geothermal gradient will be mere speculative hypotheses.

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SPECIAL ARTICLES

THE REDISCOVERY OF A LOST ART AND A FEW NOTES ON THE THEORY OF THE VIOLIN

Shortly before the discovery of America they were using, on the gondolas in Venice, a perfectly transparent, lustrous, orange-red varnish. It is reasonable to assume that the great beauty of this flame-colored material, on the handsome figured wood used, prompted the subsequent lavish extravagance in their decorations, that almost ruined the owners and was so universal, that in the sixteenth century a sumptuary edict was passed by the grand council compelling the use of black only on all gondolas. The principal use, then, for this lustrous varnish having been done away with, the price fell to a point where the cabinet-makers and others could use it for certain purposes.

The historical ceremony, "The Wedding of Venice to the Adriatic," has been preserved to us on canvas by a painting of this gorgeous scene made at the time, in which can be seen the color of this varnish on the hull of the royal gondola. The varnish itself can be seen on the wood of an old figure-head of one of these boats (preserved in the museum) where the black paint has been chipped off. The cast-off varnish had not long to wait for a market, as the violin came into existence at this time, and the now cheap varnish found immediate favor with the violin makers of Italy, and was used exclusively by them until the supply at Venice was exhausted, about the year 1730.

Tradition has it that a Venetian varnish dealer, in reply to solicitations from Cremona on the subject, said: "My supply is exhausted, I know not what it is, nor where it came from."

It is possible that this inquiry came from Stradivarius himself. If so it might account for the much more sparing coats of varnish he put on his violins at this time, than earlier —he may have already begun to husband his supply.

Italian furniture of the seventeenth century, still extant, has varnish of this character upon it, but since about the time when the old Cremona violin varnish was last used, diligent investigation fails to find any article whatever with this material upon it.

By carefully comparing the physical properties of the varnish on any of these older articles, with that on a Cremona violin, a striking similarity is at once seen, and no effort is necessary to conclude that the two are identical. The materials, then, must have been imported into Venice, as no colored gums or resins of this texture are produced in Italy, they being certainly of tropical origin. The proximity of Africa to Italy naturally suggests the source of supply of these gums. (Subsequent experiments, with African gums, produced a red varnish not to be distinguished from that on a 1715 Stradivarius.)

Certain characteristics of this varnish are known, and how these affect tone has been carefully tested, and the most distinguishing feature seems to be that it damps out the upper harmonics, leaving the pure fundamental tone to be heard.

In drawing the bow across the strings of any violin, a certain fairly constant fraction of the energy is transformed into sound—a portion of this is carried by the fundamental tone, while the rest goes into the upper harmonics. Now, the preponderance of these upper harmonics gives to a violin its harshness. If a large proportion of the total energy is dissipated in these higher harmonics, the amount of fundamental tone reaching the hearer will be small; if, on the other hand, the large proportion of the total energy is forced into the fundamental, the instrument will have great carrying power.

Had it not been for this compound, known as the old Italian varnish, the world would not have heard of the town of Cremona, nor of her sons Amati, Guarnerius and Stradivarius, and in all probability the violin itself would have passed out of existence, after a very brief experimental stage, like most other musical instruments of these early times, such as lutes, lyres, gigues, crwths, etc.

The writer, after a great deal of experi-

menting along the lines indicated above, has found a gum varnish which he believes is identical with that used by the Cremona makers.

The general appearance of this new varnish is so characteristic that the eye can not discriminate when placed side by side with the original. The chief reason for this is that the color is natural to the gum, and is not added to it, consequently we get no stain effect on the wood, such as we always do when artificially colored varnish is used. Secondly, the transparency is so perfect that we get two reflections, one from the upper and one from the under surface of the varnish. Thirdly, the color bleaches in the sun, to "Amati" yellow, it being known that this great maker dried his violins in the sun, whereas Stradivarius dried his to red in the shade of an attic, which he built on the roof of his home, open on two sides to the atmosphere. The new varnish chips off the wood, on rough usage, as does the old, and in texture and hardness they are identical. The effect on the tone of an instrument is very marked. When covered by this material all harshness disappears, being replaced by what is known among musicians as the "Italian tone."

The supposition for the explanation of this last effect is that the varnish is so similar in elasticity and other properties to the wood of the instrument, that it exerts no influence thereon whatever, leaving the violin to expand or contract, under differences of atmospheric temperature and moisture, just as though it were not varnished at all, thus differing from all other varnish, whether of spirit or of oil.

In order to give this varnish a thorough practical test twelve common trade violins "in the white," of standard models, were procured from four different makers (three from each), and varnished and strung up. Many times were duplicate pairs of these violins put in a double case and submitted to prominent professional violinists in order that they might select the better of the two, if possible. In no case has a definite decision yet been reached. This is taken to mean that the tone is so pure that the musical ear can find no point on which to offer any adverse criticism. Comparisons actually made with some of the old Cremona violins prove very flattering to the new varnish, the tone being not so "stale" as in the old instruments.

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QUOTATIONS

MERCY TO MANKIND

SURGERY in England was set back so far by the successful crusade against vivisection that probably many thousands of men, women and children have suffered days of agony for every minute of discomfort saved to any animal. The merits of the discussion are almost pitifully clear. The proposed laws will never reach the irresponsible experimenter, even if he is not entirely mythical. All they can do is to handicap the hospitals and the expert work. The present agitators are of a kind with them who sneered at Pasteur as "an obscure druggist"; opposed Harvey's experiments about the circulation of the blood, those of Galen fifteen centuries earlier, and those of Lister in our day. To show where real science stands, we may observe that the men who have protested against the present outbreak of ignorant sympathy include, among many others, Dr. Weir Mitchell, Dr. Janeway, Dr. W. W. Keen, Dr. Osler, and leading professors of anatomy, physiology, surgery, physiological chemistry, biology, bacteriology, zoology and medicine, in Harvard, Columbia, Johns Hopkins, Yale, the University of Michigan, the University of Pennsylvania, Rush Medical College, Dartmouth, the Massachusetts Institute of Technology, Georgetown University and the University of Chicago. Already there is punishment provided for experiments improperly performed. The new laws are an attempt to give ignorance a whip to hold over science. The view which would be taken of humane research by these animal-defenders is shown clearly enough by their special attack on the experiments on cats now being made in the Rockefeller Institute, designed to lead to the mastery of many serious kidney troubles. One of their gruesome pictures is called "The Dog has no Chance."