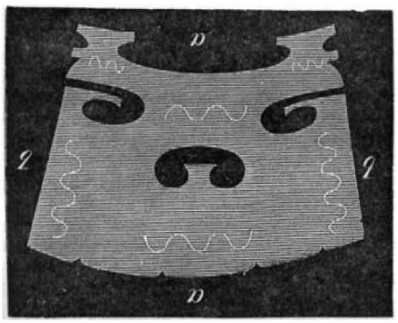
alter greatly the proportion of energy passing through the post to that which is absorbed into vibrations of this side of the belly. At the same time it must also alter slightly the nodal arrangement of the belly, which must have an influence on the tone. If from the form of construction, or relative quality of the wood of the upper plate as compared with the under plate, the conditions of a violin are such that the highest quality of tone of which it is capable requires a relatively larger amplitude of vibration of the back, the position of the sound-post should be nearer the bridge. In a contrary condition of things the sound-post should be farther from the bridge. The extreme range needed in different violins is about a quarter of an inch. Any shift of the post must affect the relative mobility of the two sides of the belly.

If the sound-post transmits vibrations, these will be in addition to those received from the sides of the violin. It may be, therefore, that one condition which determines the best position of the post is the degree in which from their form and material these fulfil this duty. All the sides must share in this duty, but the touch-rod shows that a large part of this action is borne by the parts of the sides which curve inwards under where the strings are bowed. It is in harmony with this view that Mr. Hill states that if the inside blocks at the corners, which are put to strengthen these parts, extend in a small degree into these curved portions, the tone is injured.

The plane of the vibrations of the strings is that in which they are bowed, which is more or less oblique to the bridge. The vibrations may be considered divided into two sets at right angles to each other, *a* and *b*.



The touch-rod shows that these vibrations exist strongly in the upper part of the bridge. I venture to suggest that the use of the peculiar cutting of the bridge, which was finally fixed from trials, by Stradiuarius, is to sift the vibrations communicated by the strings and to allow those only or mainly to pass to the feet which would be efficient in setting the body of the instrument into vibration, the other vibrations which would be injurious in tending to give a transverse rocking motion to the bridge, being for the most part absorbed by the greater elasticity given to the upper part of the bridge by the cutting. Below the two large lateral cuts, the touch-rod shows a very great falling off of the vibrations *b*. In the case of a violoncello these vibrations were also very greatly reduced below the side openings of the bridge.

The violin on which the experiments were made was without a bass bar, which is a piece of pine glued to the under side of the belly on the fourth string side. This bar is regarded as strengthening the belly and also enabling it to respond better to the lower notes. The touch-rod showed no difference in the general behaviour of this violin from a fine one by Stradiuarius containing a bass bar.[1]

On the Proportional Thickness of the Strings.—As the lengths of the strings are the same, we have only the two conditions of weight and tension on which their pitch depends. It is obvious that for equal pressure on the feet of the bridge, as well as for more convenient fingering and bowing, the strings should be at the same tension. They should therefore differ in weight, so as to give fifths when brought to the same tension. The weights of the strings are inversely as the squares of the number of vibrations, which in the case of fifths is as 3 to 2, namely, as 9 to 4. As the first three strings are of the same material, it is more convenient to take their diameters, which must be as 3 to 2, that is, each string in advancing from the first string must be half as thick again as the string next to it. In the case of the fourth string, covered with wire, we must find the weight of the third string of gut, and take a fourth string of which the weight is 9 to 4 for the third string.

A good average thickness of 2nd (A) string = 0·0355 inch.
Then the strings should be— 1st = 0·0237 ,,
2nd = 0·0355 ,,
3rd = 0·0532 ,,

A gut string 0·0532 inch in diameter weighs, when of the same length as a fourth string, 0·98 grm., then the fourth = 2·20 grms.

Ruffini sells sets of strings in sealed boxes, and these were found to be in about the same relative proportion to each other as the sizes indicated on the gauges sold by several makers.

The measures of a set of Ruffini's strings were found to be :—

1st = 0·0265 inch.
2nd = 0·0355 ,,
3rd = 0·0460 ,,
4th = 1·4100 grm.

It will be seen that the first string is thicker, and the third thinner, and the fourth much lighter than the theoretical values. Therefore the tension of the first string would be greater, and that of the third and fourth strings less than they should be in relation to that of the second string. The greater flexural rigidity of the fourth string will have a small effect in the direction of making the vibrations quicker, and therefore of making the tension required less.

By means of a mechanical contrivance I found the weights necessary to deflect the strings to the same amount when the violin was in tune. The results agreed with the tensions which the sizes of the strings showed they would require to give fifths.

A violin strung with strings of the theoretical size was very unsatisfactory in tone.

The explanation of this departure of the sizes of the strings which long experience has shown to be practically most suitable, from the values they should have from theory, lies probably in the circumstance that the height of the bridge is different for the different strings. It is obvious, where the bridge is high, there is a greater downward pressure. By this modification of the sizes of the strings there is not the greater pressure on the fourth string side of the bridge which would otherwise be the case. On the contrary, the pressure is less, which may assist the setting of the belly into vibration. There is also the circumstance that the strings which go over a high part of the bridge stand farther from the finger-board, and have therefore to be pressed through a greater distance, which would require more force than is required for the other strings, if the tension were not less.

[1] In the "Early History of the Violin Family," Engel, speaking of the Crwth, says :—"Furthermore, the contrivance of placing one foot of the bridge through the sound-hole, in order to cause the pressure of the strings to be resisted by the back of the instrument, instead of by the belly, is not so extraordinary and peculiar to the Crwth as most writers on Welsh music maintain. It may be seen on certain Oriental instruments of the fiddle kind which are not provided with a sound-post. For instance, the bridge is thus placed on the three-stringed fiddle of the modern Greek, which is only a variety of the ordinary rabáb, but which the Greeks call lyra. Inappropriate as the latter designation may appear, it is suggestive, inasmuch as it points to the ancient lyra as the progenitor of the fiddle."—P. 28.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE

CAMBRIDGE.—The next examination for Minor Scholarships and Open Exhibitions at St. John's College will take place in December, 1883. There will be open for competition, besides certain Exhibitions, two Minor Scholarships of 50*l*. per annum and two of 75*l*. ; also such Foundation Scholarships as shall be vacant, two of which may, after the commencement of residence, be increased in value to 100*l*. each.

Candidates may offer themselves for examination in any of the following subjects :—Classics, Mathematics, Natural Science, Hebrew, or Sanskrit.

The Examinations will begin on Tuesday, December 11.

Successful candidates will be required to commence residence not later than October, 1884. Further particulars of the Scholarships and Exhibitions may be obtained in October, 1883, on application to one of the tutors.

SCIENTIFIC SERIALS

Bulletins de la Société d'Anthropologie de Paris, tom. v. fasc. iv. 1882.—Discussion on M. Ball's case of cretinism, in which the axiom advanced by M. Lunier was generally accepted, that, while idiocy