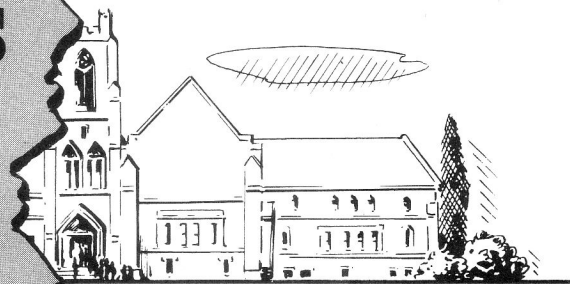




**GOOD INSTALLATIONS
SELL MORE
*HAMMOND ORGANS***



Good Installations Sell More Hammond Organs

The *best* advertising obtainable—recommendation of a satisfied customer! One good dealer after another has told us that 30%—50% of their Hammond Organ business comes from referrals by satisfied owners. How about you? It is elementary to be sure, but often lost sight of, that Good installations can be used as “Character Witnesses” for the Hammond Organ. Conversely, the competition will drag “the skeleton” of a *poor* or *careless* installation before Church Committees for miles around. Maybe it’s *only one* poor installation—but by the time your competitor gets through with it—it sounds like *one hundred*. Why give the competition a break?

Sunday after Sunday all through the year—and for years and years—thousands upon thousands of future “Home prospects” hear the Hammond Organ in their own church. Does it sound well? Does it spark the urge to “get a Hammond Organ?” Does it leave the impression that the Hammond Organ does deliver beautiful churchly organ music?

Maybe the Church Committee said “We don’t need an extra tone cabinet now”. Maybe the pinch-penny chairman said “Reverberation Control—we can do without it”. Maybe the pastor didn’t press for the tone chamber you recommended. Maybe the competition was breathing down your neck with all sorts of concessions. *Maybe*, just maybe, you didn’t sell *hard* enough on a *good* installation. Regardless—there it is—no credit to you now and a handicap to the Hammond Organ.

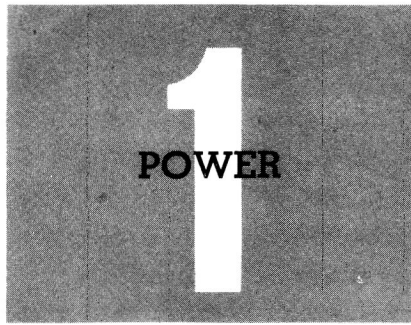
Yes, it does all sound ominous and possibly “built up” but *it can happen* and if it does it will plague you until it is corrected. Why risk it? Good installations *can* be sold—*are* sold—and they stand as a sort of extra special salesman on your staff. Good Installations *Do* Sell More Hammond Organs.

There is no “black magic” about acoustics which will prevent you from making a good installation.

If the few simple rules shown in this book are observed in selection and placement of tone cabinets good musical results can be obtained as well as installations of which you will be proud. Every Hammond Organ salesman and service man should read this booklet.

The fundamental rules which we will consider are:

1. Power
2. Distribution
3. Balance
4. Proper Reverberation



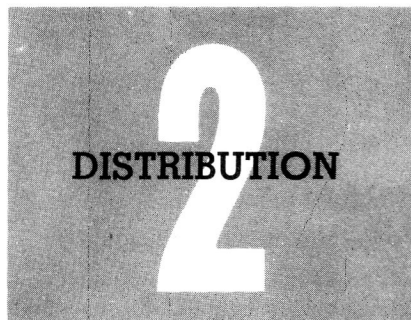
POWER

There are so many factors which have a bearing on the amount of power or sound energy necessary for best musical results in a given enclosure that an accurate formula for determining the required power in all cases would be too cumbersome for everyday use. Experience has shown that it is very seldom that too many tone cabinets are specified. Therefore, if there is doubt as to the sufficiency of tone cabinets for any installation it is reasonably safe to double this amount.

This will greatly improve the musical quality of the instrument and eliminate overloading of the speakers. Some of the factors which have a bearing on the amount of tone cabinet equipment required in any enclosure is the size and shape of the enclosure, placement of tone cabinets, amount and location of sound-absorbing materials including persons present in the enclosure. The use for which the organ is desired also has a bearing on requirements, for example, an organ to be used primarily to support congregational singing would require more tone cabinets than one that is to be used mainly for accompaniment of soloists or light entertainment.

The following conditions in an enclosure, therefore, usually indicate that more than an average installation may be required:

1. When the area of the boundaries of the enclosure is great in proportion to the volume of the enclosure. Thus, an enclosure of irregular shape having numerous alcoves, etc., would require more tone cabinets than one of cubical shape.
2. When the tone cabinets are located in a position where considerable sound absorption takes place before the music reaches the listener. A poorly designed or constructed organ chamber is an example.
3. When acoustical correction materials are used on walls or ceiling, when heavy drapes are present and carpets are used for floor covering.
4. When seating capacity is high for the size of the enclosure. For practical purposes an open window is considered as an area of 100 percent absorption of sound. A single person absorbs about as much sound as four square feet of open window. Therefore, an audience of 1,000 people have the effect on music volume of an open window area of 4,000 square feet as compared with the volume heard when the enclosure is empty. To offset this absorption, a disproportionately greater amount of tone cabinet equipment must be used.



DISTRIBUTION

The sound energy from the organ should be distributed as evenly as possible throughout the enclosure. In order that this may be accomplished, it is important that the sound be distributed in the auditorium above the listeners and that a large percentage of the sound reaching the listener is by numerous reflections from the walls and ceiling. Direct projection as well as direct reflection from the speakers should not reach the listener. Focusing effects of curved surfaces such as bar-

reled ceilings often cause difficulty in sound distribution unless the tone cabinet is so located as to reduce the direct sound energy that reaches these surfaces.

It must be remembered that although sound is reflected in a manner similar to light, the reflecting surface must be large in relation to the wave length of the sound. Therefore, a reflecting surface of a given size will reflect sounds above a certain frequency, while sounds of lower frequency will be diffracted or spread out. To reflect fully the lower tones of the organ a reflector

thousands of square feet in area is necessary. This, together with the fact that different materials absorb sounds of certain frequencies more than others explains why identical tone colors produced in different enclosures will sound very different to the ear.

WHAT TYPE TONE CABINET SHOULD I USE?

Small Room. In a small church or in a home living room, or any other small enclosure, the tone cabinet, complete with reverberation control, preferably a JR-20, should be placed at least 10 feet from the console and should be so located that the player hears the music at as high a level of volume as any listener. This simple rule is important because if the performer does not hear the instrument well, the tendency is to play it so loudly that it may well be unpleasant to the listeners.

Medium Room. The medium-sized enclosure is best served with one or more HR-40 tone cabinet. This cabinet may be placed almost anywhere and good musical results will be obtained. The objectional directional effect so often noticed when music is heard through a loud speaker placed near the listener is absent. The sound energy from this tone cabinet is so well diffused that the music is usually heard with the same loudness in any part of the auditorium.

Large Room. To properly cover large enclosures the best possible combination of equipment is a JR-20 tone cabinet as a monitor placed from 10 to 20 feet from the console, and one or more F-40 tone cabinets with reverberation. For best results the F-40's should be placed remote from the listener area—either concealed in chambers or on shelves high in the auditorium. If you have not heard the organ recently with this arrangement of tone cabinets, we urge you to try it. You will be agreeably surprised!

Public Address Amplifier. It is wise to always recommend installation of standard Hammond tone cabinets. It is true that amplification equipment made by many other manufacturers can be used with the organ, but seldom with good results. A public address system designed for speech reinforcement will usually prove unsatisfactory for use with the organ because it will emphasize the high frequencies and cut off most of the low frequencies which are essential to good organ music.

Study the Placement. Placement of tone cabinets is, of course, of greatest importance. Whenever possible, place them remotely so the organ tones are enhanced by a maximum number of reflections from hard ceiling and wall surfaces before reaching the listener area. Also, be mindful of placing tone cabinets in churches so it is possible for the organist to obtain a good balance between choir and organ in the listener area. Remember that F-40 tone cabinets are preferable in organ chambers or mounted on shelves remote and high up in the auditorium. D type tone cabinets will not perform at their best when placed in organ chambers or in other small enclosures. When used in this manner the general effect is to restrict the passage of sound from the side aperture and top grille—confining the sound within the enclosure.

BALANCE



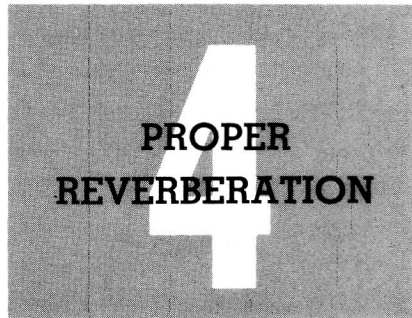
The placement of console and tone cabinets should be carefully planned so that the following conditions are fulfilled:

1. The organ should sound as loud or slightly louder to the organist at the console than it does to the audience. This allows the organist to accurately judge the musical effect he is producing and make any necessary corrections before the audience appreciates the need for them. It also reduces the tendency of playing too loud which is usually evident when

the organist hears the organ at a lower level than the audience.

2. The organist should hear the organ and the choir with the same relative loudness that the audience hears them, otherwise a perfect tonal balance between organ and choir from the organist's point of hearing will result in an unbalanced effect as heard by the audience. When we refer to the choir we also include instrumental groups or soloists who may have occasion to perform in conjunction with the organ.
3. The tonal equipment of the organ should be so located that the choir, while singing, has adequate support from the organ when played at accompaniment volume. They should not, however, hear the organ so loudly as to have difficulty in singing with it. Good tonal balance and ease of performance should result if the average distance between choir and tone cabinets is about the same distance as between tone cabinets and organist.
4. The audience should hear the choir and the organ as a balanced ensemble, and the tone cabinets should be so placed that the choir voices will not be obscured by the organ tones.

REVERBERATION



Reverberation is the prolongation or persistence of sound by reflection, what we usually mean by "echo". It is measurable by the interval of time required for the sound to decay to inaudibility after the source of the sound has been stopped. It is present in a varying degree in all enclosures and most types of music are more pleasing to the ear when accompanied by a certain amount of reverberation. It is also the most important single factor to be considered in planning an organ

installation as proper reverberation makes it easier to attain all of the other requirements necessary for a perfect installation.

In a Hammond organ installation, the proper amount of reverberation may be secured in three ways:

1. By the successive reflections of the sound by the boundaries of the auditorium.
2. By the Hammond Reverberation Control.
3. By placing the tone cabinets in a chamber, the boundaries of which cause the organ tones to reverberate before reaching the auditorium.

REVERBERATION IN THE AUDITORIUM

The reverberation that results from the successive reflections of sound back and forth by the boundaries of the auditorium itself is most desirable from the installation engineer's point of view. (By auditorium we mean any audience room such as a church or concert hall.)

In a reverberant auditorium less power is necessary and problems of sound distribution are greatly simplified and, therefore, the best possible musical results are usually obtained as a matter of course. Unfortunately, however, the reverberation characteristics of an auditorium usually are not alterable by the installation engineer, and he must accept them, good or bad as the case may be.

A reverberation time of one second when a two-thirds capacity audience is present is usually sufficient if reasonable care is taken in locating the organ equipment for proper distribution and balance although a slightly longer reverberation time is often desirable. It must be remembered that the reverberation time in any enclosure is greatly reduced when an audience is present. In general, the higher the ceiling of the auditorium, the less effect the presence of an audience has on the reverberation time; however, this effect is always considerable. If the natural reverberation in the auditorium is insufficient for best musical results from the organ, another method must be used to properly reverberate the organ tones.

HAMMOND REVERBERATION CONTROL

The Hammond Reverberation Unit provides an effective means of securing proper reverberation in all types of installations where the natural reverberation in the auditorium is insufficient. Experience has shown that best installations in homes, radio studios, mortuaries, and small churches include a tone cabinet equipped with reverberation control. It may also be used to improve the effectiveness of the organ in auditoriums where considerable natural reverberation is present, but where this natural reverberation is characterized by an objectionable echo occurring after the organ tones have seemingly ceased. The Hammond Reverberation Unit will not eliminate an echo or reduce the natural reverberation time, but will often make this natural reverberation more pleasing to the ear by "filling in" that period between the time the organ tones seem to cease and the echo occurs. The Hammond Reverberation Unit will not add to the reverberation time in auditoriums already having excessive natural reverberation. As the reverberation unit is connected to the electrical system of the organ and provides reverberation at the source of sound rather than after the sound comes from the speakers, it allows the installation engineer to place the tone cabinets for best results in balance and distribution without the necessity of compromise for reverberation considerations. The use of this device also eliminates the necessity of costly reverberation chambers, and by allowing the tone cabinets to be so located as to minimize sound energy losses, a saving in the amount of necessary power equipment is often effected. A further advantage is that the reverberation time may be regulated for best musical results after the organ is installed.

With the use of the Hammond Reverberation Unit a good organ installation should always result if the tonal equipment is placed to give even distribution and proper tonal balance.

REVERBERATION CHAMBERS

When it is desired to conceal the organ tone cabinets and there is adequate space available, a properly designed reverberation chamber may be very effective in supplying reverberation for the organ tones. In many cases, however, the space allotted for use as a reverberation chamber is anything but ideal, and often, because of structural limitations, little can be done to improve the effectiveness of the chamber other than to make minor corrections. F-40 and FR-40 tone cabinets are well suited for installation in reverberation chambers. Best results will not be obtained by placing non-directional cabinets such as DR-20's in small chambers because space restrictions reduce the efficiency of the bass-reflex baffle employed in these cabinets. The following principles of reverberation chamber design are given for guidance in properly evaluating the good and bad characteristics of a given chamber and in making such changes as will improve the effectiveness of the chamber as much as possible.

SIZE

As the reverberation time increases as the size of the chamber increases, the chamber should be as large as possible. Experience has shown that practically the only exceptions to this rule are when the shape of the chamber may be improved by reducing its size or when the tone opening cannot be made large enough in proportion to the size of the chamber. For best musical results the chamber should be at least 800 cubic feet in volume. The dimensions of the chamber are in most cases ideal if they are in the ratio of approximately 2: 3: 4½. A chamber of equal volume but more cubical in form would have a longer reverberation time, while a chamber of less cubical form would have a shorter reverberation time; however, dimensions in the above ratio usually are most desirable. Chambers of complex shape or chambers of regular shape whose greatest dimension is more than three times its least dimension should be avoided.

**CHART SHOWING SIZE OF TONE OPENING REQUIRED
FOR REVERBERATION TIME OF ONE SECOND
FOR CHAMBERS WITH DIMENSIONS IN RATIO OF 2 : 3 : 4.5**

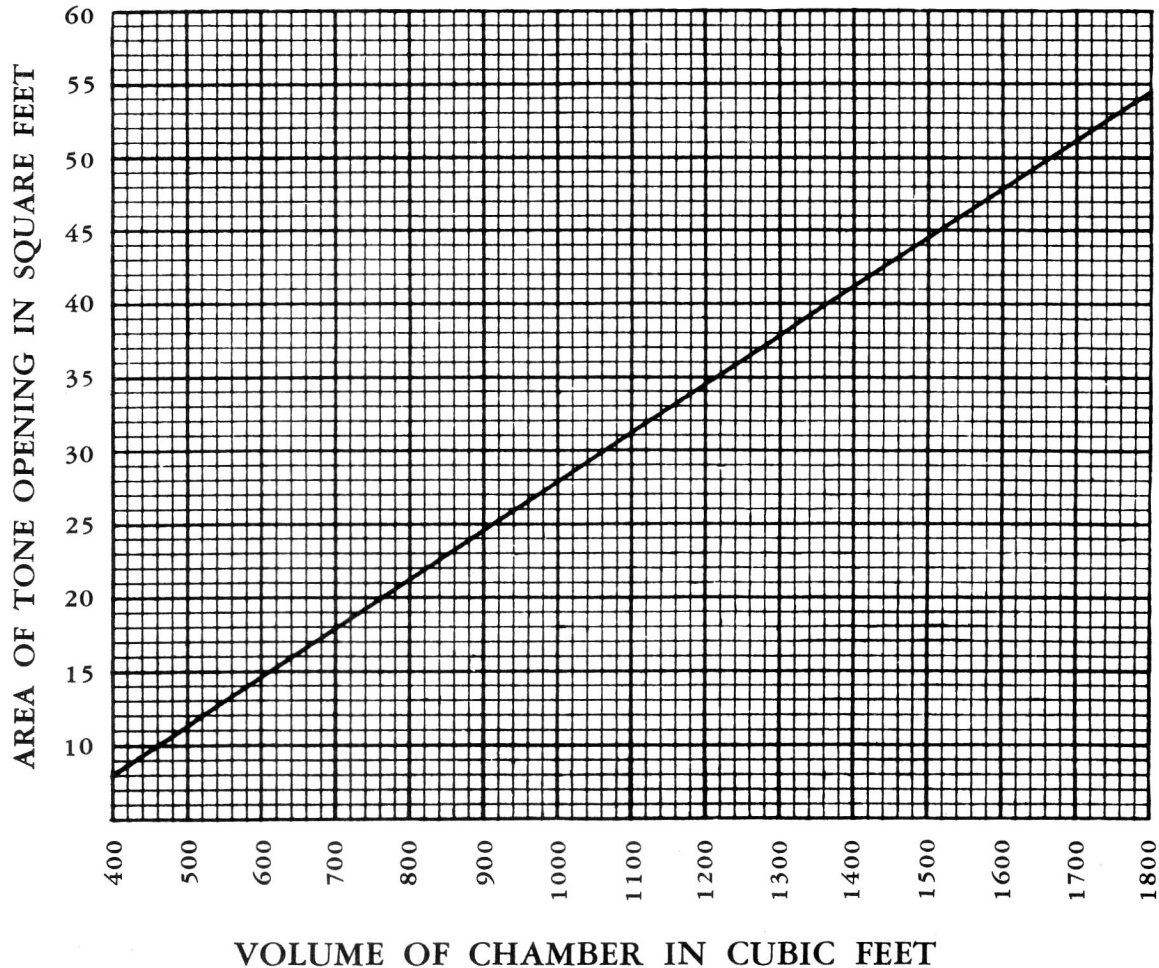


FIGURE 1

CONSTRUCTION AND FINISH

All boundaries of a reverberation chamber should be of exceptionally rigid construction. Concrete or heavy tile is ideal. If the chamber is to be of frame construction the studs should not be over fourteen inches on centers. Lath should be very securely nailed and the plaster should be hard and given a smooth finish coat.

TONE OPENINGS

The reverberation time of an organ chamber is greatly influenced by the size of the tone opening. For a chamber of given dimensions, the reverberation time is increased as the area of the tone opening is reduced. A large chamber, therefore, may have a large tone opening and still furnish sufficient reverberation, whereas a small chamber might require a very small opening. A chart is shown in Figure 1, giving the area of tone opening required to furnish one second reverberation time when the volume of the chamber is known. This chart is for chambers with dimensions in the ratio of 2: 3: 4½ only; however, in practice the areas of tone opening shown are generally satisfactory.

The tone opening should be located in the largest wall surface of the chamber if possible, and preferably near the center of the wall area.

INSTALLATION SURVEY SERVICE

We maintain an Installation Survey Service here at the factory to help you make good Hammond Organ installations. This service is available to our dealers without charge.

Some dealers use this service occasionally just to check the judgment of their own salesmen and servicemen in planning Hammond Organ installations. Others use it only for large installations involving several tone cabinets or for concealed installations where organ chambers are built especially for the Hammond Organ installation. Some dealers have told us that using the factory Installation Survey Service has helped them win sales from the competition because the church committee, for example, is impressed that the Hammond dealer is enough interested in their problems to consult with the factory to design the best possible installation.

If you would like to take advantage of our Installation Survey Service, proceed as follows:

1. Send us architects drawings of the interior of the auditorium in which the organ is to be installed, marking console location and proposed tone cabinet locations on the drawings. Send along a description of how the organ will be used—for solo purposes, for accompanying a choir, for congregational singing, etc.
2. If architects drawings are not available fill out the form "Survey For Hammond Organ Installation" and send it to us together with a sketch showing plan and elevation views of the auditorium in which the organ will be played showing proposed location of console and tone cabinets.
3. Given this information our installation engineers will carefully study the problem and make specific recommendations about type and number of tone cabinets and placement. We will also supply, if you request it, a wiring layout to guide electricians in providing permanent concealed wiring for the organ installation.

HAMMOND INSTRUMENT COMPANY
4200 WEST DIVERSEY AVENUE • CHICAGO 39, ILLNOIS