

The Art and Science of the Gramophone

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Some Gramophone Styli and Ways of Reducing Surface Noise.

Ever since the conception of the talking machine the greatest bugbear has undoubtedly been surface noise, or scratch, as some prefer to call it, that has until recently seemed to be inseparable from all gramphonic reproductions, but happily great improvements have been made within the last year or two, mostly in the record itself; in fact, some are so excellent that it is difficult to observe any scratch at all whilst playing on a good instrument, providing certain precautions are taken. The eminent person who is reputed to have said some few years back that "gramophone music was very good, but was spoilt by the grindstone accompaniment," would have less to complain about now.

However, in spite of great improvements surface noise has not yet been entirely eliminated, and many otherwise excellent records are faulty in this respect; and besides, records will wear, and naturally the surface does not improve as time goes on.

Before going into the question of styli in connection with surface noise, it will be as well to state what it really is and what causes it. Leaving out wear and tear, there are three main causes which may be enumerated as follows:—

1. Rough surface produced by inferior or unsuitable material.
2. Faulty manufacture, especially during the process of duplicating.
3. Imperfect recording.

Generally speaking, the first is the cause of most of the trouble, for unless the material is hard, of a very

close and uniform texture, and capable of taking a very high finish, roughness must inevitably result, which, of course, will manifest itself by the only too familiar sound of scratch as soon as the needle engages the revolving record.

The second cause may be produced during manufacture in many different ways, some of which are pitting and wearing of the matrix, not leaving the record in the press to cool sufficiently before removing, insufficiently or over-heating the material before placing in the press.

The third cause is rather more difficult to understand, but is produced by a microscopical chatter of the recording tool. It is a very difficult matter indeed to set up a recording tool in such a manner that it will be extremely sensitive to sound vibrations, and at the same time be sufficiently rigid to prevent chattering. The actual cutting of the wax, of which material master records are at present made, produces a noise in itself, and this sound of cutting wax is very apt to record itself in with the music, which helps to produce the sound of scratch in the finished article.

It will now be readily seen that roughness and pits in the material, the chatter of the recording tool and possibly the recorded sound of cutting wax, will all affect the reproducing stylus in both a vertical and horizontal direction, and will be reproduced with the music.

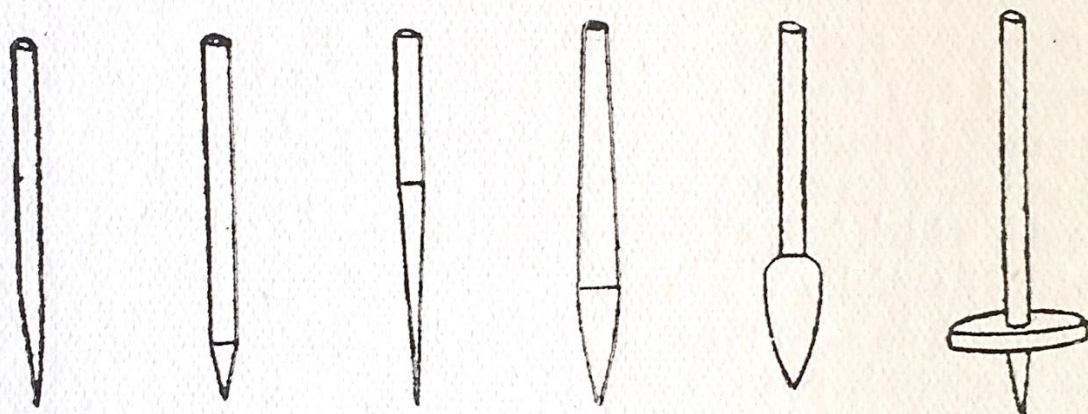
In the case of a needle or lateral-cut record, those false vibrations that happen to be on each side of the V-shape track, are transmitted to the diaphragm through the stylus bar along with the music, by more or less direct lever action, but those on the bottom which are vertical, are actually transmitted to the diaphragm molecularly.

Users of gramophones will probably have noticed that with powerful records, especially heavy band selections, surface noise is not at all obvious, but others not so robust in volume seem to have an enormous amount. This, of course, can be partly accounted for by the fact that the great volume in the first case tends to drown it, whereas in the latter, a comparatively weak volume of sound

enables the noise to manifest itself, but this does not entirely account for it. It is partly due to the fact that when recording heavy music a comparatively thick diaphragm may be used with heavy fittings which will give the cutting tool a firm support, thus to a great extent preventing the chatter before referred to, whereas in the case of violin or similar records the recorder must of necessity be very delicate, consequently there is a much less rigid support for the cutting tool.

Many attempts have been made in different directions to cut the surface noise out in reproducing instruments, not the least important and interesting being the styli.

Fig. 137 is a sketch of the ordinary full tone gramophone needle such as supplied by all well-known makers.



Figs. 137

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142

Fig. 138 has a short stubby point, and is a loud needle.

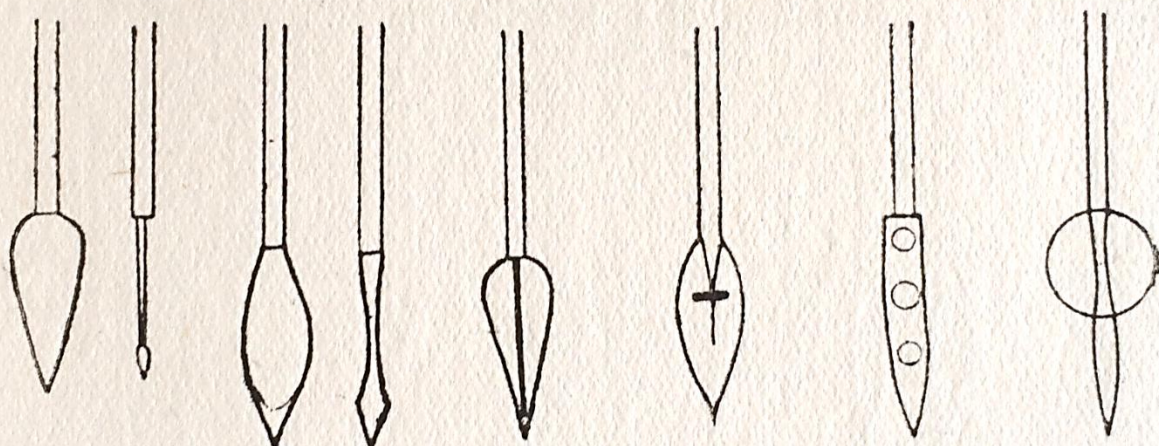
Fig. 139 has a long gently-tapering point, such as the Columbia Ideal or H.M.V. Medium, and is excellent for all-round reproduction where a reduced surface noise is desired. There are, of course, many others which are still finer, but give less volume.

Fig. 140 is a needle which was placed on the market some few years ago, known then as the Cleopatra. This is probably the loudest needle which has ever been manufactured. It is very thick and heavy, the top portion being tapered so that it will jamb tightly into the stylus bar, the point being short and rounded.

Fig. 141 is another extra loud-tone needle made on a somewhat different principle.

Fig. 142 is similar to Fig. 138, but with a disc of metal forced on just above the point. For reasons which we cannot go into here, this tends to increase the volume of the reproduction, but at the expense of the record.

In all the foregoing illustrations the loudest-tone needle is, of course, the greatest sinner in regard to surface noise, and, generally speaking, the reproduction is metallic and only suitable for use outdoors or in very large rooms. For small rooms a medium-tone needle is the best for all ordinary purposes, and in many cases the quality of the music is greatly improved, and the surface noise so reduced as to be practically negligible. Finer needles usually result in the reproduction losing in clearness, but with some records give very beautiful results.

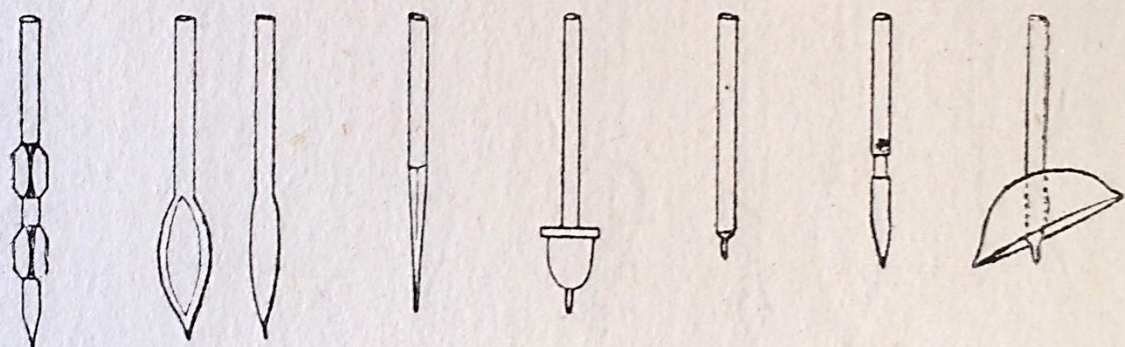


Figs. 143 144 145 146 147 148

Fig. 143 is a very interesting example of the needle that can be purchased practically anywhere, known as the *Spearpoint*. It is not generally known that this needle was originally invented for the express purpose of eliminating surface noise, and the idea is undoubtedly ingenious. It was generally considered that the only cause of surface noise was the roughness of the material at the bottom of the track. This, of course, would produce vertical vibrations only, and as stylus bars on a good sound-box cannot move in a vertical direction, these vibrations were, nevertheless, transmitted to the diaphragm by means of molecular action as already explained. Now with this needle placed in the sound-box with the broad part across the record, that is at right angles to

the direction of the revolution, and engaging the record at the usual angle, it was supposed that these vibrations would cause the needle to spring vertically, thus preventing the transmission of same to the diaphragm. But at the same time, owing to the great rigidity of the needle in the lateral direction, the music would be transmitted without diminution.

Undoubtedly there is a great tendency for the needle to act in this manner, but unfortunately the drag of the record on the needle due to the musical vibrations as apart from the surface friction tends to spoil the reproduction, as a little consideration will show. Another object of this needle was to enable the user to vary the volume from pianissimo to fortissimo by the simple expediency of turning the needle in the stylus bar to



Figs. 149 150 151 152 153 154 155

different angles. Obviously when the broad part of the needle lies across the record the reproduction will be powerful, whereas if it lies in line with the record in the direction of rotation a weak reproduction will result.

Fig. 144 is the famous Petmecky needle, which we believe is an American production. This is most excellent, and the makers claim that it will play ten records without changing. Owing to its shape, particularly that of the point and the material of which it is made, unquestionably these needles last very much longer than the average, and give a very excellent reproduction.

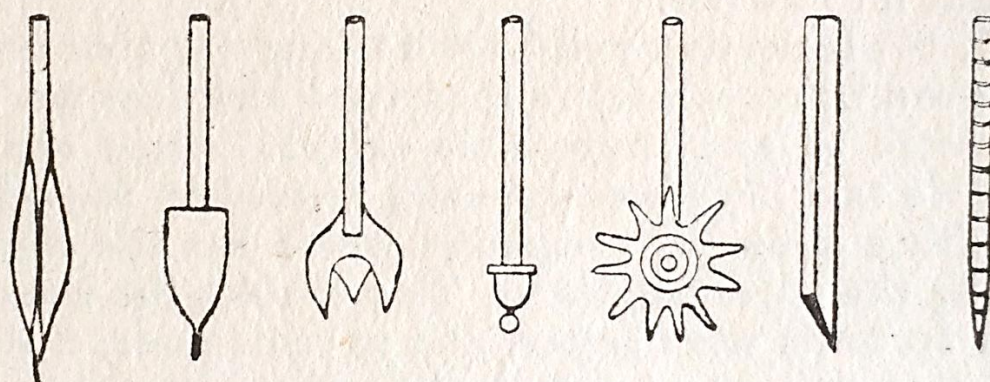
Figs. 145 and 146 are modified forms of spearpoint with reinforced ribs which are obviously intended to prevent distortion due to the drag of the record.

Figs. 147, 148 and 149 are other interesting examples which were on the market before the war. It is difficult to say what advantage there is in these over the simple form.

Fig. 150 is a spoon-shaped stylus, although very loud, is productive of surface noise.

Fig. 151 is a needle with a triangular point.

Figs. 152, 153, 154 and 155 are known as semi-permanent needles, the first two being the Tonofone and Sonora, the latter two being H.M.V. and the Bell Hood. All these have very fine wire-inserted points, which engage in the groove of the record, and owing to its fineness will play 50 to 200 records, or until they wear right down. The reproduction is good, but not so loud as a full-tone needle.



Figs. 156 157 158 159 160 161 162

Fig. 155 is an interesting example having a miniature bell-shape attachment, which the makers claim greatly improves the quality and volume of the tone.

Figs. 156 and 157 are believed to be the first semi-permanent needles. They were first marketed some years ago by Messrs. Daws Clarke. Fig. 156 has an aluminium holder, and is known as the Silver Sheath. Fig. 157 has a cane holder. The object of both these was to avoid the continual changing of the needle and reduce surface noise, which they undoubtedly do, but, of course, at the expense of the volume.

Fig. 158 is another interesting example of a needle that was placed on the market a long time ago, and consists of a metal shank with a glass tip. The glass is formed in

such a manner as to contain three points, all of which were supposed to play several records each, and by simply twisting the needle a new point could be used until they were all three worn out.

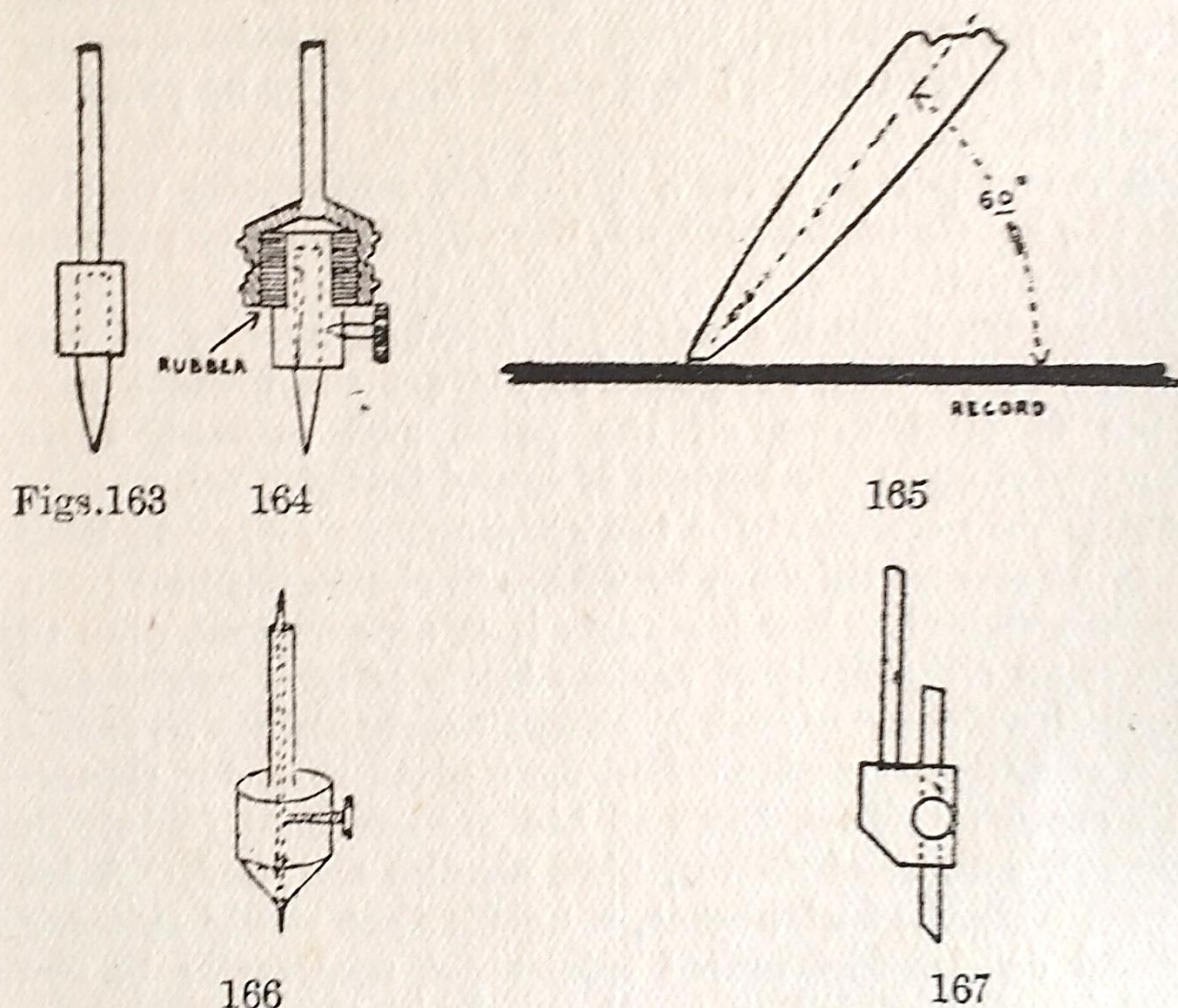
Fig. 159 is an ordinary ball sapphire stylus as used for reproducing Pathé and similar records. These sapphires can be obtained mounted in metal as shown, or in ivory and other materials, the object of the ivory being to reduce volume and surface noise. The Edison diamond stylus for playing Edison disc records is somewhat similar, but much smaller and differently shaped.

Fig. 160 is a multiple needle for attaching to the stylus bar under the usual needle screw. This was an attempt to mitigate the continual changing, by loosening the screw and twisting the wheel a new point could be quickly brought into service.

Fig. 161 is the now well-known triangular fibre needle, which can be repeatedly re-sharpened and does not wear the record to any appreciable extent. Some are now available that have been specially treated by impregnating with a stiffening compound which has the effect of binding the fibres together. This enables the needle to stand up to its work better, and in some cases, will give a greater volume of sound than the untreated ones. Fig. 162 is another type of fibre needle which does not necessitate a special holder, but will fit any sound-box. These unfortunately do not appear to have yet come on the market; the writer understands that it is a natural thorn which grows somewhere on the American Continent. A few samples which happened to come his way certainly proved very excellent.

Fig. 163 is another natural thorn, which is very hard, of a semi-transparent nature; in fact, almost like horn. Two or three of these were sent over from Australia a year or two back and were mounted, as shown, in a special holder. These were tried on records and reproduced fifty times with practically no sign of wear, and the tone of the reproduction was certainly very good. These again apparently are not yet on the market.

Fig. 164 has a little attachment known as the War-roner Mute. This fits into the ordinary stylus bar, and consists of a cup-like portion inside which is a rubber bush which supports and insulates the needle-holder. When using ordinary steel needles with this attachment a very fine reproduction in most cases results, surface noise being greatly reduced, as also is the volume. Also there is the Edison Bell Sympathetic Chromic needle, Fig. 166, which consists of a special holder or grip for



fixing into the needle socket of sound-box. In the grip is inserted a double-pointed Chromic needle of small dimension. Each point will play many records, and the volume of sound can be controlled by varying the length of needle exposed. They are really good.

For the benefit of those who wish to use fibre needles, and whose sound-boxes are not cut to accommodate same, a small attachment is now available which answers admirably. (Fig. 167.)

In addition to the foregoing there have been produced at different times many other most ingenious devices to avoid continual changing, and uneven wear of the needles, such as, for instance, a device with a coil of fine wire, the end of which passes through a special holder and protrudes about one-sixteenth of an inch. As this wears, a new portion is pushed through, and the process repeated as required.

Also several others, consisting of a magazine containing fifty or more needles, which are changed automatically each time sound-box is lifted off the record, or by pressing a button.

A recent patent is for a device for continually revolving the needle whilst playing, the object being to prevent uneven wear.

Magnetised needles were yet another novelty at one time. These were supposed to attract the minute particles of steel worn off the point and prevent their accumulation in the bottom of sound track.

It is very essential for the gramophone owner to bear in mind several things if he wishes to obtain the best from his instrument. For instance, it is an excellent plan to secure an assortment of various kinds of needles and test them on different records. It will nearly always be found that one type of needle is best for a given record. Generally speaking, Figs. 139 and 144 are excellent for violin records, unless, of course, fibre needles are used. A lot depends on the instrument, a needle that would suit one record on one instrument might not necessarily be the best for that record on another. It is, therefore, advisable to experiment and learn which is the best, and always use the same type of needle for reproducing that record. Some users are in the habit of placing the needle two or three lines in when playing their instrument, in order to avoid the sound of scratch which comes from the first few blank lines. Except in the case of fibre needles this is not at all advisable for the following reason: As records are made now, the shape of the track varies with different makes, and often even in the same

make. Now when a new needle is used it has a very sharp point, which will offer a very small surface to the record. As this point has to bear a weight of anything from five to eight ounces, it will be readily seen that excessive cutting action must take place until the needle has worn sufficiently to offer a perceptible bearing surface (Fig. 165), when little or no cutting action will then take place.

The first three grooves should be used for grinding the needle to fit same, and it will be often noticed that it is the first part of the record that wears the quickest owing to this reason. A good plan is to let the needle run on the smooth part of the record before the groove commences for a few revolutions to take off the extreme point, then gently slide it in the first groove. The record will then suffer scarcely any damage. In order to eliminate this preliminary scratch one may gently hold the stylus bar close to the diaphragm between the finger and thumb during its travel until it reaches the music, when it can be released instantly. This will tend to damp out noise.

Another point of some importance is the question of needle angle. If too upright on the record there is a tendency to greater wear. On the other hand, if it is sloping too much definition will be lost. The correct angle should be about sixty degrees from the horizontal. (See Fig. 165.)

It is also essential that all joints in the tone-arm should be free and sound-tight. Any stiffness here will not only tend to produce surface noise, but will cause excessive wear.

All good records should be treated with respect, properly stored in envelopes or albums and kept absolutely free from dust and dirt, and cleaned occasionally with a fine brush.

Those desiring very loud reproductions might try shortening full-tone needles as much as their sound-box will allow.

As all good needles are glass hard, they can be easily snapped off with the aid of two pairs of stiff pliers.