Figure I

AWAKENING THE GIANT

A TREATISE ON THEATRE ORGAN REEDS

PART I

by Bob Mitchell

During the twenties and thirties, hundreds of movie palaces across the nation adopted the orchestral unit pipe organ as the most viable form of musical entertainment for the accompaniment of silent films. Orchestras, with or without the organ, were synonymous with the larger and more plush houses. The theatre pipe organ concept departed from traditional principles of a classic organ by employing expanded pipe scales, high wind pressures, augmented octave coupling, and an array of electropneumatic operated traps. Its sky rocketing success was due no doubt to its expansive versatility. From the singing nuances of its Tibias to the crashing thunder of its Diaphones, it brought a "musical voice" to the projected silent frames of early screen epics. Such versatility, a broad compass of orchestral voices, and the economics of a "one man band" gave the theatre pipe organ a promise of many years of unassailed success and popularity. Complacent with this thought, the theatre organ Industry "geared up" to full production, placing several thousand orchestral pipe units in theatres across the nation. As the development of the theatre organ grew by leaps and bounds in mechanical and tonal design, the ingenuity and inventiveness of the scientist was diligently at work searching to create a new medium for transducing sound – phonic and musical. Thus, a new marvel of sound emerged, and the great musical giant of the silent film era fell into an undisturbed slumber.

Not all the giants slept. Those who were fortunate enough to continue flexing their gussets and bellows survived the ravages of time. As the years

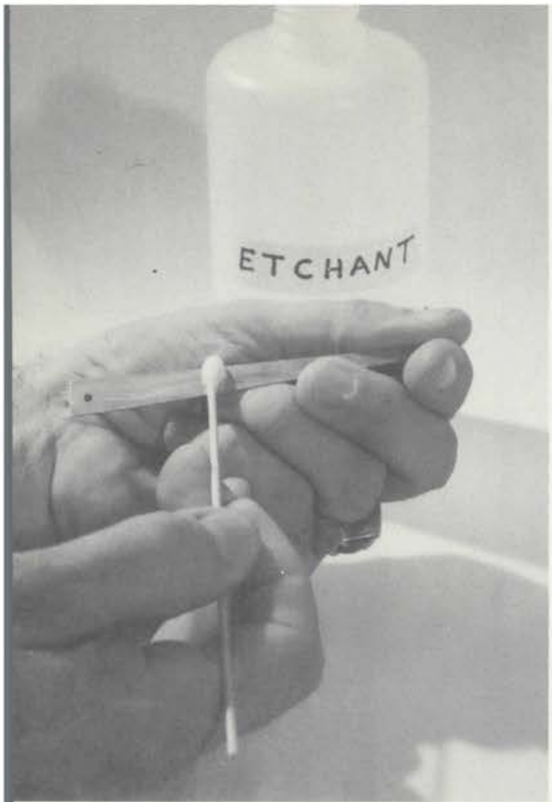


Figure II

passed, a gradual renewed interest in the theatre organ took hold and then, as suddenly as they went to sleep, the mighty giants awoke.

Restoration of the theatre pipe organ suddenly became the predominant hobby adventure of thousands of organ devotees throughout the world. Determined to learn as they progressed, they were confronted with the realization that their experiences, whether successful or fruitless, were to be their teachers. Electromechanics, winding, traps, and labial pipes were the easiest of the essential elements to deal with during the restoration efforts performed on the orchestrial unit pipe organ. Reeds proved to be the most difficult of all.

Reed tongues have been the subject of intensive study by the writer for some years. Of late, and at the insistence of friends in the ATOS, we will attempt to delve into the mysteries of what a reed tongue is made of, what applied scientific principles cause it to respond, what factors cause it to malfunction, and some "dos and don'ts" when coaxing these rascals into service.

As a start, consider the metallurgical composition of an original theatre organ reed "tongue". It's brilliant, lustrous copper appearance generally identifies its origin as being of some vintage theatre organ. To be scientifically correct the material was Grade "A" Phosphor Bronze in the No. 8 Spring Temper Range. Chemically, the compositions would mainly consist of 95% Copper, 4.30% Tin and .22% Phosphorous and some remaining trace elements. Grade "A" Phosphor Bronze is readily available today in spring temper as well as yellow brass. If one should desire such reed material, specify a hardness of 78.0 testing out at the Rockwell Indentation index of 30T. Given the proper brass material, it is cut to shape and in a perfectly flat state it is "sanded" through various grades of abrasive materials and finished mirror-like, completely free of surface aberrations. This surface preparation is absolutely essential to the reed voicing technique. When the prepared reed "tongue" is placed upon a curving iron and stroked with a burnishing tool, the brass material on the side facing the tool becomes "strain hardened", and due to high tensile stresses created on that one side of the reed tongue, a curve is produced. When proper "curving" techniques are performed on a reed "tongue", and it is placed in position on the shallot, it will react to wind pressure by making oscillatory excursions "up and down" the shallot. Depending on the mass of the brass material and the vibrating length of the "tongue", these periods of oscillatory vibrations will produce pulses of air in the column of the pipe causing a "musicial" note to sound. Laboratory tests prove the finished curve to be definitely parabolic in shape. High speed photography also shows that the reed "tongue" never completely closes the aperture of the shallot. Should closure take place, then the wind pressure could seal the "tongue" against the shallot and prevent oscillation. Of course, such techniques performed on reed tongues are manifest in that specialized field known as "reed voicing".

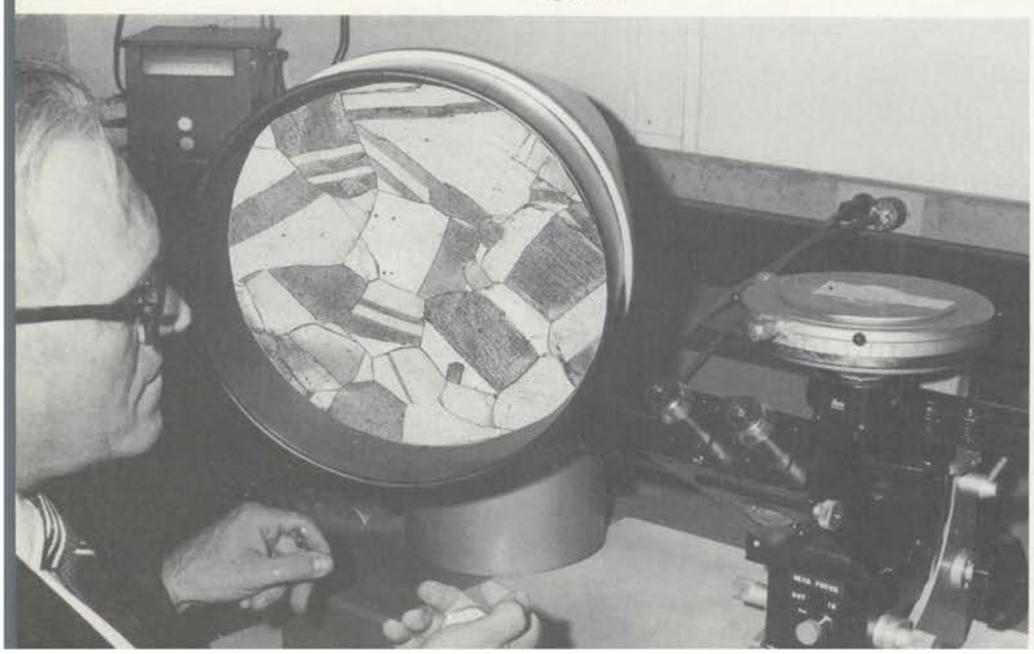
Experience and artistic ability in that particular field are the necessary ingredients for creating a voice which will articulate with proper speech throughout the compass of a particular stop; be it reed or labial.

Reeds suffer from many ills. Malfunctioning can be attributed to such intruders as dust, flying insects, an occasional inquisitive bird, and corrosion. However, the two major enemies of organ reeds are man and metallic strain. An inexperienced "finger nail" voicer can cause irreparable harm to a reed by bending the "tongue" to a point where it could exceed its yield strength and thus not be able to spring back to the precise place where the voicer left it.

What about metallic strain? We know that the burnishing tool creates the curve on the reed "tongue" by inducing tensile stresses on the surface next to the tool. Let us now proceed to investigate any phenomena which may cause a "flat" spot to appear upon a reed "tongue" after years of use. If the reed "tongue" is depressed against the shallot and the closing is observed by holding the unit before a light source, a "window" or "flat spot" will appear in the vicinity where the tuning wire rides the surface of the tongue.

In Figure I a tenor "C" reed tongue from a Wurlitzer 260 Brass Trumpet is being mounted for polishing. The brass

Figure III



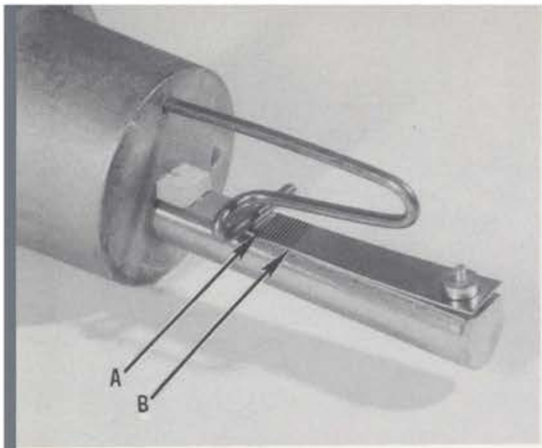


Figure IV

surface is prepared by rubbing same in a flat state on successively finer grades of special polishing papers and removing the finest scratches by polishing on a cloth or leather disc that is fed with water and fine polishing powder such as alumina or magnesia. The effect of this preparation is to produce a very thin layer of "flowed" metal that has been dragged over the surface. Etchants are used (Figure II) to lightly attack the layer, revealing fine lines called grain boundaries, which are clearly visible for study under a high powered microscope. Figure III a metallographic microscope is used to photograph areas of the brass reed "tongue" relating to our investigation. A completely assembled Tenor "C" Brass Trumpet reed is shown in Figure IV. This unit was subjected to eight inches of wind pressure in a laboratory controlled environment for a period of time equivalent to fifteen years of actual use in a pipe organ. Applying the law of probability, the Tenor "C" reed under study could have performed two billion excursions "up and down" the shallot. Multiple tunings, because of atmospheric temperature changes, have to be made. In Figure IV, the shaded area indicated between "A" and "B" (exaggerated for graphic purposes) represents that portion of the "tongue" over which the tuning wire passes. During the laboratory "shake-down", the tuning wire was automatically moved back and forth between "A" and "B" at the end of every 10,000 oscillations. It is this area and that portion directly adjacent to point "B" that photomicrographs have been taken. Figure V shows the area adjacent to point "B" which was not acted upon by the tuning wire. The areas surrounded by the grain boundaries are as expected on the entire convex surface of a new reed tongue which has just been voiced and not subjected to tuning other that the

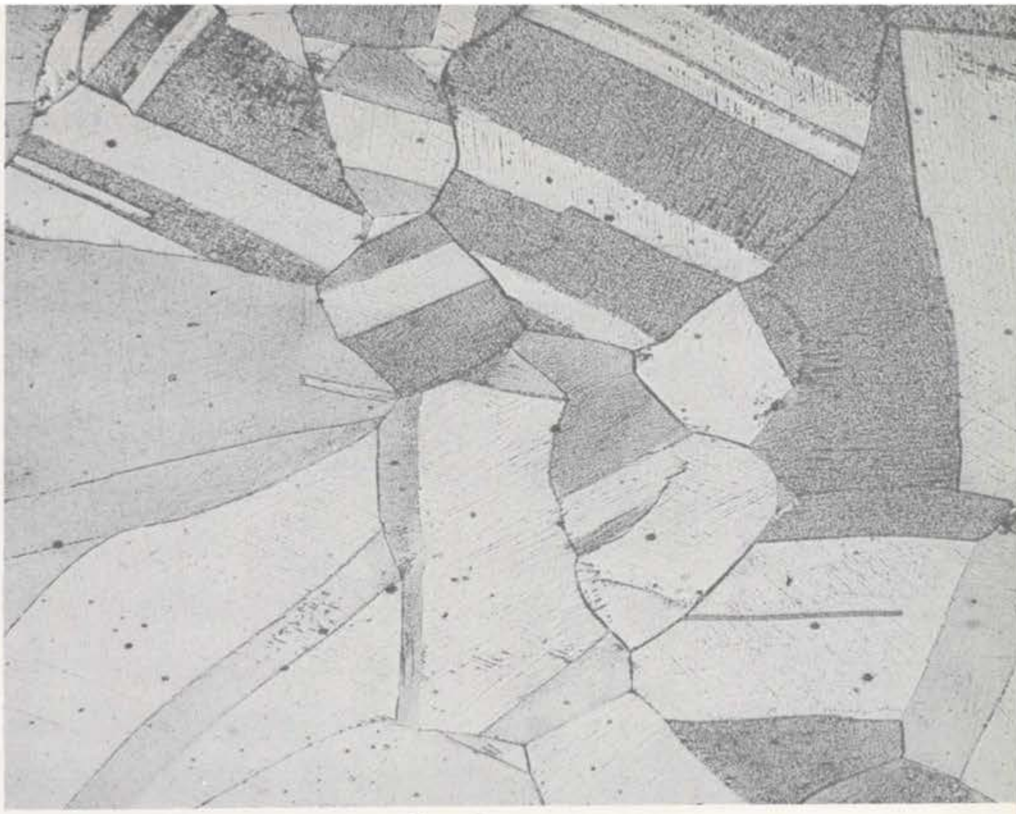
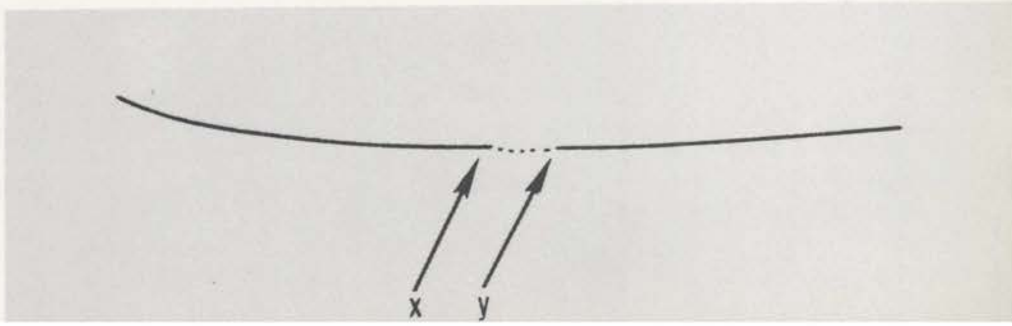


Figure V

Figure VI

Figure VII



slight amount done by the voicer. However, Figure VI taken at the same magnification (200X) shows surface deformation of the area between "A" and "B". The only physical cause for this change was the action of the tuning wire on the surface creating the same high tensile stresses as the voicers burnishing tool. The tuning wire acts as a high unit load on the surface of the "reed tongue" as it is moved back and forth between "A" and "B" (Figure IV) This results in an additional curve in line with the original primary curve of a newly voiced reed. Figure VII shows this area between "X" and "Y". Such plastic deformation does not cause a "flat" spot on the tongue, but rather a curve within a curve. This "depression" acts as a lever and when the tongue is rolled down the shallot and observed in front of a light source, voila!, there is the "window"! It usually appears at point "X", but with excessive strain could also show up at point "Y". In actual practice, this "flat" spot or "window" is the main cause of a "buzzy" reed; provided it has been properly cleaned. Removal of the "buzzy flat spot" is a very difficult operation and usually meets with utter failure. Under an extremely skilled hand, a fraction of such reeds could be corrected.

There is one additional cause for "buzzy" reeds; and that is caused by a metallurgical reaction caused by the metal surface of the "tongue" rolling against the metal surface of the shallot. This action is called "fretting". Fretting is a form of corrosion that occurs on the contacting surfaces between loaded materials which are subject to slight relative movement. In the case of a "rolling" reed tongue there is always a very small amount of play between such surfaces. This gives rise to the galling and tearing off of tiny metallic particles, which sift out and gradually become oxidized. This oxide is found deposited between the tongue and shallot. It is formed by the action of moisture in the air acting on the metallic brass particles. The green oxide is either copper chloride or copper carbonate. It is easily removed by dipping the corroded parts in a solution of boiling water and sulfamic acid. It takes only a few seconds to remove and care must be taken not to erode the metal. The cleaned brass can than be polished with "crocus" cloth wetted with water. Under no circumstances, should a reed tongue or shallot be subjected to abrasive cleaning.

These notes and experiments are in no way intended to contradict the findings and opinions of those more expert than this writer in the art of organ technology. It is hoped that these humble efforts may spark others to conduct similar investigative experiments into other areas of organ mechanics.

Part II of this treatise will illustrate and detail the actual construction of reeds and the voicing techniques employed by one of the foremost reed voicers in the world, Mr. Adolph Zajic of the M.P. Moller Organ Company, Inc., of Hagerstown, Maryland. □

DINNY'S COLYUM

as transcribed by Del Castillo

I see as how all the organ enthoosiasticks will be congregatin at Detroit next month for there Annual Convention, and I wonder if they will be any streakin goin on. The reason is that in Los Angelees last month at the Sunday mornin concert at the Wiltern Theayter which Mr. Bud Iverson had come down from San Francisco to play at, they was a streaker showed up. When the first people come in to take there seats around 9 A.M., all of a sudden they noticed a guy sittin right plum in the middle of the stage startin to take his close off. He got on there without nobody noticin him, and when the officers see him they didnt know just what to do, and the mgr. of the theayter sez we dont want no trouble except the poleece handles it because we dont want to get into no law suits or nothin like that.

Some of the boys was all for rushin him off the stage but on acct. of what the mgr. said they closed the doors and didnt let no one else in and then they had the elecktrician put out all the lites and the people that had come in just had to sit there in the dark. So the mgr. put in a fone call for the fuzz and pretty soon they come in and by that time the guy didnt have nothin on, so they made him put his shorts on and one officer took him by the arm and put handcuffs on him and marched him off the stage and the other officer gathered up all his close, so then the show was over and they put the lites up and let the rest of the people in and when Mr. Bud Iverson come up in the spotlite he says well I know the Los Angelees chapter of the ATOS always puts on a good show, but I never expected this. Later on he made a gag out of it and says well they got him outa the theayter before I could pay him the five bucks I promised him, and somebody else says probaly it was a member of the AGO that did it, but anyways it made a lot of excitement.

So I suppose most anywheres they is any kind of a meetin you never know but some streaker is goin to get into the act. I was lookin at Mr. David Nivens on TV at the Academy Awards, and sure enuff while I was lookin along comes a streaker runnin past the camera, and it broke Mr. Nivens all up. These streakers is all tryin to outdo each other, and one of em some place got nabbed and fined when he went streakin on a bicycle. But the one I liked the best was the two streakers that took there close off in there car, and when they got back to the car they found they locked thereselfs out.

I see by the peace the Detroit ATOS sent out about how to get there you can go by dog sled or the Iron Horse as they say or in a open cart or by bicycle. So on acct. I aint got the price of the R.R. fare, Im goin to start out this month by bicycle and if I can once get over the San Bardoo mountins maybe I can get to Detroit by July the 12th. If they's anybody tries to streak acrost the stage on one of them organ concerts I sure want to be there to see it. I just hope the organ player can think up somethin cute like The Streak of Araby, or Runnin Wild. □