THE ARTS AND SCIENCES

Physics

THE VIOLIN

By John Redfield

The historical development of the bowed instruments of the orchestra has been recounted in great detail again and again. But the reasons for the successive changes in them, and what has been gained thereby, if anything, have been much less frequently considered. This is as might have been expected, for chroniclers are more numerous than writers on the philosophy of history. To enumerate the changes that have been made in the bow instruments is a much easier task than to estimate the value of those changes. Why the violin and its cousins have assumed their present forms, whether those forms are the best possible, and whether further changes can be advantageously made in them—these are questions which can be answered only in the light of a thorough comprehension of the essential nature of the instruments and of the methods by which they accomplish the results they are designed to produce. And any understanding whatever of their action is enormously difficult.

Of all musical instruments, indeed, the bowed are, with the sole exception of the human voice, the most indirect and complicated in their method of tone production. In the brass instruments, of which the horn may be taken as a type, the production of tone is comparatively straightforward and simple. The lips of the player are so compressed and stretched as to allow air to escape into the instrument only in a series of puffs. These puffs travel from the mouthpiece of the horn to the bell and enter the atmosphere in which we live immersed, producing a succession of pulsations which the ear interprets as sound This process is easy to understand. In the reed instruments, of which the clarinet is an example, a reed flutters back and forth between the air cavity of the mouth and that of the instrument, likewise compelling the air to escape in puffs. This, again, is easy to understand. But now consider the process by which the violin produces its atmospheric pulsations. A rosined bow is drawn across a taut string, pulling it away from its position of straightness between bridge and nut. When the string has been drawn so far that its pull against the bow is greater than the rosin can withstand it escapes from the hold of the bow and flies back toward its original position. Whether it goes the entire way to that position, or stops short of it, or goes beyond it, is, I believe, not yet definitely known. It must be remembered that the bow is all the time seeking again to lay hold of the string and stop its retreat. When the bow does again finally get hold of the string, the little drama begins all over again. It is evident to my mind that the bow, because of its constant clutching at the string, does not permit it to recede quite to its position of rest; although this latter is not the orthodox view. But it is certain that neither the progress nor the recession of the string is at a uniform rate; its rate of motion varies continuously. That this is the case is shown very clearly and conclusively by photographs of the sound the string makes.

But if an understanding of the string's motion is not easy, that of the bridge is difficult indeed. Is the bridge pulled back and forth in its own plane by the action of the string, does it jump up and down on

the belly of the violin, or does it move forward toward the neck and backward toward the tail-piece? All these questions are in dispute and entirely unsettled. So far as the vertical motion is concerned, it is known that the right foot of the bridge is less free to move than the left. The view most generally accepted seems to be that the right foot is approximately stationary while the left foot pounds up and down on the belly like a hammer, but without ever entirely leaving it. To me this view appears incomplete at least, if not fantastic. I am convinced that the amount of motion communicated to the atmosphere by the motion of the bridge toward and from the neck is greatly underestimated. The effect of a mute on the tone of a violin would tend to indicate to any reflective mind that the bridge is pretty nearly the whole show. Yet only a few students of the subject seem to have grasped the tremendous importance of the forward and backward motion of the bridge.

It is generally believed that by far the major portion of the string's motion is communicated to the atmosphere by way of the belly. I am willing to concede that the portion so communicated is large; but the effect of the mute, like a troublesome ghost, will not permit me entire acceptance of the conventional view. But, be the amount greater or smaller, it is obvious that whatever motion the belly has it must receive through the two feet of the bridge. And Savart has shown conclusively, by clamping first one foot of the bridge and then the other, that the motion received from the right foot is small indeed. This is, of course, due to its proximity to the sound-post, which serves to damp its motion almost completely.

With the sound-post we arrive at "the soul" of the violin, as the French call it. But whether *l'âme* is a beneficent spirit or an evil one does not so easily appear. The removal of the sound-post does, indeed, greatly impair the tone of the instrument; but this proves only that it serves *some* useful purpose. What that purpose is, and whether it might not be much better served by some other means, is not at all established thereby. It is usually assumed, rather hastily it would seem, that the function of the sound-post is to communicate motion to the back of the violin, but this view I can't share. The principal duty of the sound-post is undoubtedly its most obvious one—and its most overlooked: to enable the back to assume part of the downward pressure of the bridge upon the belly. This downward pressure varies considerably for different instruments and with different strings, but is usually somewhere in the neighborhood of fifteen pounds—too much to be borne continuously by the belly alone. The sound-post transfers part of this pressure to the violin's back. But wouldn't some other form of support permit greater freedom of motion by the right foot of the bridge? Wouldn't a treble-bar, for instance, provide adequate belly support and still allow as great freedom of motion to the right foot as the bass-bar now allows to the left —or even greater? Or wouldn't some other type of strut between belly and back give better results? Or, again, shouldn't the ribs be tied together for the belly to rest upon like a roof, and the belly bear the whole pressure without other assistance except possibly some additional thickening? The problem is essentially one for an engineer, not for a musician. This much, however, is approximately certain: whatever method of belly support will permit the greatest freedom of motion to the two feet of the bridge will give the most satisfactory tone.

Nor must it be forgotten that the strings are tied indirectly to the ribs of the violin through the neck at one end and through the tail-piece and button at the other, and that a small portion of the string's motion is therefore contributed to the atmosphere by way of the ribs. This fact is usually overlooked, and its significance entirely missed.

It will have been noted that the influence

of the varnish, that subject so dear to the heart of the violin connoisseur, has not been enlarged upon. This is for the reason that the vast accumulation of doctrine about the tonal importance of the varnish is largely unadulterated superstition. So far as I am aware no one advocates the varnishing of the inside of the violin; yet whatever tonal reason exists for varnishing the outside calls with equal force for a similar treatment of the inside.

With all these matters of fundamental importance regarding the manner in which the violin essentially behaves still in doubt, with the precise function of each of its constituent parts as yet unknown, how can any sober-minded person not entirely devoid of fiddle knowledge assert that the violin has reached a state of perfection? To do so is arrant nonsense. Have all the steps by which the bow instruments have reached their present status been taken in the wisest possible direction, and has the last step been taken? No one has enough positive knowledge on the subject to warrant our becoming disturbed for a single moment by any man's answers to these questions, be he an "authority" or not. Any expression of opinion on the matter is a statement of faith pure and simple, and not of knowledge actually possessed. My confession of faith with respect to the violin runs counter to the one conventionally accepted: I believe the violin, together with the rest of the bow instruments, can be improved; and that materially.

Let us note some of the defects in it that are persistently ignored by those to whom Cremona is the holy city. In the first place, the tone of the violin is inexcusably weak. When twenty-four first violins are necessary to balance one first flute, one first oboe, and one first clarinet, something is wrong. A musical instrument is a machine for producing periodic pulsations in the atmosphere. Its efficiency is measured by the degree of success with which it accomplishes this end. No method is at present known of determining what portion of the bowing energy in violin playing is actually communicated to the atmosphere to produce pulsations, but the fraction is probably small. But it is also more than likely that the efficiency of all bowed instruments can be materially increased. If anyone thinks their tone quality would necessarily be impaired by increasing their volume, let him listen to the playing of a string quartette amplified by present day improved methods almost to the sonority of a concert band. So far from losing in quality, the tone gains if anything.

And the violin possesses wolf-tones—notes so objectionable both in quality and volume that they would be considered inexcusable if found in the voice of a first-rate singer. The wolf is due to the fact that the machine, for some reason, almost completely fails of its purpose so far as the production of a particular note, or notes, is concerned. The failure is, of course, due to defective structure, of which three varieties are already known: faulty placement of the sound-post, faulty construction or position of the bass-bar, and faulty graduation of the belly's thickness. That a wolf may be caused in each of these three ways is shown by the fact that it has been removed by treatment in each direction.

A third fault of the violin is that the open tones differ from the stopped ones, both in quality and volume, to such an extent that the evenness of the scale is seriously impaired. The cause of the discrepancy is not far to seek; for stopped notes the string is terminated by the soft finger-end, while for open notes it is terminated by the hard nut. The result is that the open notes are much more resonant and brilliant in quality than the stopped. Of course this discrepancy can be more or less concealed by avoiding the use of open notes; but it would vanish entirely if either the nut were soft like the finger-end, or the finger-ends were hard like the nut.

All these defects of the violin can be

remedied; but, as I have said, they present problems for the engineer, not for the musician. Put a violin in the hands of an able engineer—one capable of designing a suspension bridge—furnish him with a moderate amount of fundamental information about sound, tell him to improve the instrument, and in a year or so he will turn out such an instrument as Stradivarius dreamed of all his life but never succeeded in building. If this be blasphemy, make the most of it!

Cookery

VICTUALRY AMONG THE PENNSYLVANIA GERMANS

By Bland Johaneson

Pennsylvania has three eastern counties, Berks, Lehigh and Lancaster, which for a hundred and fifty years have been celebrated for their cooks and respected for their digestions. The ad-writers with their add-water-and-serve cuisine have not seduced them. The dietitian's charts of calories and diagrams of the human pancreas wrestling a steak have neither interested nor impressed them. The Pennsylvania Germans, whose proud tradition is that every infant comes into the world equipped with a cast-iron stomach, have obstinately preserved the individuality of their cookery.

Strangers have been too ready to label that cookery poisonous. They have visited some hospitable farm and left with dyspepsia, denouncing the butter and the seasoning, when the sin was not the cook's but their own. They simply overate. The food was so fondly prepared, so succulent and distinguished, that they lost their heads and forgot the polite art of knowing when to stop. The native does not eat so frivolously. He has been schooled. He knows the dangers. The very babes are apprenticed with crusts soaked in ketchup. Without this training, the tourists naturally find the diet exhausting. Their first meals progress into pains. Blinded by the ensuing bellyaches they cast a noble cuisine into disrepute.

Schnitz und Knepp is probably the most misunderstood of the local delicacies. A poetic alliance of ham, slices of dried apple and puff dumpling, the dish is far prettier than its name. The dumplings, studded with the *Schnitz*, are dropped into the caldron with the boiling ham and steamed. The very mention of *Schnitz und Knepp* will send the novice into agonies of heart-burn. But if tenderly prepared there is no dish in the Pennsylvania répertoire more alluring or less suicidal. No responsibility is mine if you are introduced to it by a cook who has taken the cover off the pot and spied upon the dumpling steaming. A dumpling is shy at its boldest, and if surprised *in fragrante delicto* with apple *Schnitz* and boiled ham, it will be hopelessly depressed. The privacy of the rite should be sacred for at least twenty-five minutes. When the apples are home-dried and the ham home-cured, *Schnitz und Knepp* is as seductive as whipped cream.

Sauerkraut is another homely delicacy which the Pennsylvania Dutch properly respect. Their version of it is unlike the German, which is watery, and the Hungarian, which is creamy. It is closely related to a meat and vegetable stew, and is usually attended by potatoes, mashed and whipped with cream and butter. The kraut first must be thoroughly soured to a rich gold color—none of your pallid canned stuff, redolent of immaturity. Then it must simmer for three hours with fresh pork—chops, or tenderloin, or other parts that are decently edible. No odds and ends of questionable stewing meat. Nor are flavorless and rubber-skinned doggies ever admitted to the kraut kettle.

The homely doggie itself assumes in Pennsylvania many more ethereal forms. It appears as blood pudding and as a rich