soda. The preparation is conducted as follows:

1. Sulpho-ricinoleate of soda.—Castor oil, ordinary or purified, is mixed with 20 per cent. of its weight of sulphuric acid, at 66° B., the acid being caused to flow into the oil in a thin stream. This operation is best conducted in iron vessels, lined with lead, on the bottom of which lie leaden tubes, in which ice-cold water is allowed to circulate, in order to prevent a rise of temperature in the sirupy mixture. After standing for two or three hours the mass is diluted with water at pleasure, and neutralized with a lukewarm solution of soda—2.8 kilos. soda crystals to every kilo. of acid employed. The alkaline liquid is added slowly and with constant stirring. The mixture is then allowed to stand over night. The next morning the sulpho-ricinoleate of soda is found separated, and after the removal of the water is ready for future use. If pure oil is employed, the quantity of sulphuric acid may be reduced to 15 per cent. If impure castor oil is taken, 20 per cent. will be needed, and in some cases even more.

By sulpho-ricinoleic acid the inventor understands an acid of the formula—



i.e., ricinoleic acid, conjugated with sulphuric acid, resembling sulpho-glyceric acid, or Frey's sulpholeic acid, which latter is formed on treating olive oil with concentrated sulphuric acid in the cold. The acid itself, and its alkaline and ammoniacal salts, are readily soluble in water, but on prolonged standing or on boiling are decomposed, taking up water, and forming a fatty acid, closely connected with oleic acid (metaoleic or hydroleic acid), and sulphuric acid or sulphates. The inventor has examined the mixture of castor oil and sulphuric acid. The analytic results show that a compound is formed resembling sulpholeic acid. The aqueous solutions are precipitated by metallic salts, and on the decomposition of the latter by heat, e.g., the lead precipitate, there remains a quantity of lead sulphate tolerably in harmony with theory. The glycerine simultaneously liberated by the treatment of the oil forms sulpho-glyceric acid, and forms an aqueous solution with excess of sulphuric acid, from which the sulpho-ricinoleic acid and its salts are readily separated, being insoluble therein.

The compound obtained is naturally not of absolute purity. While castor oil soaps have absolutely no power as mordants, the action of this substance as a mordant is readily intelligible. On mere exposure to the air there are formed in textile fibers steeped in this mordant salts of sulphuric acid, along with those of ricinoleic acids, analogous to metaoleic and hydroleic acids—which are also mordants—insoluble in alcohol, and soluble only in ether. They are scarcely attacked by strong alkalis. The same compound can be

formed from olive oil by slow oxidation. No acid is necessary, in order to separate the alkali from a sulpho-ricinoleate. The substance is decomposed spontaneously, and the sulphate of soda washed out.

2. Pyrotterebate of soda is prepared by boiling, in enameled iron vessels, 250 parts of rosin, which is powdered and added in small portions. After the lapse of 1½ hour the liquid is gradually concentrated, and the residue is heated for half an hour to 200°–250° in closed iron vessels. When cold the semi-fluid mass is treated with 20 to 30 percent. of sulphuric acid at 65° B., and after two or three hours it is neutralized with soda, and the sulpho-pyrotterebate of soda, which separates out of the solution of sulphate of soda, is reserved for use. To make up the mordant, equal volumes of the solutions of the sulpho-ricinoleate and of the sulpho-pyrotterebate of soda are mixed, and used at once in the preparation of Turkey-red. Experiments with chemically pure products show that the best proportions are 6 to 7 parts of the sulpho-ricinoleate and 3 to 4 of the sulpho-pyrotterebate. Instead of soda may be used potash, caustic alkalies, ammonia, alkaline earths, or their carbonates. Instead of the above-specified mixture, the inventor claims the use of a mixture of the sulpho-ricinoleate of soda or ammonia, with the mixture of sulpholeate and sulph-margarate of soda or ammonia, formed by treating olive oil with sulphuric acid and neutralizing with ammonia.

A FLAX AND JUTE CARD, AND HOW IT IS MADE.

SUCH of our readers who follow our articles on the manufacture of the common objects in a mill will have before now remarked that to make some of the most simple of them, several processes and very intricate machines are required. This is especially the case for the description of card clothing we purpose commenting upon in this article.

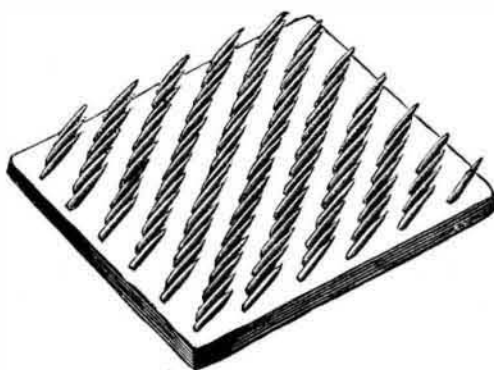


Fig. 1.

The broad distinction between it and other kinds of clothing, say that for cotton or wool, consists in the wires being considerably larger, sharply pointed, and more widely spaced. Our illustrations, Figs. 1 and 2, will give an idea of the appearance of this clothing, which is made in any required length, sometimes hundreds of feet, for the purpose of wrapping spirally around the cylinders and rollers of the carding engine. Our sketches therefore show only short lengths of card fillets (as they are called), the illustrations being about three-fourths of the actual size.

We defer for a while saying anything about card filleting for cotton and wool, the backing for which, that is, the material in which the wires are set, is made in almost endless variety, whilst that of the card, now the subject of our notice, with a few exceptions, consists of leather. When the use of this material, for the sake of cheapness, is departed from, its substitutes cannot always be recommended. The

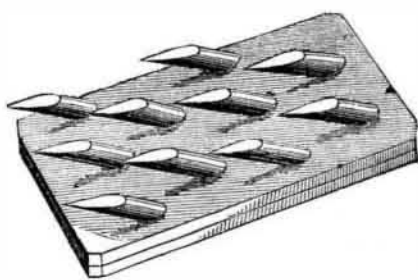


Fig. 2.

hides, when they arrive from the tanners, are in a condition utterly unfit for immediate use; they have first to be steeped, scoured, and to undergo the other operations of the currying process, the product being leather. The sheets are now cut by a special tool, forced along by hand, into strips sufficient in width to make two card fillets. Every time a strip is cut the workman tries its thickness in several places with a Birmingham wire gauge, the number corresponding to the thinnest part being marked on the strip. The card backing must be perfectly uniform in its thickness, otherwise some teeth would be higher than others, and uneven carding would result; therefore every piece of leather has to be shaved down to its thinnest part, which is all it stands good for. The pieces of equal thickness go together to make one fillet, and a rigorous inspection has now to be made for the flaws and imperfections the leather may contain, which flaws are only too frequently present on account of careless currying and bad butchering; in fact, an unskilled butcher can, without knowing it, depreciate the value of a hide by the sum of 10s., and cause those who have subsequently to use the leather made from it a great amount of trouble and loss. Too much care cannot be taken in searching for weak places in the strips, and when found to remorselessly cut them out, even though the result be the loss of several inches of good leather, for should the clothing break when the carding engine is at work, the state of affairs for confusion and damage would be fairly on a par with "a bull in a china shop."

We have now pieces of leather of all lengths, from one to four feet, which have to be joined into one continuous fillet. The ends of every strip are thinned down, or "spliced," as it is termed, so that when the spliced ends are brought together and cemented with isinglass the whole fillet is of one

even thickness, which, as we have already pointed out, it is important to attain. A sizing preparation is next applied to the leather, and the fillets hung up to dry, the object of this application being to give it greater stiffness and the better to support the teeth. If the teeth are to be set in by hand, the filleting is punched with holes properly spaced for their reception. The edges are also made truly parallel with the same machine.

We come now to the preparation of the teeth. The shape and size of these vary greatly. In Figs. 3, 4, and 5 we show the prevailing typical forms. Fig. 4 represents the variety known as needle points. In these, as we leave the extreme points, the acting parts of the teeth get more blunt as it were; it was therefore considered an improvement

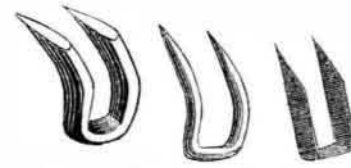


Fig. 3. Fig. 4. Fig. 5.

to make them of flat wire, as shown in Fig. 5, but here the objection is the small amount of stiffness the teeth have sideways. To remedy this the wire is made triangular in section; in fact, with a thick back and with almost a knife edge in front. This form is shown in Fig. 3, nearly actual size, and is used for opening cotton cop bottoms, and also in mungo machines. Other forms of teeth are in use, the difference consisting in the section of the wires, some being oval, others with rounded backs and edges in front, and some of a double convex section.

We will not attempt to describe the machines employed for setting the teeth, for without several pages of engravings and columns of letterpress it would be utterly futile to do so, even supposing a card maker would supply us with the necessary particulars with a view to their publication. Each maker, it may be said, has machines of his own contriving, and as the trade is an exclusive one, as a rule they are jealously guarded from inquisitive strangers. We, however, had *carte blanche* to inspect the card making establishment of Messrs. Thomas Fleming & Son, West Grove Mill, Halifax, and full permission to describe what we saw there. When the cards are to have needle-pointed teeth, the wire has to be prepared in one machine and set to the fillets by another. The wire (of iron) is fed from its coil into the first machine, which shears off lengths sufficient to make a pair of teeth. (See Fig. 4.) The same machine also makes the points and burnishes them, so that when the lengths are ejected into a receptacle they are neatly pointed at each extremity. They are now ready for setting in the fillets, and for this purpose are placed in a box situated on the top of the machine used for that purpose. The box has a width equal to the lengths of the pins, and is made with an inclined bottom, at the lower end of which is a small slit through which the pins can just emerge on to a small incline. A moving magnet takes charge of the first pin, the others being retained on the incline during the time it is being bent and set. The magnet conveys the wires to a pair of jaws which grip it at its middle, and after other movements have bent its ends, forces these ends into the leather, holes for their reception having already been made from the other side



Fig. 6.

of the fillet. These two teeth, so set, at this moment project at right angles from the filleting, but by means of a lever and another movement in the machine, they are bent into the proper inclined form. The fillet now moves and exposes a fresh place for the insertion of two more teeth, and others in succession. The wires are sometimes inserted by hand, particularly on the Continent, in which case an addition to the machine which points the wires also bends them into the form shown in Fig. 4.

When triangular or flat wire is used for teeth the preliminary pointing required for round wire is dispensed with, the points here being made when the lengths for two teeth are sheared off. This is done by a peculiar shaped punch which cuts out a wedge-shaped blank. (See Fig. 6.) In this case this pointing is done in the machine which sets the teeth, their construction being therefore different to those for setting needle points.

The teeth being set, the fillets are cut up their center lines, thus making two each of half the original width, and their edges are also pared so as to be exactly parallel with each other. The fillets have next to be stretched. This is accomplished by coiling it on a large cylinder, and inserting a piece of wood under one of its ends, then revolving the cylinder until it passes along under the spiral to the other end, at the same time pulling the leather as far as its elasticity will allow from the surface of the drum. The stretch thus taken out of it, the end last reached is secured to the cylinder, and the teeth of the fillet subjected to close scrutiny, sometimes with a magnifying glass, in order that imperfections, such as bent points, and points left out, may

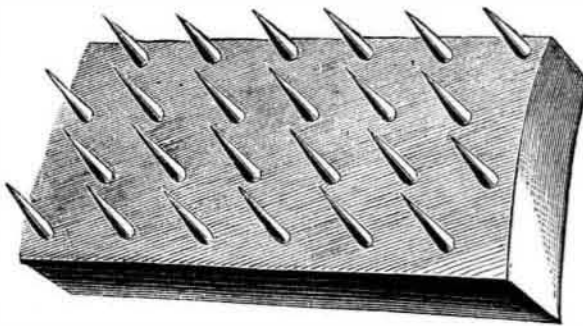


Fig. 7.

be rectified. With machine-setting the faults are extremely few, and consist chiefly of a pair of teeth left out here and there. These, however, are of so rare occurrence as scarcely to merit notice; a fillet may be completely set with not a single defect in it. After coiling up, protecting the points with thick paper, it is ready for the market; when for export it is further packed in waterproof cases. As a curious instance of