KPDP

Notes on the Construction of the Violin

Notes on the Construction of the Violin

Notes on the Construction of the Violin

By
W. B. COVENTRY, M. Inst. C.E.

"O'r Masarn yo geir Mwsig."—Gruffydd ab Davydd ab Hywel.

London
DULAU AND CO.
37 Soho Square, W.
—
1902

PRINTED FOR THE AUTHOR
BY THE
ART AND BOOK COMPANY, LEAMINGTON

PREFACE

IT is one of the marvels of the age that for the last two centuries no improvement whatever has been found possible in the construction of the violin.

The apparent simplicity of its structure sometimes gives rise to the idea that there is almost a reproach to science in the fact that so little is known concerning the principles of the instrument; that there is in fact no theory of the violin worthy of the name.

Certain writers, indeed, profess to see in the works of the old masters a perfect compliance

with the laws of acoustics, but we are left entirely in the dark as to what those particular laws are.

It seems, however, certain that the exact functions performed by the instrument in reinforcing the tones of the string are of an intensely complicated character, sufficiently so to almost forbid any attempt to analyse them, even in the roughest way.

In the case of a symmetrical and homogeneous body, such as a rod or plate, vibrating in its natural manner (for example, when lightly agitated with a bow), certain laws of vibration have been determined; they depend only on the form, dimensions and physical properties of the

material of the plate; but if to these natural vibrations, whose rate for any given mode of vibration is independent of the manner in which they are generated, we add others of a compulsory order —such, for example, as those communicated by the violin string, and whose rate depends only on the rate of the string— the resultant vibrations may become extremely complicated.

Such appears to be the case with the violin. The vibration of the string, besides communicating to the instrument its own rate of vibration, also excites the natural vibrations of the various component parts of the instrument, and the two orders of vibrations

combine to reinforce the tones of the string.

The tables of the instrument, however, are neither symmetrical * nor homogeneous; they do not act independently, but as component parts of a still less symmetrical and still less homogeneous whole; added to which the instrument is subject to an extremely intricate system of stresses which play their part in the distribution of the nodes

* The tables themselves are of course symmetrical about the longitudinal axis of the instrument; but the symmetry of their modes of vibration is destroyed by the bass-bar, the eccentric position of the sound-post, and the unequal action of the two feet of the bridge.

which are formed throughout the instrument.

May one not therefore apply to this problem a phrase of Tyndall's, and say that "the imagination retires baffled from any attempt to realize" the modes of vibration of the violin?

The conclusion seems forced upon one that, given the model of the violin, the determination of the dimensions of its component parts must ever remain an empirical art, to be guided by the ear alone.

There are many so-called theories on the form of the instrument, and nearly every treatise on the violin professes to explain the scientific princi-

ples of the seventeenth-century model; but such "theories" are, for the most part, easily resolved into the bare statement that any departure from that model is detrimental to the tone of the instrument.

But there is something beyond the model. The most casual reader of a text-book on the construction of the violin cannot fail to be struck by the vague, and even meaningless character of some of the rules that have been formulated on such an obviously essential matter as the selection of the wood of the instrument; and it is the object of the following notes to suggest one or two directions in which

further experimental research might possibly prove instructive, and perhaps lead to a more rational treatment of this important question.

W. B. C.

Broad Sanctuary Chambers,
Westminster, S.W.
February 26, 1902.

Notes on the Construction of the Violin

BOTH as musical instruments and works of art, the masterpieces of the early Italian and Tyrolese violin-makers stand by themselves in the front rank.

Such is the almost unanimous verdict of the fiddle world; and it goes without saying that the high appreciation of the work of art is but the natural sequel to the merits of the musical instrument.

To what then can we attribute

the superiority of these old instruments in the latter capacity?

There are two distinct opinions on this question. By some it is held to be merely a matter of time, and that with age and use the modern violin is to acquire that beauty of tone which for two centuries has characterized the early Italian and Tyrolese instruments.

Others again believe that as regards tone and varnish, violin-making is a lost art; that the old masters in fact possessed something in the nature of a secret; or (as certainly seems quite possible) that the true causes of their success were unknown to them.

About three-quarters of a cen-

tury ago the results of Savart's investigations were made known; and it was very generally thought that the "Italian secret" had been discovered.

Thirty-five years later Charles Reade writes: "The fiddles of Cremona gained their reputation by superior tone, but they hold it now mainly by their beauty. For thirty years past violins have been made equal in model to the *chefs-d'œuvres* of Cremona, and stronger in wood than Stradivarius, and more scientific (!) than Guarnerius in the thicknesses."

A more recent writer, after endorsing this opinion, says: "No one who has seen [? heard] the magnificent new instruments

. . . . can possibly deny that these new instruments will be, when a little matured by age, far sweeter and finer than any of the time-withered, tampered-with, over-repaired and dilapidated instruments which flood the market under the names of Stradivari, of Guarneri, of Amati, of Ruggerius, of Stainer, of Bergonzi, and a hundred lesser names." *

All this is quite true, but rather beside the mark. It is only in the comparatively few, but tolerably sound and unmutilated, instruments—which, by the way, do not flood the market—that we

* *Violin-Making: as it was and is.* By E. Heron-Allen, London, 1885.

find the superiority of tone which distinguishes the work of those great makers; and which gives one an idea of what the tone of those dilapidated instruments would be if they had escaped the attentions of the unscrupulous and incompetent repairer, and had been handed down to us in something like the condition in which they left their maker's hands.

Since the days of Savart the same story has repeatedly been told; but where, may one ask, are these "more scientific," and (now) more than a *little* matured instruments? And why is it that the "Cremona tone" and the "Italian tone" remain to this day as household words?

That even Stradivari should have possessed a secret, in the sense that he withheld his knowledge from his pupils, is of course highly improbable; but it is also obvious that he could not impart to them his own power of observing and appreciating the effect of every little alteration he made in the course of bringing his instruments to such perfection. He certainly knew that he was making the finest violins the world had ever seen (there was no question of waiting for them to mature); and he also knew that the success of his instruments was chiefly due to certain improvements of form and dimen-

sions introduced by himself; but there is nothing to warrant a belief that he could have given anything like a scientific explanation of the causes of his success.

He may well have been in the position of Leibnitz, who undoubtedly discovered the calculus without knowing the *secret* of his invention; and of whom it has been said that "he seems to have stood gazing with wonder at the workings of the machine he had found, but whose mechanism he could not understand."

There is no "secret" in the construction of American yachts; and it is quite conceivable that the success of those boats may be in a great measure due to

some cause—the elasticity of the materials, for instance—entirely unknown to the American designer.

The whole history of the violin points to a gradual evolution of the instrument, brought about by tentative and empirical methods of "trial and error," aided at times—as, for example, in the case of the bass-bar and sound-post—by the fortuitous success of alterations and additions originally introduced for totally different purposes to those which they now serve.*

* Strangely enough Savart remarks that "so slender a rod of dry wood (the sound-post) would be of little use for strengthening purposes."—*Vide* a trans-

The tone of a violin evidently depends on one or more of the following qualifications:

1. The form or model.
2. The dimensions.
3. The workmanship.
4. The varnish.
5. The quality of the wood.

With regard to the first two of these qualifications, it is impossible to believe that, either singly or jointly, they can be made to account for the marked superiority of tone in the Italian and Tyrolese instruments. Amongst these instruments we find an

ation of Savart's lectures in *The Violin*, by P. Davidson; London, 1881.

extraordinary variety of model and dimensions, with characteristic variations in the intensity or volume of tone; but what so clearly distinguishes them from the more modern violin is their remarkable *timbre (Klangfarbe)*, or, briefly, their "Italian tone."

In modern instruments again we find every conceivable variety of model and dimensions with a corresponding variation in volume of tone; but rarely, if ever, anything equal to the *timbre* of the early instruments.

With regard to the workmanship, it would seem sufficient to note that many of the finest Italian instruments are not con-

spicuous by any marked excellence in this respect.

As to the varnish, this may be removed and a substitute provided, without altogether destroying the "Italian tone"; and the same may be said of the neck, bass-bar and sound-post.

Coming now to the fifth qualification, it is not difficult to believe that quality of wood and quality of tone must be most intimately related. No two vibrating substances, even of the same species, yield precisely the same tone. In each there is a difference, either in the number or in the intensity of its overtones constituting its own peculiar *timbre;* a difference quite distinct

from the pitch or intensity of the consonant note.

We have moreover strong evidence to show that the early makers attached great importance to the wood they employed, especially in the case of the pine: sufficient indeed to suggest its scarcity. It may therefore be of interest to inquire into the possible causes of a scarcity of such material and of its superiority.

Let us assume as a starting point, (1) that by some fortuitous circumstances a wood of exceptionally good sonorous qualities found its way to the workshop of one of the early makers, and that, by the migration of his pupils, the knowledge of the

locality whence this wood was obtained spread to other parts of the country; and (2) that this wood was found only on comparatively small and scattered areas of forest which eventually became denuded of their timber.

The marked influence of geographical position, aspect of situation and nature of soil on the general properties of timber are well-known; and as regards the influence of the soil, the argument may perhaps be carried a little further than appears to have been hitherto done.

By way of analogy: it is a well-known fact that in some of the wine-growing districts of France (and no doubt in other

countries) small areas of land—in some cases only a few acres—produce an exceptionally fine quality of wine as compared with the produce of other vineyards in the immediate locality. These small areas are often enclosed by a fence, and are known as the celebrated *clos* of their district. The wine from these *clos* is found to be sweet, mellow, etc., whilst the produce of the neighbouring vines—literally only a few yards off—may lack all the finer qualities of its distinguished neighbour.

This superiority in the quality of the wine from a very restricted area is without doubt chiefly, if not entirely, due to a difference in the soil; and without pushing

the analogy too far, it seems admissible to suggest that a similar cause may account for the superior sonority of the wood from a small area of the same forest.

The Havana cigar offers an analogy of the same kind. It is made from tobacco grown in a certain district of the island of Cuba, known as the *Vuelta Abajo*; but the finest leaf is only found on isolated areas of this district. These areas, as in the case of the vineyards, are sometimes very small, and a distance of a hundred yards or so in any direction may make a difference of a hundred per cent or more in the market value of the leaf. A

difference in the soil of these patches of land is often perceptible to the eye.

In no other part of Cuba is the true "Havana flavour" found; nor have the attempts that have been made to impart it artificially been more successful than the various means that have been tried for imparting, what one may perhaps be allowed to call, the "Italian flavour" to the tone of nineteenth-century fiddles.

The French vine and the Havana tobacco seed may be transferred to other lands; but the produce rapidly loses all its finer characteristics.

Fortunately the vine and the

tobacco plant admit of a succession of crops which do not require a century to mature; otherwise we should now be worse off for fine-flavoured claret and cigars than we are for fine-toned violins.

Importance is attached by violin-makers to the selection of wood that is "not too hard and not too soft"; "grown on a southern slope"; "cut from the south side of the tree," etc., etc.; some of which conditions, even to the sojourn in the "Swiss châlet," have a sort of *raison-d'être*; but the food which built up the cells of the tree would seem to be of at least equal importance.

The salt deposits of the Tyrol

have been suggested as a possible cause of the superiority of the wood from that country; and no doubt outcrops of other minerals would have a similar bearing on the question; whilst the scarcity of such outcrops might well explain the disappearance of a marked characteristic in the wood from a particular forest.

It may well be inferred that under the more simple conditions of trade of two centuries ago, the commercial relations between the violin-maker and the wood-cutter were of a much more direct kind than in these days of the "middleman." The maker was thus able to trace the origin of a log that

was found to make a good-toned instrument; and in such case he would no doubt, according to his means, lay in a stock of the wood, almost regardless of its appearance.

This would account for the fact that the violins of certain makers, and from certain localities, show a preponderance of a wood of one particular pattern or "figure"; as well as certain minor variations in the quality of tone characteristic of the maker and of the birthplace of the instrument.

It seems regrettable that Savart should have attached so little importance to the origin of the wood in the Italian instru-

ments. He might otherwise have been led to investigate this subject with a greater chance of throwing some light on the matter that could be hoped for nowadays. He strongly advocated the pine from the Vosges and the sycamore from the Ardennes, and considered the Tyrolese pine to be "of too uniform a density": yet this was the wood of the Italian makers.

Good wood is of course no panacea for defective dimensions; and there are reasons for believing that one of the chief merits of the old instruments lies in an accurate adjustment of the form and dimensions of the tables and sound-holes in accordance with

the physical character of the wood. This at once suggests that the process of determining these dimensions was a tentative one; consisting in its final stage of a delicate working down of the tables and widening of the sound-holes *after the instrument had been put together*, the tables and sound-holes being previously cut as closely to their final dimensions as the experience of a former instrument (made of the same wood) would indicate; a process analogous, for example, to the filing down the metal of a bell for the purpose of flattening its tierce.

If, as here suggested, the Italian maker possessed a wood

singularly capable of responding to the slender cuttings that constituted his finishing touches to the instrument, there is no cause for surprise in the failure of the copyist who stops short at a mathematically exact copy, especially if he is using a wood that the Italian maker might very possibly have rejected as unfit for violin-making; a wood perhaps physically incapable of reinforcing the full series of over-tones that go to build up the *timbre* of the "Italian tone."

A violin-maker of high repute recently showed the writer an exceedingly well made and well varnished violin of his own make. The price asked for this

instrument was almost exactly its weight in gold! On inquiring as to the tone of the instrument, the reply was that it had "never had a string on it." Was the maker sure that the tone of this instrument would justify his expectations? "Yes; unless there is something radically wrong with it!"

Is it after all possible that the finishing touches to the "king of instruments" may be of a less tentative kind than those bestowed, for example, on the salmon-rod, the lens, and that humble contrivance the fiddle bow?*

* Vuillaume has endeavoured to show that the profile of the fiddle-stick should

A noted authority on the violin has remarked on the wonderful simplicity of the instrument. "It seems to scorn complication in its structure, and successfully holds its own in its simplicity." *

This is true only in the sense in which the horse is "an animal with a head at one end, a tail at the other, and a leg at each

be a logarithmic curve. We may perhaps be thankful that François Tourte and John Dodd were unfettered by any knowledge of such a curve. The "continuous beam" and the "solid of equal resistance" are also fine ideal conceptions, but nature refuses to supply the perfectly homogeneous material.

* *The Violin.* By G. Hart. London, 1887.

corner." From the mechanical point of view the violin is a highly complex structure. When tuned to concert pitch it is subject to statically indeterminate stresses of considerable intensity which are quite beyond the reach of mathematical analysis, and which no doubt affect the transverse vibrations of the tables in a very intricate manner. It is also obvious that the results of experiments made with simple and symmetrical test pieces, for the purpose of determining the general laws of vibration and sound, are not immediately applicable to the violin as a whole.

The *timbre* of the violin, like that of the human voice, is de-

veloped by the vibration of constant use; and of all the means that have been proposed for promoting this development, none is more rational than that of Otto, which may be described as "vibration by machinery." Whether this is an advisable proceeding, is another question; and the owner of a good violin would do well to consider the experiments of Wöhler and Spangenberg on the "fatigue" due to often-repeated stresses of small intensity, before submitting his instrument to any severe treatment of this kind. It is doubtful whether any solid is perfectly elastic, and it would seem that certain intervals of rest are required to allow of

recovery after strain. Carried sufficiently far, it would be theoretically possible by this means to "shake a violin to pieces."

Savart has undoubtedly contributed more than anyone to our knowledge of the principles of the violin; the modern treatise on the subject contains in fact little more than a *réchauffé* of the conclusions arrived at by that industrious experimenter. Unfortunately he set himself the gigantic task of improving on the model of the Italian makers before attempting to solve the problem of why it was that he could not make an equally good instrument on the same model; and all his work shows him to have been

keenly intent on the laws of quantity rather than quality of sound. His investigations yielded some instructive results with respect to the principles of construction which govern the volume of tone, but they can hardly be said to throw much light on the more subtle question of *timbre;* and there is great need of further experimental research on this interesting, and to all admirers of the violin and its music, important subject.

Amongst the many experiments recorded by Savart there is one of special interest, as it seems to form the basis of the idea that the modern violin-maker is more scientific in his

methods than the early Italian makers.

Fétis, in his *Notice of Anthony Stradivari*,* relates the following experiments made conjointly by Savart and the celebrated violin-maker, Jean Baptiste Vuillaume, by whom Fétis was personally supplied with the details of the experiments.

From some fragments of violins made by Stradivari, rectangular rods were cut 200 millimètres long, twenty millimètres wide, and five millimètres thick. These rods (presumably cut with their lengths in the direction of the axis of the tree) were supported

* English translation by John Bishop, London, 1864.

at points about one-fourth of their length from each end, and made to vibrate transversely so as to emit their fundamental notes for that method of vibration. The following were the results obtained:

Three rods of deal (pine, no doubt) from instruments dated respectively 1690, 1724 and 1730, yielded the same note F=682 vibrations; and two rods of maple (? sycamore), dated 1708 and 1717, gave the note A sharp=450 vibrations.

In the ordinary course of things the record of these experiments would be open to a certain amount of suspicion, for it is in the highest degree anomalous.

that three rods of pine and two rods of maple should in both cases give exactly the same note. The experiments of Chevandier and Wertheim * show that this perfect coincidence is very rarely found even in test pieces from the same tree; and then only when cut from the same annual rings, and at the same height above the ground.

However this may be, the following experiment, recently made by the writer, would seem to show that the record given of Savart's experiments is probably substantially correct.

A piece of Swiss pine and a

* *Mémoire sur les Propriétés mécaniques du Bois.* Paris, 1848.

piece of sycamore, of the usual form sold for violin-making, were taken at random from the stock of a London dealer. From each piece of wood a rod was cut (with its length in the direction of the axis of the tree) of the same length and width as Savart's rods, but ten millimètres thick. On vibrating these rods in the manner just described (by striking them sharply at the centre), the pine rod gave the note corresponding to 1338 vibrations, and the sycamore the note corresponding to 1024 vibrations.

Since these rods are twice as thick as Savart's rods, the vibration numbers must be halved to make the comparison; thus giving

for the pine 669 vibrations and for the sycamore 512 vibrations. The note of the pine is only about a semi-tone below; but the note of the sycamore is considerably higher than the corresponding notes in Savart's rods.

The sycamore used in this experiment has a wide "curl" (about seventeen curls in the length of the rod); but on repeating the experiment with a piece of sycamore obtained from another dealer, and having a narrow curl (about forty-five curls in the length of the rod), it gave the note equal to 856 vibrations; or, reduced to the dimensions of Savart's rods, 428 vibrations; or

about a semi-tone below the note given by Savart's rods.

These rods were made thicker than Savart's rods for two reasons; first because a thick rod gives a much more distinct note; and secondly, because any little error in gauging the thickness is of less importance in a thick rod than in a thin one. Savart's rods were, of course, as thick as the tables of the violin admitted.*

* It may perhaps be useful to note that it is not necessary to make test rods of exactly the same dimensions; and it is often more convenient to reduce the vibrations to those of a standard rod by calculation. Thus if L is the length and T the thickness of the standard rod: l the length, t the thickness, and n the number of vibrations of another rod of

Having established the fact of a remarkable similarity in the woods used by the chief of all violin-makers, Savart deduced therefrom many interesting con-

proportionately the same width; then if this rod were reduced to the same length and thickness as the standard rod, the number of its vibrations would be

$$N = n \frac{T l^2}{t L^2}$$

Theoretically the value of the note is independent of the width of the rod; but for practical reasons the width should be comparatively small in relation to the length; and one-tenth is a good proportion. If the thickness is one-half of the width, the rod when struck on the edge should give very approximately the octave above the note emitted when struck on the flat.

clusions. Amongst others he formulated the theory that, of two pieces of pine of the same dimensions, that which yields the highest note is the best for violin making.

(It is only right to say that few, if any, violin-makers of repute admit the utility of this test.)

Chladni had already pointed out* that rods of steel, glass and pine of the same dimensions yield the same note; and apparently on the strength of this statement (which of course is practically correct) Savart was led to the extraordinary conclusion that the reason why deal (pine) is pre-

* *Traité d'Acoustique.* Paris, 1809.

ferred to all other woods for the table of the violin, is because of its small density, its elasticity, and "because its resistance to flexion is greater than that of any other wood, and also than a great number of other substances even metallic; *it is equal to that of glass and steel!*" *

There is evidently some confusion here. It is a great mistake to suppose that because a rod of pine and a rod of steel of the same dimensions yield the same note (and consequently that the velocity of sound is the same in the two substances), that these rods are therefore equal as re-

* *Vide* Davidson, also Fétis, *loc. cit.*

gards elasticity and resistance to flexure. The velocity of sound in any substance is directly proportional to the square root of its coefficient of elasticity, and inversely proportional to the square root of its density; consequently the equality of the pitch of the notes yielded by rods of different substances (or rods of different specimens of the same wood), merely indicates that the ratio

$$\frac{\text{coefficient of elasticity}}{\text{density}}$$

is the same in both cases. The absolute values of the coefficient of elasticity (which is directly proportional to the resistance to

flexure), and the density, may be—and indeed in the case of pine and steel actually are—very different.

As the writer has proved (curiously enough on a first trial) it is easy to find a piece of pine possessing very nearly the same conductivity of sound along its "fibres"* as that employed by Stradivari; and yet, for all we know, that distinguished maker would have used this wood to heat his glue-pot, simply because,

* The pitch of the note obtained by the transverse vibration of the rod having its length in the direction of the "fibres," is that due to the *longitudinal* elasticity. Transverse *vibration* must not be confounded with transverse *elasticity* referred to further on.

not having the proper absolute values of coefficient of elasticity and density, it will not yield the "Cremona tone." Glass, yielding the same note as pine, will not make an equally good violin; there would be something radically wrong with its *timbre*.

Pitch alone is evidently insufficient as a criterion of the quality of wood required, and we must seek for some further test.

The following table, compiled from the records of experiments made by Chevandier and Wertheim,* contains the average values of the velocity of sound along the three "axes of elasticity" in fourteen different kinds

* *Loc. cit.*

of wood, the unit being the the velocity of sound in air.

Name of wood	Velocity along the fibres	Velocity across the annual rings	Velocity along the annual rings
Aspen	15·30	4·86	2·74
Acacia.....	14·19	4·44	4·07
Ash	14·05	4·19	3·80
Alder	13·95	4·12	3·14
Beech	10·06	5·53	4·26
Birch	13·32	3·23*	4·57
Elm.....	12·40	4·28	3·05
Hornbeam	11·80	5·14	3·60
Oak	11·58	4·62	3·88
Poplar.....	12·89	4·22	3·16
Maple	12·36	4·63	3·12
Sycamore...	13·43	4·51	3·42
Fir	13·96	4·02	2·36
Pine.....	10·00	4·23	2·39

* One experiment only.

(It is necessary to observe that, owing to the limited number of trees experimented with—ninety-four in all, and in some cases only one of each species—and to the fact that the trees were all cut in one particular country, these experiments, admirable as they are, can only be regarded as exhibiting the general tendency of the qualities indicated for each wood.)

On comparing the figures in this table, it is seen that, as regards the velocity of sound along the fibres, *i.e.*, in the direction of the axis of the tree, pine stands at the bottom of the list, whilst fir *(sapin)* is amongst the highest. On examining the complete tables published by Chevandier

and Wertheim, it is found that the highest and lowest values recorded for these two woods are respectively 17·80 and 10·07 for fir, and 12·53 and 7·56 for pine. It must be observed, however, that the wide difference between the high and low values is chiefly due to the variation of moisture in the test pieces.

By a process of experiment and calculation, which need not be described here, the writer finds that the velocity of sound along the fibres of Stradivari's pine is sixteen times the velocity of sound in air,* and comparing this with

* The velocity of sound "along the fibres" of the rod may also be obtained directly from its transverse

the values given by Chevandier and Wertheim, it will be seen to be a relatively high velocity, corresponding to the fir rather than the pine *(Pinus Sylvestris)* used by those experimenters.

A possible explanation of this apparent anomaly is that, physically, the line of demarcation between fir and pine is not very clearly defined, and the terms are often used in a loose sense; but, without going further into this question, it will be sufficient

vibrations. Thus, if l is the length, t the thickness, and n the number of vibrations, then, for a rectangular rod vibrating in the manner described above, the velocity of sound along its axis is

$$v = \cdot 973 \frac{l^2 n}{t}$$

for the present purpose to consider the wood under its position as a conifer.

In the absence of more complete data, we may perhaps assume, on the evidence of Stradivari's pine, that one of the properties of the wood used for the upper table or "belly" of the violin should be a high conductivity of sound along its fibres; that is to say, a high value of the ratio $\frac{E}{d}$ (where E is the coefficient of longitudinal elasticity, and d the density of the wood); but as Savart does not appear to have recorded the value of d in Stradivari's wood, it is impossible to say whether the high value of the

ratio is due to a high value of E or a low value of d.

There are no doubt practical limits to these values. A high value of E indicates a stiff or inelastic wood, whilst a high or a low value of d indicates respectively a hard or a soft wood; all of which extremes are known to be objectionable.* The skilled

* The experiments of Chevandier and Wertheim show that in wood from the same tree an increase of density—except when due to moisture—is generally accompanied by an approximately proportional increase in the coefficient of elasticity; but it would not be safe to assume that this is always the case.

In the two pieces of sycamore experimented with by the writer, the densities are very nearly the same, namely, ·547

eye and hand may no doubt be able to roughly interpret the specification of the text-book, which says that the wood must be "not too hard, and not too soft"; but the *timbre* of the violin is far too delicate a matter to come under the common rules of carpentry.

As to the velocity of sound across the annual rings, *i.e.*,

and ·554; so that the difference in the velocity of sound (pitch of the notes) is here almost entirely due to a difference of elasticity.

In another experiment, two rods of Swiss pine, whose densities are ·420 and ·468, gave almost exactly the same note. In this case the greater density is accompanied by a proportionally higher coefficient of elasticity.

along a diameter of the tree, there is nothing very noteworthy in the figures recorded in the above table; and the tendency would seem to be that all woods are approximately equal in this respect.

Coming to the velocity "along the rings," *i.e.*, tangentially to the annual rings, it is seen that pine and its relative, fir, are in this case practically equal, but lower in the scale than all the other woods.

Now, the experience of more than two centuries has proved beyond doubt that one of these two conifers is, of all woods, the best for the belly of the violin, whilst experiment seems to show

that this wood is, as regards sonority, chiefly conspicuous amongst other woods by a very low conductivity of sound along its rings, which implies a low coefficient of elasticity, and consequently great elasticity,* along that "axis."

This being so, it may perhaps be inferred that the same property which marks the suitability of the wood amongst others of different genera should also be

* Some writers speak of the velocity of sound as being directly proportional to the square root of the "elasticity," instead of "coefficient of elasticity." Chladni very correctly uses the word "*rigidité*" (stiffness), which is the inverse of elasticity (extensibility or flexibility).

the guide in selecting the most suitable wood from different specimens of the same genus (or species); or possibly that a low conductivity along the rings, coupled with a high conductivity along the fibres (or some particular ratio of the two) should be the resultant index of the quality to be sought for.*

Unfortunately the writer is unable to go beyond the sugges-

* It would appear from the above table that, as regards conductivity of sound, the aspen corresponds very nearly to the conifers. It is, however, a differently-constituted wood, in having the true *vessels*, which are not found in the pines and firs, and this perhaps accounts for the wood not being suitable for the tables of the violin.

tion; for, owing to the form in which violin wood is supplied to the market, it is impossible to cut test-rods of sufficient length to determine the velocity of sound along the "tangential axis." The co-operation of the wood-cutter is here required, and experiments with such rods could hardly fail to supply results of great interest, if not something more in the shape of a "missing-link" in the "lignology" of the violin; and it would certainly be well to connect the experiments with the character of the soil at the spot where the tree was felled.

What rules the old makers may have had to guide them in the selection of their wood we

shall probably never know. They evidently knew a good wood when they got it, and up to the middle of the eighteenth century they also knew—perhaps to a few yards—where to go for more when they wanted it. There was thus a continuity in the supply, of great assistance to them in perfecting their instruments. Any little change of form or dimensions found to be advantageous could be repeated with something like a certainty of obtaining the same result, because the wood was the same.

They were therefore placed at a great advantage over the modern maker, who knows little or nothing of the origin of his

wood—no more in fact than the "middleman" who supplies it to him.

When Alessandro Gagliano went to Naples he must have taken with him something more than his mere knowledge of the handicraft of violin-making. He did not use the wood of the *Azzeruolo* (Neapolitan medlar-tree), nor even *Epicea* (? Pitch Pine),*

* It is curious that these woods should have been suggested as an explanation of the excellence of the old Italian instruments; but the solution of an enigma of this kind is often sought for in most unlikely quarters. The writer was once present at a conversation between an Englishman and a boot-maker in a continental town, when the former was praising the greater durability of the

and the consequence is that his instruments and those of his sons possess some of the beauty and "carrying power" of the "Cremona tone."

Thanks to Helmholtz, we know why a rod of pine, yielding the same *note* as a rod of glass, does not yield the same *tone;* but we have yet to learn the wherefore of the fact that the wood of the modern violin does not reinforce the same "demonstrable crowd of overtones" as the wood of the old Italian and Tyrolese instruments.

English boot. "C'est très vrai, monsieur," was the reply, "et je vous dirai pourquoi"; then in a half-whisper, "c'est parceque les anglais emploient du cuir *d'hippopotame*"!

In the meantime it would be a mistake to rest satisfied with the belief that the violin-making of to-day is more scientific than the violin-making of the seventeenth and eighteenth centuries. The whole doctrine of the existing theory of the violin, so far as concerns the practical construction of the instrument, may be very briefly paraphrased, "Copy the Italian makers; we do not know precisely why, but copy them as closely as you can." Very sound advice; and the first step is to discover the equivalent of their wood, especially the pine; though there is perhaps something more than meets the eye in the quaint remark made four

centuries ago by Gruffydd ab Davydd ab Hywel, when describing the Welsh *Crŵth*, that "music is to be got out of the sycamore," and it seems safe to say that if any improvement is to be made in the modern violin, it will only be as the result of carefully recorded experiments on the properties of the two principal woods employed in the construction of the instrument.

There is another "rule" formulated by Savart, to the effect that in a properly-proportioned violin the back and belly when vibrated separately should give notes of different pitch.

There are two somewhat conflicting accounts of the experi-

ments from which this rule is derived: one, contained in the report of the lectures delivered by Savart at the College of France in 1838-9, and published in *L'Institut* in 1840; and the other as given by Fétis in the book already mentioned.

Both accounts agree in stating that Savart detached the backs and bellies from several violins of Stradivari and Guarneri, and that on clamping them in a vice and vibrating them with a bow it was found that there was always a difference in the pitch of the notes emitted respectively by the back and belly of each instrument.

According to the account in

L'Institut,* the note given by the bellies of these instruments varied between C sharp and D, whilst the note of the backs varied between D and D sharp, so that the note given by the back might be anything from *o* to one tone *higher* than the note of the belly, but never lower.

Fétis, on the other hand, says that the back was always found to give a note exactly one tone *lower* than the belly.

This discrepancy has been keenly discussed, but there is nothing to show what Savart himself would have said on the matter, as he died before com-

* *Vide* Davidson's translation of Savart's lectures, *loc. cit.*

pleting the publication of the records of his experiments.

Mr Heron-Allen* adopts the version given in *L'Institut*, and holds that the back should give a note about a tone *higher* than the belly; stating that this opinion will be confirmed by the experience of any one who will make a fiddle; whilst Mr Bishop in his translation of Otto's book† maintains the version given by Fétis, arguing that Vuillaume, who assisted Savart in making the experiments in question, would have corrected

* *Loc. cit.*

† *A Treatise on the Structure and Preservation of the Violin.* Third Edition. London, 1875.

Fétis if his account had been incorrect. It certainly tells against the probability of the version given by Fétis, that the difference between the notes found in the instruments of two independent makers should be stated to have always been *exactly* the same.

However this may be, and whichever version be adopted, these experiments cannot be held to indicate any "scientific rule" for determining the relative dimensions of the tables of the violin. It is curious that in the report given by *L'Institut* we are told that besides this difference of note in the back and belly, the dimensions must be the same as

in the instruments of Stradivari. Suppose then that we make a back and belly strictly to the dimensions of a Stradivari violin, it is obvious that they may or may not give the difference of notes we are told they should; and they certainly will not unless the two ratios $\frac{B}{d}$ are the same, or in the same proportion as in the woods of the instrument that is copied; but this would be a rare coincidence. Moreover, we cannot expect in this way to reproduce the qualities of Stradivari's instrument, unless we have the equivalent of his wood; but this we do not know, because, as already explained, we do not know

what are the particular values of E* and *d* in that wood.

If, as is practically certain, we are working with two woods having different values to those of Stradivari's woods, there is nothing to warrant the conclusion that the same difference between the notes will also in this case give us the proper relative thicknesses of the two tables; and,

* It may be noted that the value of E in the present case is not the same as in the experiments with the rods. The mode of vibration of a thin, wide, and unsymmetrical plate is not so simple as that of a narrow rod; and the value of E (and consequently the pitch of the note) would depend on a combination of the two elasticities "along the fibres" and "across the rings."

moreover, this rule tells us nothing as to the *absolute* thicknesses, a matter of great importance.

There is one more rule laid down by Savart which deserves notice; *viz.*, that the volume of air contained by the violin should be such that, when set in vibration by blowing in at one of the sound-holes, it should emit the note C of 512 vibrations (256 double vibrations). Savart states that this is always the case with the best instruments of Stradivari and Guarneri, and that any violin of the same size which does not comply with this condition is certain to be defective in tone.

But we are further told that the pitch of the note emitted de-

pends on (1) the thickness of the tables, (2) the pressure exerted by the sound-post, (3) the height of the sides, and (4) the dimensions of the sound-holes.

There are consequently many ways in which an instrument may be adjusted, so as to make it give the required note, by ringing the changes in varying degrees with the four conditions mentioned.

Savart indeed recognizes the indeterminate character of these conditions, but says that "they are so related to each other that *one* being determined it is easy to determine the others." This of course is not so; and we cannot be sure that the solution arrived at will be the proper one.

At the same time there may perhaps be something more than mere coincidence in the results recorded by Savart; but if we have here any indication of a principle actually practised by the Italian makers, we have yet to discover the particular method by which they effected the adjustment of the pitch of the note.

We must however remember that many of the finest instruments have been fitted with new and stronger bass-bars, an alteration which would change the relation between the notes of the back and belly, as well as the pitch of the note emitted by the vibration of the contained air; and according to Savart the in-

hav
sibl
the
no
min
bea
the
mig
pea
teri
part
I
und
of tr
com
violi
were
than
man.
to t

The relative dimensions adopted for the violin and other instruments of the same tribe would appear to indicate that this should not be so.

It is impossible therefore to admit Savart's claim that these theories "determine the rôle of each part of the violin, and indicate the means of constructing excellent instruments resembling in *everything* the most perfect ones of Stradivari;" neither do they afford sufficient grounds for the opinion that the modern violin is "more scientific in its thicknesses" than the instruments of Giuseppe Guarneri del Gesù; an opinion not, of course, generally accepted, but on the contrary said to be

"very difficult to hammer into the heads of amateurs and others."

The practical question is whether by varying the model, relative and absolute thicknesses of the tables, shape and position of the sound-holes, etc., we can compensate for the difference in the values of E and *d* possessed by the wood of the modern violin-maker. The innumerable trials of a century and a half seem to tell us that we cannot; and if by chance a violin-maker is fortunate enough to succeed in producing an instrument at all comparable with the old Italian masterpieces, he can give no explanation of the causes of his success; nor can he, unless pro-

vided with a further supply of the same wood, repeat his work with any certainty.

It is of course quite impossible to suggest anything like an exact course to be followed in the investigation of this question, but, in principle, what seems to be required is that the wood used in violin-making should be tested by experiments similar to those of Chevandier and Wertheim, and the properties of the wood carefully recorded. This would probably soon make it possible to form a tolerably exact idea as to why two woods, in appearance equally good but of such widely different densities as are now to be found in the market, are not

equally suitable for violin-making; and though further progress might be slow, we should at least be on the way towards a more rational method of selecting the woods of the instrument.

APPENDIX

THE following are some of the general conclusions arrived at by Chevandier and Wertheim with respect to the variations observed in the mechanical properties (conductivity of sound, coefficient of elasticity, etc.) of the woods experimented with. They are of interest in connection with the present subject, and have a certain bearing on some of the conditions which are held to mark the suitability of wood for the violin:

(1) Rods cut from the same annual rings, and at the same height in the tree, but from parts exposed respec-

tively to the four cardinal points, present certain differences in their mechanical properties, without however indicating any relation between the variations observed and the position of the rod in the tree with reference to the cardinal points. The *maxima* and *minima* are found sometimes in one and sometimes in another of those parts of the tree.

The notion that there is some particular merit in wood "cut from the south side of the tree" is very possibly a survival of the theory suggested by Musschenbroek in 1726, to the effect that the colder temperature on the north side of the tree checks the development of the wood. This theory was founded on very insufficient data.

(2) In fir, pine, hornbeam, maple, sycamore, aspen, birch, and to some extent in acacia, the mechanical properties increase in value in a constant manner from the centre towards the circumference; though there is somesometimes a slight falling off in the values for wood cut near the bark. This increase from the centre towards the circumference is especially marked in the resinous woods, and seems independent of the age of the tree. In large trees the coefficient of elasticity in the outer rings is often double, and sometimes more than double, that found in wood from the centre of the tree. Oak and birch are exceptions to this rule, and in these two woods the highest coefficient of elasticity is generally found at about one-third of the radius from the centre of the tree.

(3) The mechanical properties are generally found to decrease in value in proportion to the height in the tree.

(4) The season in which the tree is felled does not appear to have any influence on the mechanical properties of the wood.

In the ordinary treatment of timber it is no doubt better that the tree should be cut when the sap is down, as the wood is then less liable to warp, split, etc.; but there is not sufficient knowledge of this subject to enable one to say whether cutting the wood with the sap in is detrimental, or otherwise, to the particular properties of the wood which constitute its merits in violin-making.

(5) The coefficient of elasticity seems, in a general way, to diminish

with the age of the tree; but there is no uniformity in this respect.

(6) The relative thickness of the annual rings cannot be considered the cause of the variations observed in the properties of the wood from different parts of the same tree, nor in woods from different trees; though narrow rings generally indicate a high coefficient of elasticity. In fir there is often a gradual narrowing of the rings from the centre towards the circumference, but even in a contrary case there is still an appreciable increase in the coefficient of elasticity, as noted above.

The common rule in this matter is that the rings should be "not too wide and not too narrow"; and Maugin in his *Manuel du Luthier* recommends two millimetres as about the best width;

but it seems very doubtful whether any rule can be laid down in this matter.

(7) Woods grown in situations exposed to the north, and in dry ground, always possess a comparatively high coefficient of elasticity; and all the higher when these two conditions occur together; whilst woods grown in marshy land have low coefficients of elasticity.

The popular rules that wood for violin-making should be "grown on a southern slope" and at the same time possess a high conductivity of sound may therefore be antagonistic.

(8) In the same tree the variations in the mechanical properties nearly

always accompany each other in the same direction. For instance, the densest part of the tree generally possesses the highest conductivity of sound, and consequently the highest coefficient of elasticity; but this relation, which is not constant in the same tree, rarely holds good in different woods of the same species; and disappears altogether in woods of different natural orders.

Though the examination of woods other than those employed in violin-making might not have any direct bearing on the subject, there would still appear to be scope for the research of points of difference between such woods and those known to be suitable for the construction of the instrument. There is always the chance

that any peculiarity found in the physical or mechanical properties of the pines (or firs) and the sycamores, may prove a clue to the discovery of the particular qualities that should be sought for in their highest degree in those two woods themselves; and which make them *par excellence* the proper materials for the violin.

Knowing the velocity V of the sound pulse along a rod (see foot-note p. 43-44), and the density d of the wood, the coefficient of elasticity is given by the relation

$$E = \frac{V^2 d}{g}$$

Taking as units: for dimen-

sions, the millimetre; for weight, the kilogramme; for the velocity of sound, its velocity in air (say 332226 millimetres = 1090 feet per sec.); for density, the specific weight of water ($\frac{1}{1000000}$ kilo. per cubic millimetre); then with $g = 9810$ millimetres ($= 32{\cdot}2$ feet) per second, the above equation may be written:

$$\log E = 2 \log V + \log d + 1{\cdot}05119$$

It is of course still possible to determine the density, and consequently the coefficients of elasticity "along the fibres," and perhaps "across the rings," (though not "along the rings") of the woods in old violins; but it would be impossible to say

to what extent they have been affected by the varnish.

It seems practically certain that age increases the ratio $\frac{E}{d}$ (and consequently the pitch of the note emitted by the wood), since d must diminish owing to the evaporation of volatile matter; and there may possibly be an increase in the value of E due to the vibration of the instrument, for, up to a certain limit, strain is sometimes found to raise the coefficient of elasticity.

Violin Manufacture In Italy and Its German Origin

WORKS ON THE VIOLIN.

HOW TO MAKE A VIOLIN, Practically Treated. 2 Folding Plates and many Illustrations, by J. Broadhouse, cr. 8vo, bevelled cloth, 3s. 6d.

SKETCHES OF GREAT VIOLINISTS AND GREAT PIANISTS. Biographical and Anecdotal, with Account of the Violin and Early Violinists (Viotti, Spohr, Paganini, De Beriot, Ole Bull, Clementi, Moscheles, Schumann (Robert and Clara), Chopin, Thalberg, Gottschalk, Liszt), by G. T. Ferris; *Second Edition*, cr. 8vo, bevelled cloth, 3s. 6d., (or cloth, gilt edges, 4s. 6d.)

FACTS ABOUT FIDDLES, Violins Old and New. By J. Broadhouse, 3rd Edition, 6d.

TECHNICS OF VIOLIN PLAYING. By Karl Courvoisier. *With Illustrations*, 8th Edition, paper 1s. (or cloth, thick paper, 2s. 6d.) *Highly commended by Joachim.*

HOW TO PLAY THE FIDDLE, for Beginners on the Violin. By H. W. and G. Gresswell. 7th edition, 1s. (cloth, 2s.)

AUTOBIOGRAPHY OF LOUIS SPOHR. 2 vols in 1, thick 8vo, cloth, 7s. 6d. (pub. 15s.)

TREATISE ON THE STRUCTURE AND PRESERVATION OF THE VIOLIN AND ALL OTHER BOW INSTRUMENTS, together with an account of the most celebrated makers and of the genuine characteristics of their Instruments, by J. A. Carlo[illegible] by J. Bishop, cr. 8vo, cloth

---

THE

VIOLIN MANUFACTURE IN ITALY

AND ITS

GERMAN ORIGIN.

AN HISTORICAL SKETCH;

BY

DR. EDMUND SCHEBEK.

TRANSLATED FROM THE GERMAN BY

WALTER E. LAWSON.

LONDON:
WILLIAM REEVES, 83, CHARING CROSS ROAD, W.C
Publisher of Musical Works.

TRANSLATOR'S NOTE.

"In presenting to the public a translation of Dr. Schebek's excellent little sketch, no apology is needed, the name of its author being sufficient guarantee of its scientific value. It will be found to contain much that is highly original, and likely to be of considerable use in the compilation of future histories of the Italian violin manufacture."
—W. E. L.

THE

VIOLIN MANUFACTURE IN ITALY,

AND

ITS GERMAN ORIGIN.

ALTHOUGH the Italian violin manufacture is universally known from its chief seat, Cremona; yet it is by no means free from obscurity: and to this fact may doubtless be attributed much of the importance which has attached to it. Instead of seeking for natural explanation, recourse has been had to mystery, around

which tradition and legend have woven a veil.

Certainly it is extraordinary that through the Praxis alone a violin model could be created, which, while offering beauty of form, and an easy manner of performance, should prove, with regard to richness and power of tone, to be the best which can be invented, notwithstanding the numerous endeavours which have been made, accompanied in part by the most rigorous and ingenious scientific enquiry. Even the preparation of the Italian lac—upon which such store is set by amateurs and collectors, and which, for colour, fire, and transparency, has never been equalled—must be regarded as a secret.

It seems, however, erroneous to ascribe to any peculiarity of manipulation in the manufacture, the superiority of tone which characterises the Cremonese instruments, seeing that the rules adhered to in their construction have been made quite clear to observant and thoughtful masters of the craft by means of disjointed specimens; and experience teaches us that modern instruments constructed on similar principles, would, in the course of time, equal them in tone, and facile tone production. The chief difficulty with which the modern violin manufacture has to contend, is one which, unfortunately, it has to some extent itself engendered, and which arises from the fact that it can-

not raise itself to any real importance, nor, consequently, to a lasting and vigorous productiveness.

During the hundred years which have elapsed since the decline of the classical violin manufacture in Italy, new instruments have continuously been produced; but can they be considered to fill the gap which the Italians have left? This may reasonably be doubted. It is not to be denied, that, amongst these results, there is much that is excellent; but, on the whole, the period has been one of experiment. A leading principle has been wanting, like the well preserved tradition which the old Italian masters adhered to the whole time. Many

thought to make them better, and deviated from the right path; and, moreover, a method was discovered of imitating the great Italian masters, and instruments were prepared which, unlike those that had once left their hands, had the appearance of Italian violins of a hundred years old and more, in a worn-out and even damaged condition. In order to make these new productions similar to the old ones in delicacy of tone and easy intonation, it was the custom to reduce the thickness of back and belly, to macerate, or artificially dry the wood, whereby the instrument was robbed of its power to sustain for any length of time the violent shaking to which, as a resona-

Violin Manufacture In Italy and Its German Origin

make in the minor details such alterations as the development of violin virtuosity and the higher pitch of the present day have rendered necessary. The unavoidable self-denial which will be required of the makers, must be met by the confidence of the purchasers, for supply and demand stand in the most intimate relations to one another; where the one relaxes, the other must also fail.

For these reasons, the propagation of correct views concerning the violin manufacture, and its development, has also a practical side; indeed, it is the inevitable condition supposed in raising it again to that elevation which, strangely enough, it occupied at a time when the demand for perfect instru-

ments was neither so extensive nor intensive by far as it is at the present day.*

Such was the intended object of the

* In order to avoid an accusation of plagiarism, I may here be allowed to remark that, in my report concerning the orchestral instruments in the Paris Exhibition of 1855 (the twenty-seventh book of the official reports of Austria), I have already given to the world, in a more extended form, my views upon violin manufacture. This report has been most freely quoted from by Hiacinthe Abele, in his work, *Die Violine*, without the acknowledgment which he accords in other instances. Whole pages are cited verbally from my pamphlet, and have, in part, been reproduced in other works bearing his name. Under these circumstances, it is by no means impossible that the authorship might be falsely attributed, seeing, moreover, that my report, as part of a large and but little circulated collection, has not become well known in musical circles.

show of Cremonese instruments which, at my incitation, was to have formed part of the plan of the Vienna Exhibition. Assisted by a material such as is otherwise unattainable, the idea was to lay before the most celebrated instrument makers and musicians, and such physicists as had sifted and led to the solution of debateable questions in this province, the instruments thus collected illustrating the development of the classical violin manufacture as a whole, and in its various schools and masters; and, at the same time, as far as might be possible, to clear up the still so obscure history of this branch of art, and its representatives. This special collection did not take place, though

not, fortunately, because of any difficulties which existed in the nature of the undertaking; therefore, one need not relinquish the hope of seeing, sooner or later, under more favourable circumstances, the realization of the idea.

Although based upon no great selection of instruments, a reference to the progress, and to the part which individual masters, or whole schools, have taken in it, is attended with considerable uncertainty. Being unable to comprehend the general coherency, people are not in a position to judge correctly of cause and effect. Hereby is not to be overlooked the fact, that instruments which proceeded from one

and the same workshop were not always equally good or well finished; even masters of minor repute have turned out magnificent specimens; while, on the other hand, the Coryphæ have sometimes fallen behind their usual excellence in some point or other. If we make the peculiarities which we observe in any one instrument which happens to be at hand a matter for generalization, errors become naturally unavoidable, and representations made after this manner by pretended authorities who wish to appear more learned than they really are, find a ready circulation, and, after a time, become difficult to eradicate. Lastly, a general terminology is necessary, in

order that the same ideas may always be expressed in the same language. In all these respects it appears hardly possible to dispense with special exhibitions of Cremonese instruments. Different is it with the superficial history of the violin manufacture, inasmuch as this is reflected in the lives of its representatives, and in the results of an active trade. Here, at least, the material for a future erection may be collected. The following remarks concerning the province to be explored may serve as a guide.

The original form from which the violin and other instruments of the same family—viola, violoncello, and contra-bass—are derived, is very

simple, and is found at the present day under the name of Omerti and Ravanstrom in India, and of Rebab or Rebec in Java and Arabia. In all probability these instruments—if, according to our present ideas, they merit the name—were introduced into Europe under the many modifications of the original form which they had acquired amongst various tribes at the time of the migration of the Indo-Germanic races. Even now we find varieties of them in use; for instance, the Gusle of the Servians and the Russian Goudok. To two, apparently, of these original types does it seem possible to trace back the origin of the violin, viz., to the Crwth of the ancient Britons and the Rebec,

which, without doubt, passed through Spain into France. Centuries elapsed, however, and a vast number of sometimes very extraordinary transformations were necessary before the violin acquired its existing form. Of these ancient varieties we are in possession of a compendious pattern-list derived from carvings in old churches and sketches in ancient manuscripts. The viola was the instrument of transition, which in its turn passed through many metamorphoses before it acquired a settled form. One can without difficulty picture to one's self this form of the viola; for, by reason of the flat back, and, towards the neck more pointed than rounded body, and the

broad sides, it greatly resembled our contra-bass, or the viola d'amour, which, by the way, threatens to become a rarity. Sometimes the sides were only curved, like those of the guitar, in intimate association with voices to accompany which, they came more and more into use. Violas were divided into four kinds, viz., treble, alto, tenor, and bass, which were held during performance either at the shoulder or between the knees—hence the term "shoulder violin" (Viola di Spalte, Viola di Braccio, the origin of the German word, Bratsche), and "knee violin" (Viola da Gamba). The bass viola alone, which still exists in a slightly modified form, as the contra-

bass, was played, like this instrument, in a free position.

The manufacture of viols of the old sort continued for a considerable time after the new model for violins, violas and violoncellos, had been introduced, a proof that the flat whizzing tone, which necessarily resulted from its outer form and inner structure, in which often the indispensable bass-bar was wanting, continued to be admired for a long time, before the clear, brilliant, powerful and sonorous tone of the new instruments usurped the monarchy.

Although Galileo, in his "Dialogues," says—"The violin, and the bass or violoncello, were invented by

the Italians—perhaps by the Neapolitans (?)," still the statement is open to doubt. In ancient times England displayed great activity in the production of instruments played with the bow, at the same time seeking out, and renumerating freely, performers upon the violin and viola. Is it not possible that the metamorphosis from the original bow instruments to the violin took place in that country? Further, it is by no means improbable that the violin was introduced into Italy from Germany; for there were masters whose names hint at a German extraction by whom the manufacture of the violin proper was first cultivated in Italy. The history of ancient commerce is in

both countries too obscure to admit of positive proof of this. It is nevertheless certain, that the oldest known violins were made in Italy.

It has been customary, hitherto, to regard Brescia as the cradle of the Italian violin manufacture; but, while this opinion was based upon Gaspar da Salo (circa 1560-1610), it was incorrect. Later enquiries, to which a violin bearing the name "Joan Kerlino, 1449," gave rise, proved that a maker of that name had lived in Brescia, whereby the above opinion received a justification. On the other hand, Bologna must be accredited with the honour of having been the cradle of a branch of human art industry which, in its pro-

ductiveness and constantly progressive development, was no less wonderful; for from this town a master, known hitherto by the name of Gasparo Duiffoprugcar, sent forth—from the year 1511, upwards—a series of violins no less remarkable for their technical excellence than for their external beauty.

Simultaneously with Bologna, both Mantua, Verona, and Venice furnished bow instruments; but, from specimens which have been preserved in museums, these appear to have principally consisted of violas of the old species.

Towards the middle of the 16th century, the violin manufacture in Brescia, under Gaspar da Salo, came

again to the fore; and it also took firm root in Cremona, through Andrea Amati, who was the progenitor of a highly celebrated family of violin makers which flourished throughout four generations.

Brescia adheres, in the principles of construction and external elaboration, to the line laid down by Duiffoprugcar; but Cremona, although starting from the same point, strikes out an independent path; so, at least, under Antonius and Hieronymus, sons of Andrea, and Nicholas (born 1596, died 1684,) son of Hieronymus. The forms become ennobled, and sometimes considerably smaller, the breasts are more arched; and, at the same time, the

purely external ornamentation is dispensed with, while particular attention is given to the choice of wood and varnish. The tone is distinguished more by sweetness than grandeur. The reform brought about by Amati was adopted more or less by the rest of the violin makers. Cremona was, from this time, the chief seat, and the high school of the violin manufacture. Even Brescia relinquished by degrees its peculiarities; and the last maker who honourably represented this town, Johann Bapt. Ruger, of Bologna, was educated in the school of the Amati.

But the ideal of the violin was not yet attained to. That was reserved

for Antonius Straduarius,* who, like Amati, sprang from an illustrious Cremonese family. A pupil of Nicholas Amati, he followed at first in the footsteps of his master; but soon struck out into new paths, in his endeavours to attain to perfection; and these endeavours occupied him more than half of his long life—he was born in 1644, and died in 1737—until, at the turn of the century, he attained to his ideal—sweetness and grandeur of tone

* The names of the various masters mentioned in this sketch, are, for the most part, Latinized; this change having, usually, been undertaken by the masters themselves. Therefore, for Antonius may be read Antonio; Hieronymus—Geronimo; Guarnerius Guarneri or Guarnerio; Straduarius—Straduari or Straduario, etc., etc.—W. E. L.

combined with perfection of form. It is generally imagined that Straduarius created something entirely new; but, in my humble opinion, all the properties which distinguished his instruments from those of earlier periods, were already in existence, but were greatly scattered; and to him is due the merit of having, with great penetration, selected everywhere that which was the best, and united it into one harmonious whole. He had a large number of pupils, and a still greater number of imitators; and some of them produced such excellent specimens, that, doubtless, at the present day many instruments are falsely ascribed to him. He did not, however, occupy the position

of master of the period in the same degree as did Amati, before him.

His most distinguished disciple, Joseph Guarnerius (born 1683, died about 1745), called *del Gesu*, after the trade-sign which he adopted to distinguish him from a cousin of the same name—adhered, in the main, to his master's precepts, but differed from him so greatly in some particulars that their instruments cannot well be confounded. Unlike his master, who consistently strove to attain to his ideal, and on doing so, faithfully adhered to it—his ideas were irregular, and so, consequently, were his productions. Sometimes he turned out instruments which were equal to the most perfect creations

of Straduarius—nay, are considered by many to be better. Paganini's favourite violin was a Guarnerius. Sometimes his productions were so inferior, as regards choice of wood and finish, that one is tempted to deny their genuineness. Guarnerius found imitators here and there, but he does not appear to have educated any pupils. According to a tradition, he ended his life in a prison.

At the time that Andrea Amati founded the new era, the manufacture of violins was carried on in several other towns besides Brescia and Cremona. But it was owing to the impulse which the works of Nicholas Amati and Straduarius gave to it that

it began to spread. Like a tree that grows in good soil, and to which Heaven sends showers and sunshine, so it sent forth its shoots and branches in all directions. In most of the large towns of Northern Italy it had a seat; and, next to Cremona, it attained to the greatest importance in Venice and Milan. From Northern Italy, it passed through Florence and Rome, to Naples and Palermo. Altogether, as far as I have been able to ascertain, the independent makers numbered about two hundred.

That which not a little assisted its advancement, was the successive inheritance by members of the same family. Before the Amati, we find, in

Venice, the Duiffoprugcars and Linarolos carrying on the trade throughout generations; and the period during which the Amati laboured in this field extended over a century and a half. Beside these, flourished the families of the Guarneri and Ruger, followed by the Guadagnini and Berganzi, each of which probably existed throughout a century. In Brescia, we meet with the families of Maggini and Zanetto; in Milan, of the Grancini, and Testore; in Venice, of the Novellos, Tononi, and Gofriller; while, in Naples, the Gagliani have continued to exist from the 17th century to the present day—latterly, however, only as string manufacturers.

Upon the tickets which they were in the habit of affixing to their productions, it was not uncommon for them to give their genealogy, thus—N.N., the son (grandson, or nephew,) of N. N. In this manner, Nicholas Amati, for instance, carries his genealogy back to his grandfather. Often the native town was named; and it was customary to mention the master, or the school—more especially if it could be referred to Cremona, and to Nicholas Amati, or Straduarius. Sometimes the names of firms, such as *Antonius and Hieronymus Amati; Fratelli Grancini,* are met with. Through such remarks, and the mention of name, place, and date, these tickets became a most important—nay,

in most cases, the only source for obtaining the history of this interesting branch of art; but, unfortunately, their use is rendered difficult by the fact that trickery has often been resorted to, whereby genuine instruments from which the proper tickets have been removed, are provided with false ones, while spurious specimens are furnished with genuine tickets. Experience and caution are therefore necessary to avoid error. The directors, etc., of museums, and of the libraries of musical societies, should regard it as a duty to assist the investigation, by securing, at every opportunity, exact copies of genuine labels.

A more certain source would be

opened up in the registers of births, marriages, and deaths. At present, this source has only been made use of with regard to the Amati, Straduari, and Guarneri, through the unwearying efforts of J. B. Vuillaume, who has regarded it as a pious duty towards his illustrious models; and by S. Ruf, who is to be accredited with similar researches respecting Stainer.

In the case then of these masters, *connoisseurs* are no longer likely to be deceived by labels of instruments dating from a time when the makers were either dead or not yet born, or were still boys at school. Such anachronisms occurred repeatedly in the announcements for the Vienna Exhibi-

tion. Even Spohr dated the demise of Straduarius at about forty years later than the actual time; consequently, as, according to Vuillaume's researches, his birth took place in the year 1644, he must have attained to the age of nearly one hundred and forty years! It were to be wished that such "historical disinfection" could be extended to the remaining representatives of the Italian violin manufacture; the history of this department would then soon secure a strong foundation. Again, in the family of Guadagnini, the existence of a certain Joannes Baptista was considered as proved beyond doubt; he was stated to have lived in the eightieth year of the last century; but the fact

was overlooked, that, a hundred years earlier, a Joannes Baptista Guadagnini worked independently; and that consequently there must have been at least two masters bearing that name. The active life of Alexander Mezzadrie, of Ferrara, was fixed between the years 1690 and 1710; but genuine instruments of his make, with genuine labels dating from the year 1616, are still in existence. Errors of this, and similar kinds—of which many instances might be mentioned, pass from one work to another, because the searching light of criticism has not yet been brought to bear upon the subject.

To root them out, there are two methods which recommend themselves.

The first of these consists in the examination of church-registers, and of such trade-registers as are still in existence. This is a task for clergymen, communal officers, keepers of archives, and local historians.

On the preparation for the Vienna Exhibition, I had, already, this and similar objects in view. The Italian Government was to have been petitioned to give the impulse—for it must be regarded as the national duty of Italy to throw more light upon a branch of art in which it attained to the highest rank. To the Germans may be recommended a similar procedure, with regard to the names of native artists, who, as we shall see here-

after, introduced the violin manufacture into Italy. Particularly should their attention be turned to the history of German lute manufacture, which, in several Bavarian towns, to wit, Nurembourg, and Munich, and perhaps also in the Tyrol, must have formerly attained to considerable development.

The second requisite is the avoidance of all generalisation—*i.e.*, nothing should be advanced with regard to which the slightest doubt exists; and, in case of uncertainty, the source should be mentioned, whereby persons are placed in a position to make further enquiries into the matter, and are not induced to grant to it a greater amount of credence than it really deserves. It

is best to mention each label, or each date, in connection with the instrument from which it is quoted, and to give the external peculiarities, referring only to the instrument on which they are apparent, and not—as a well-known writer on musical subjects, who in this province must be read with caution, has often done, namely, constructed whole periods from *one date or other*, and observed in single instruments the particular tendencies evinced by a master during a whole life, or a succession of different periods.

An excellent preparation for a reliable history of the Italian violin manufacture would be found in a statistic of those of its productions which have

been left to us—such as has already been commenced by M. Jules Gallay, of Paris. But, in such a case, the masters must be clearly denoted, and the external peculiarities of the instruments described in an unmistakable manner.

After this digression, let us return to the historical sketch of our subject.

It was but natural that the violin manufacture, which had acquired such importance in Italy, should exert an influence upon other countries. Whether Jacob Stainer (born 1621, died 1683), the celebrated master of Absam, near Innsbruck, served his apprenticeship at Cremona, as was formerly asserted, must, after the thorough researches of

his latest biographers, remain undecided. He was unable to withdraw himself from the influence of the Amati, as his—truly but seldom genuine—works (imitations, bearing the name of his firm, particularly from the old Mettenwalder manufactory, are circulated by hundreds), show. He went to greater extremes in the curve of the breasts than was justified by the model of Nicholas Amati, whereby his instruments acquired a peculiar—from the Italian—widely-differing quality of tone, more resembling that of a flute than of strings—which, however, was not wanting in beauty, and formerly enjoyed general appreciation, although at the present day it finds no favour

with artists. But in his works may be traced an independency of procedure. He understood how to render the effect of these coarser curves milder by a suitable thinness of the parts; and, further, to give the violin model a certain original individuality, by the perfect accordance of all its parts. But for all that, his imitators—and among the Germans he had many—seized now upon this, now upon that detail, partly following up new ideas; and so led the violin manufacture in Germany into bye-paths.

After Stainer's time, we find—if the labels do not deceive us—Germans established in Cremona; for instance, the two Pfretzhners, and Fricker. From

the inscriptions upon violins, we also learn that the Germans at Cremona produced formal tests of mastership. David Techler, in Rome, Hans Mann, in Naples, and the three Gofriller (Gottfriedl), in Venice, were Germans. Whether the illustrious family of Ruger was of German descent is questionable, seeing that the name Ruger is there likewise native.

On the other hand, Italian violin makers settled in foreign countries. With the Albini, they pushed forward their outposts towards Bozen and Gratz. Others settled in London, Paris, Lyons, and Barcelona. Even in Constantinople, there lived, at the end of the 17th century, an Italian violin-maker,

who, however, was sufficiently acute to take into consideration the Oriental taste, when decorating his instruments.

As everything in this life, so the classical period of violin manufacture came to a close. Enigmatical, like its beginning, but still more sudden, was its decline. Neither for the one nor the other have we sufficient grounds for explanation. Without observing a corresponding progress in the art of violin playing we find the masters from which the epoch of violin manufacture dates, progressing to ever greater perfection. After the Duiffoprugcars, Amati, Straduari, and Guarneri, came slowly limping Baltazarini, Corelli, Tartini, and Viotti; and from the moment when

violin virtuosity reached its zenith, hardly a trace is left of Italian violin manufacture. It would seem that the power of its representatives ceased immediately on the attainment of the long sought for ideal. After Straduari and Guarneri, it still continued for a time to assert itself under several of their pupils and contemporaries; but, in the hands of the immediate successors of these latter, its degeneration became more and more apparent; and before long, the manufacture had entirely vanished. Peculiarly enough, a foreigner—the Frenchman, Michel Decouet, concluded the period which had been commenced by Germans.

The hypothesis, that the violin manufacture in Italy was founded by Germans, I have already advanced in an article in the Vienna *Presse*, of the 27th October, 1872, (reprinted in the *Gazetta de Venezia*, on the 11th April, 1873). Since that time, no facts have reached me which militate against it, but rather such as strengthen it. The following are, in brief, the grounds upon which it is based:

A mustering of instruments at the chateau of Count Lobkowitz, Eisenberg, brought to light several old lutes. Two of these, of fine workmanship, have the inscription—"Laux Maler," (Lucas Maler, the "Amati of lutes," in 1415, at Bologna); a third, to all appearance of

similar date, the name of "Marx Unverdorben a Venetia." The establishment in Italy of these undoubted German lute-makers, shows that at this period the profession was either not native, or did not occupy a like high position with that in Germany, where, in the 15th century, Johann Ott, and Hans Frei—the father-in-law of Albrecht Dürer—and the family, Gerle, all of Nurembourg, had attained to celebrity as lute-makers. With lute-making, the manufacture of bow instruments has much in common. The most celebrated Italian violin-makers —for instance, Gaspar da Salo, and Straduarius—did not disdain to manufacture lutes; while, before them, in

addition to lutes, Dardelli and the Linarollos made violas; and Duiffoprugcar, violas and violins. Indeed, there was an instrument which served to link together the two species, viz., the bow-lyre (lire d'arco). In Germany, as long as the lute remained in use, we have evidence that its manufacture was always associated with that of violins, constituting a single profession; as, even at the present day, occasional trade nomenclature shows. In France, there is no other name for the violin-maker than "luthier," which word evidently bears reference to the lute, (luthe), period. Is it then unlikely that these old German lute-makers, Lucas Maler, of Bologna, and Marx

Unverdorben, of Venice, together with the later Magno Stegher, of Venice, (a German Tyrolese—the name occurs in other German districts, with the orthography, Stöger), one of whose lutes, apparently of the time of Duiffoprugcar, I met with at the Monastery of the Augustines, Neustift, near Brixen—also manufactured violins?

Certainly not a very hazardous conclusion. But even if we argue solely with regard to the production of violins we shall be equally successful in finding a German origin.

The, as yet, oldest known violin and viola makers, are Kerlino, Dardelli, and Duiffoprugcar. To these may now be added the hitherto unknown master,

Johannes Andreas, of Verona, a viola of whose make, bearing the date 1511, I found in the Archducal Museum, Modena, at Vienna. Although a splendid specimen, its form is too grotesque to admit of the maker—whose family name still remains unknown—being ranked, by reason of this single instrument, with the professional string instrument makers. Among the above named, only Dardelli may be considered an Italian. He is believed to have lived in Mantua, about the year 1500, and to have manufactured, in addition to lutes, violas of the old description. We find no mention of him whatever as a maker of the violin proper; and, as a monk—he is called

Padre Dardelli—he appears to have followed the art more as an amateur. The two others, Kerlino and Duiffoprugcar, are of German nationality.

As regards Kerlino, of whose make, a violin—or, as some persons who have seen it declare, a viola reduced to the size of a violin—bearing the date, 1449, is still in existence, it is evident—from the initial letter of his name, which is unknown to the Italian language, that he is not of Italian descent. Judging from the root, Kerl, the bearer of the name could only have been of Breton or German origin. But how could he have been transplanted from Brittany into Italy? On the other hand, there is a great probability in favour of the

emigration of himself or family from Germany; for, at that time, the German lute-makers gravitated towards Northern Italy, as we observe in other cases. The name Gerle, or Kerle, is often met with in Germany. In the middle of the 17th century, it was borne by a celebrated organist. It is possible that Johannes Kerlino, the first of known violin-makers, was a member of the family of lute-makers, Gerle, which flourished in Nurembourg about the year 1460; and that, for the—in Italy—unpronounceable German *G*, a K was substituted. In the collection of instruments on show at the South Kensington Museum, in London, in August, 1872, there were two violins bearing

the name Karlino, with the remark, "very old," but no date. It is very probable that this was the result of an error, as sometimes the a is pronounced like e in the English language. But even if this were not the case, the supposition of the German nationality of the violin-maker now under consideration must still appear well-founded, as Karl is also a German name.

This hypothesis takes a more decided form than as regards Kerlino—although the most ancient—in the case of that master who, upon the instruments made in Italy, spells his name Duiffopruggar, and on those manufactured in France, Duiffoprugcar. However enigmatical the name may

appear in this manner of spelling, the solution seems very simple when it is written according to the German orthography—Tieffenbrucker.*

Tieffenbrucker was long known by name, through a portrait engraved in 1512 by Pierre Voëirriot,† and Gerber also refers to him (Neues Tonkünstler-

* As an addition to the orthographical evidence offered by Dr. Schebek, it may be remarked that the collection of musical instruments in the South Kensington Museum includes a lute by a certain Magnus *Tieffenbrucker*, and also the photograph of a violin manufactured by Casparo *Duiffoprugcar*, presumably the father of the afore-mentioned.—W. E. L.

† In Mendel's *Musikalisches Conversations Lexikon*, now in process of publication, we read—"Gaspard Duiffoprugcar, one of the most celebrated lute and string manufacturers of the sixteenth century, was born

lexikon, 1812), but only as far as he was enabled by the existence of the portrait. Even up to the present time, it has not been possible to ascertain the particulars of his life and works. It is only known that from Bologna—the town from which his first works are dated—he was called to Paris by Francis the First, where he furnished a

in the Italian Tyrol in 1514. After having travelled considerably, he lived for a time in Bologna and Paris, but eventually settled in Lyons."

On comparing dates, the reader will immediately become aware that an error has crept into this statement; for, whereas Dr. Schebek speaks of violins of Tieffenbrucker's manufacture of the year 1511, his birth is here, curiously enough, fixed in 1514. No doubt can arise as to identity while there is such a coincidence in other respects.—W. E. L.

number of instruments for the royal orchestra; and that, later, he settled in Lyons.

Until quite lately his only known productions consisted of lutes and violas, but at the present time more and more violins of his make are gradually brought to light, placing beyond dispute his importance in creating an epoch of violin manufacture in Italy. Some have been found in St. Petersburg, Brussels, Bologna, London, Bucharest, and in several towns on the Rhine. Two of his violins, the property of Mr. Neiderheitmann, of Aix-la-Chapelle, were for a considerable time on view at the Vienna Exhibition. I here give some inscriptions from violins

that are known to me:—Gasparo Duiffopruggar Bonnoniensis Anno 1511 (the oldest), and 1517 (the latest). The violin which was formerly to be seen in Brussels, bore the date, 1539. From a bass viol the following label is quoted:— "Gaspar Duiffoprugcar à la Coste Sainct Sebastien à Lyon." A lute of the Lyons period, which I met with at the Neustift monastery, bore the simple signature:—Duiffoprugcar à Lyon.

This is not the place to enter into technical details; but, judging from the few specimens which I myself have met with, and from the description of others, it seems really a matter for astonishment that he should have done so much,

especially when we take the period into consideration, and regard either the pleasing form, the convenience of performance, the design of the separate parts, the careful choice of wood, the exquisite workmanship, or the beautiful varnish. Even the principles of the flat (flache) model, the adoption of which has added so much to the reputation of Straduarius, were present in his instruments. In the case of well preserved instruments of his make, the tone is remarkable for grandeur and sonorousness. It must, however, be remarked that Tieffenbrucker is not to be judged by a single specimen; for we perceive in the varying form and details that he—like Straduarius, during

his first period—spent considerable time in experiment.

A great peculiarity of his instruments consists in the external decoration. The neck sometimes ends in the ordinary scroll-form, sometimes it takes that of a salamander (emblem of Francis I.), sometimes that of a man's head—occasionally a representation of his own, in which thoughtfulness and energy may be traced. The breasts are generally ornamented with coats of arms in colours, or regal crowns executed in gold; the backs either with views or plans of towns (for instance, Rome or Paris), in inlaid wood work or with oil-paintings (the Madonna or other holy

persons); and for this purpose he chose real art-works for his patterns—the holy Luke or the holy John after Raphael, and the Madonna after Coreggio or Andrea del Sarta, the latter it is believed by the master himself. The beads round the edge are sometimes either singly or doubly inlaid, with or without arabesque-like figuring, and the sides of such instruments are often ornamented in a similar manner, or with devices in burnished gold,—the following thoughtful motto being frequently met with, though occasionally with omission of the first verse:—

"Viva fui in sylvis, sum dura occisa securi.
Dum vixi tacui; mortua dulce cano."*

* I lived in the forest, and was killed by the hard axe. Living, I was silent; dead, I sing sweetly.

After Kaspar Tieffenbrucker there still lived, as makers of lutes in Italy, Leonard, Wendelin, and Magnus, members of the same family—the latter until the beginning of the 17th century. Like other members of the trade, they, in all probability, also busied themselves in the manufacture of violas; but only one instrument of the kind is known to me, and that was made by Wendelin, and is to be seen in the Modena Museum in Vienna.

To render apparent the influence which the above-mentioned masters, and possibly others, of German descent, have exerted in the foundation of the classical violin manufacture in Italy, as also to show the technical

development of this manufacture from one school and one master to the other, it would require, as I have already observed, a collection of the dispersed material in a certain place, and for a certain length of time; and also a revival of the subject by the most learned men of all participating circles. We might then look forward to results such as have been already achieved in other provinces by means of special exhibitions.

From the slight historical sketch which I have here attempted to give, the reader will draw a conviction of the once honourable position which the Germans held in this branch of art. At the present day, the prospect is not

so pleasing. In the production of *quantity* the Germans are undoubtedly in advance of all nations, not excepting the French; but as regards the higher violin manufacture, they have not—with certain exceptions—made themselves in the least conspicuous; they rank in this respect not only beneath the French, but also below the English, by which nations the good method is followed, at least by a few—for instance, by the family, Lupot-Gand, of Paris, for nearly a hundred years.

In the art industries, in the strict sense of the words, noticeable endeavours have been made of late years by Austria and Germany to reach again

the position occupied by them a hundred years ago. Shall we not, then, in the violin manufacture, which, as regards object and labour, deserves to be ranked with the art industries, endeavour to follow the example of our forefathers?

THE END.

VIOLIN WORKS.

HOW TO REPAIR VIOLINS AND OTHER MUSICAL INSTRUMENTS. With diagrams, by Alfred F. Common, cr. 8vo, boards, 1s.

INFORMATION FOR PLAYERS, OWNERS, DEALERS AND MAKERS OF BOW INSTRUMENTS, ALSO FOR STRING MANUFACFACTURERS, taken from Personal Experiences, Studies and Observations by William Hepworth, with Illustrations of Stainer and Guarnerius Violins, etc., cr. 8vo, cloth, 2s. 6d.

NOTICE OF ANTHONY STRADIVARI, the celebrated Violin Maker known by the name of Stradivarius, preceded by Historical and Critical Researches on the origin and Transformations of Bow Instruments, and followed by a Theoretical Analysis of the Bow, etc., by F. J. Fetis, translated by J. Bishop, Facsimile, 8vo, cloth, 5s.

BIOGRAPHICAL DICTIONARY OF FIDDLERS, including Performers on the Violoncello and Double Bass, Past and Present, containing a Sketch of their Artistic Career, together with Notes of their Compositions, by A. Mason Clarke, 9 *Portraits*, post 8vo, cloth, 5s.

NEW WORKS AND NEW EDITIONS.

THE PLACE OF SCIENCE IN MUSIC, by Henry Saint-George, 8vo, sewed, 1s.

THE PEDAL ORGAN: ITS HISTORY, DESIGN AND CONTROL, a Lecture by Thomas Casson, 8vo, sewed, 1s. net.

MODERN ORCHESTRAL INSTRUMENTS, Their Origin, Construction, and Use, together with "Precursors of the Violin Family," by K. Schlesinger, being a Practical Illustrated Handbook for the Use of Amateurs or Students, Profusely Illustrated, 8vo, cloth, 7s. 6d.

PRECURSORS OF THE VIOLIN FAMILY, by K. Schlesinger, many Illustrations, printed on fine paper, 8vo, cloth, 5s.

POST-BEETHOVEN SYMPHONISTS, by Felix Weingartner, Translated by A. Bles, many Portraits, cr. 8vo, cloth, 6s.

CHOPIN, As Revealed by Extracts from his Diary, by Count Stanislas Tarnowski, Translated from the Polish by N. Janotha, Edited by J. T. Tanqueray, paper cover, 1s. 6d. or cloth 2s. 6d.

LIFE AND LETTERS OF FREDERIC CHOPIN, by M. Karasowska, Translated by E. Hill, New and Revised Edition, 1906, 2 vols., cr. 8vo, cloth, 12s. 6d.

London: W. Reeves, 83, Charing Cross rd., W.C.