

REBUILDING THE PLAYER PIANO

After the glue has dried and all the pouches are finished, replace the small fiber discs in their centers, if they were originally so equipped. Use only a tiny drop of glue in the center of the discs, as too much glue will spread onto the exposed leather surface and obstruct the motion of the pouches.

The repairman can now begin reassembling the lower portion of the pneumatic stack. Here again, description of procedure is difficult. In general, the stack should be assembled in reverse of the order in which it was taken apart. If the pouch and valve assemblies are of the unit block variety, these can be glued back together and clamped. See that their mating surfaces are entirely together, or leakage will result. New gaskets must usually be used for each unit block, as the old ones have split and torn when the blocks were broken apart. The pneumatic decks should then be assembled. Attach the rail with the push-rod guides to the top deck of pneumatics. Turn the deck upside down on the workbench. Place a little glue under each pneumatic's push-rod bracket, and insert the screws which hold it to the board. Then place the second deck on the assembly, and do the same for it. After the third deck is in place and its brackets attached, the screws, if any, holding the decks to the main supporting boards should be inserted. Then the long screws or bolts holding the ends of the stack together should be inserted. If the pouches are in board form, the board should be screwed onto the assembly. Gaskets should generally be replaced, and they can be made from white gasket leather, which is cut to size and glued to one of the mating surfaces before the joint is tightened. Some rebuilders prefer a cork

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composition material, available from the piano supply houses noted in a later chapter. All screws and bolts should be drawn as tightly as possible without tearing the threads out of the wood. Often, where this has happened, pieces of match-stick or toothpick can be forced into the holes, to provide material into which the screw can get a new grip. Tight joints are essential for an easy-pumping player. After the lower half of the player action stack has been reconditioned, it can be re-joined to the upper half in the same manner in which it came apart.

After the two parts of the stack have been re-united, the repairman should turn his attention to the tracker bar tubing. Many players came equipped with metallic tubing, which, in some cases, has oxidized and deteriorated with the passage of time. The repairman should pull off one or two of the metal tubes at their lower ends (if he has not already done so when separating the two parts of the stack) and blow through the tubes vigorously, from the lower end. In most cases, lead was used as the metal from which the tubing was manufactured, and this is especially prone to oxidation. If a white, dusty oxide is blown out of the tracker bar, the tubing has deteriorated on the inside and should be replaced. The lead tubing was originally slipped onto the brass nipples in the back of the tracker bar, then cemented into place. By carefully chipping away the cement, the tubing can be pulled off the tracker bar. Usually the tubing has been inserted into holes in the wood at its lower ends, from which it can be removed after the surrounding shellac or other sealer has been chipped away. If the repairman determines that the lead tubing needs to be replaced, he should remove it and replace it with rubber tubing.

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Many pianos were originally equipped with rubber tracker bar tubing. Often this has stiffened and become rock-hard. In this case, the tubing can easily be broken off the tracker bar nipples and the nipples at its lower end, and new tubing can be installed. However, rubber can also deteriorate in such fashion that it becomes soft and sticky. In this condition it will kink easily, and will tear with slight effort, having lost all its strength. Naturally this tubing must also be replaced with new material. If the repairman finds the old tubing sticking to the tracker bar nipples, resisting all efforts to scrape it off, he should cut the old tubing at the tracker bar, remove the tracker bar from the spool box, and soak it for a few hours in gasoline. This will penetrate the old rubber and cause it to lose its grip on the nipples. After soaking, the rubber residue can be removed quickly with a stiff wire brush, which will clean the nipples and leave them ready for the new tubing after the tracker bar has dried.

In general, it can be said that almost all pianos which were originally equipped with rubber tubing should be re-tubed when they are rebuilt. Occasionally a piano will be found with tubing which, inexplicably, is still good. However, if the repairman discovers any traces of hardening, stickiness, or loss of strength, he should proceed to re-tube the piano at once. He should use the phrase "when in doubt, re-tube" as his guide if he is undecided whether to replace it or not. The low cost of tracker bar tubing and the ease with which it is replaced certainly do not warrant taking any chances by leaving old tubing in service after it has begun to deteriorate.

Some pianos were equipped with a transposer, a device which changes the key of the music being played, in case a

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singer wishes the music played in a certain key. This transposer is usually a lever at one side of the spool box with several notched positions, which, when moved, shifts the tracker bar from side to side, bringing different holes into alignment on the tracker bar. Pianos with transposing devices invariably have rubber tubing leading to the tracker bar. However, occasionally these pianos have rubber tubing leading only from the tracker bar to the back of the spool box, where, after passing through a row of nipples, it changes to metallic tubing. Sometimes the metal tubing in this arrangement is still good, while the rubber has hardened or otherwise deteriorated. The repairman should make it a strict point to trace the tubing carefully on pianos equipped with transposing devices, to catch any bad rubber tubing which may be in the assembly.

The actual operation of re-tubing the action is a simple one. The tubing is attached to a tracker bar nipple as it comes from the bundle. It is then run to the other nipple, and cut in such fashion that it can be attached to the nipple and still be slightly slack. The tubes are attached in order, and there is very little chance for mix-up. The sustaining pedal tube runs from the large hole at the left of the note holes, and usually goes from the tracker bar to a switch, which enables the player pianist to shut off the automatic sustaining pedal if he so desires. From the switch, it goes to the left end of the action, where it is usually attached to another nipple after the action is replaced in the piano. If the piano is equipped with an automatic tracking mechanism, this may also need to be re-tubed. Simply remove the old tubes to the automatic tracker one at a time, and replace them in this fashion.

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Any other miscellaneous pneumatics around the spool box should be re-covered at this time. Pianos with pneumatic tracking devices have a pair of tracker pneumatics which must be covered. Also, some players have pneumatics which actuate friction brakes on the roll drive transmission frame, to keep proper brake tension on the roll as it rewinds and plays. These pneumatics are re-covered using exactly the same procedure as was outlined in the section on re-covering striker stack pneumatics. The only difference between stack pneumatics and any other pneumatics is one of size and shape. They are all processed using the same technique.

The air-motor should now be removed from the player action for reconditioning. This is one of the most delicate mechanisms in the piano, and it must be rebuilt skillfully and carefully for good results.

The crankshaft brackets are unscrewed from the body of the air-motor, and the entire crankshaft and sliding valve assembly can generally be lifted away from the rest of the air-motor after the connecting rods from the individual pneumatics are disconnected. The repairman must now remove the individual air-motor pneumatics from their deck, after first numbering them to prevent incorrect replacement. Air-motors were constructed in literally dozens of ways, and again the repairman must use his ingenuity in lieu of any procedure which can be given here. Sometimes the pneumatics are screwed to the deck, and sometimes they can be removed after certain metal rods which hold the assembly together have been removed. However, in many cases they have been firmly glued to the deck, and the repairman must patiently attack them with his mallet and putty-knife until

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they have been detached. The use of a hot iron to soften the glue, as outlined in the paragraph on removal of the stack pneumatics, may come in handy here.

After the pneumatics have been detached and cleaned, they are covered with new cloth. Large air-motor pneumatics should be re-covered with air-motor cloth, which is a double-weight cloth made expressly for this purpose. Smaller air-motor pneumatics should be covered with the regular thin cloth used on the stack striker pneumatics. The only criterion for judgment in this case is whether the use of the heavier cloth will cause internal friction in the air-motor. The heavier cloth will give longer service and will be less prone to wear out at the corners. However, it will also create considerably more friction and will offer more resistance to smooth rotation of the air-motor crankshaft. Large air-motors which have plenty of power can overcome this resistance, and can safely be covered with the heavier material; but smaller ones are often not able to handle the internal friction and thus operate erratically. A good general rule for this situation is: if the perimeter of the air-motor pneumatics is twenty inches or more, use double-weight cloth. If it is under twenty inches, use thin pneumatic cloth.

When the crankshaft and connecting rods are replaced, they should be inspected for wear. The crankshaft bearings and slide valve bearings usually are equipped with felt bushings, which may be worn. If wear is evident, the bearings should be detached from the shaft and the old felt removed and replaced with new material. Powdered graphite should be worked into the new felt to provide lubrication for the bearings. The felt along the edges of the sliders should be inspected and replaced if worn. If the air-motor jerks or

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runs unevenly, check the sliders for warping or sticking. If any warping is detected, remove the defective slider and sand it true on a piece of fine sandpaper placed on a perfectly flat surface. After sanding, powdered graphite should be rubbed into the freshly-sanded wood to allow the slider to operate freely. If the air-motor runs unevenly and no warping of the sliders can be detected, check the adjustment of each slider to see that it is properly timed with respect to the ports which it alternately covers and uncovers. Most sliders operate over three ports, the center of which is the supply port, and the other two connect the suction supply to the pneumatics. Each slider should travel exactly the same distance each way from the center port. Check this adjustment carefully, and regulate it if necessary. Adjustment is usually made by screw threads somewhere in the slider linkage. On some air-motors, the slider rods may have to be bent to accomplish this adjustment. When the air-motor has been properly reconditioned and adjusted, it should operate without the slightest jerking or hesitation. Any irregularity in its operation evinces some defect in it which must be remedied before it is installed in the piano. Nothing is so exasperating to a player pianist as a halting, uneven motor, and the repairman should take special pains to see that the air-motor is perfect before he proceeds to the next step in the job.

At this time it is generally convenient to recondition the air-motor governor pneumatic. This is usually covered with the same material which was used on the air-motor. After the old fabric is removed from the governor, the interior parts of the unit should be thoroughly cleaned and dusted. If the piano has been used in a smoky atmosphere, the in-

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terior of the governor will sometimes be sticky and dirty. All foreign material must be removed from the moving parts. Governors which work on the knife-valve principle may need to have the surfaces of the sliding parts sanded true, then impregnated with powdered graphite. If the governor contains screens or grids, they should be cleaned well. Before applying the new pneumatic fabric, the governor should be blown out with compressed air.

After the air-motor and governor are completed, and the stack is given a final check-over (which includes oiling the roll drive transmission and checking the brake adjustments), the repairman can turn his attention to the lower bellows unit, containing the pumps and reservoir.

The first step on the lower bellows unit is to check the bellows fabric carefully, to determine whether it is in need of replacement. Many player manufacturers used good-quality bellows fabric which still retains its life. This can be quickly determined by inspecting the bellows for cracks or holes at the inner creases, and by feeling the fabric. The pump bellows should be opened to their fullest extent and the creases in their inner folds examined very carefully, as this is where the first signs of deterioration occur. Any holes or worn-through spots in the fabric spell replacement at once. Also, any crackling or hardness of the fabric means that its life has vanished and dooms it to replacement.

If no holes or worn spots are visible, and if the fabric feels as though it has retained its life, the bellows may need little attention. This is quickly determined by sealing off all external openings to the bellows, with tape or other material, and by working one or both foot pedals to build up a vacuum

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inside the bellows unit. A usable bellows unit should hold its vacuum for at least six or eight seconds, preferably longer. The bellows unit should be carefully checked for cracks in its wood, and if any are discovered they should be sealed by gluing a strip of pneumatic cloth over them, taking care to seal the open end-grain of the crack as well as its length. All screws in the entire unit should be tightened to insure snug, air-tight joints. If the external openings of the unit are tightly sealed off, and if the fabric is in good condition, the unit should maintain a vacuum for considerably longer than six or eight seconds. If the bellows unit meets this test, the fabric does not need to be replaced. The repairman should check the leather flap valves on the movable boards of the pumps, to determine their condition. Often they have become rotten or have curled up into an uneven strip which does not lie flat against the surface of the bellows board. In this case, they should be replaced with new strips of flap valve leather. Often the flap valves inside the pumps are in better condition than the external ones, due to their having been kept away from circulating air.

If the repairman determines that the bellows unit will maintain a strong vacuum for at least six seconds, and that its external flap valves are good (or have been replaced), he may proceed to re-install it in the piano. However, if all openings have been carefully sealed, the joints tightened, cracks sealed, and the unit will still not meet this test, it needs recovering. The bellows fabric may appear to be perfectly good, but unless the vacuum can be maintained for a minimum of six seconds, the fabric has deteriorated. Bellows fabric can be one of the most deceiving things in a player piano. The fabric can appear to be perfectly good, and can

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even feel soft and usable to the touch—yet it can still be porous. When the defective fabric is removed and held up to a strong light, it will be discovered to be full of thousands of tiny holes through which air can leak. The repairman can *never* take for granted that pneumatic fabric is usable simply because it looks good and feels soft. It may be as porous as a sponge. This applies to all bellows cloth, thick and thin.

If the bellows unit is in need of covering, it should be dismantled and cleaned of its old fabric. On large bellows such as pumps and reservoirs, a block plane provides the easiest method of cleaning off old fabric and glue.

Care should be taken when dismantling the reservoir, for it contains one or more powerful leaf springs which can cause serious injury. If possible, the springs should be removed through the inner opening of the reservoir before the old fabric is removed. If this is not possible, the old cloth should be partially cut away, leaving a wide strip to hold the reservoir boards from springing apart until the springs can be removed through the holes in the cloth.

While the pumps are stripped of their fabric, the inner flap valves should be checked. Unless these flaps make perfectly tight seals against their respective bellows boards, leakage will occur which will impair the performance of the piano. The flaps should be inspected for dryness or brittleness in the leather, and especially for any curling or warping. Unless the flaps lie perfectly flat against the boards, they will not be airtight. Any signs of deterioration or curling of the flaps provide immediate cause for replacement. When new flaps are installed, they should be firmly anchored at the fixed end with glue *and* tacks. If both ends are

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fixed, the flaps should be stretched tightly across the board before they are finally anchored. If one end of the flaps is spring-anchored, the springs should be under tension at all times, to keep the flaps tight and smooth.

When covering large spring-loaded bellows, the springs can often become troublesome. One way to get around this problem is to attach a piece of strong pneumatic cloth to the open end of the bellows. The cloth should be cut to a dimension equal to the normal span of the open end. It should be wide enough to withstand the full force of the springs, which will tend to pull it apart. The strip of cloth is attached to the open end of the pneumatic with glue and tacks. After it has thoroughly dried, the springs can be inserted into the open bellows through the sides. The bellows will then be held in an open position, and can be covered in the usual way. The fastener strip which is holding the bellows in normal position will not interfere with its operation after it is placed into service, as it can be covered up by the outer layer of cloth with no harm. Of course, the fastener strip should not be glued entirely to the outer cloth, as this would cause binding. It should be glued to the outer cloth only along the edges of the bellows, as in normal covering procedure.

The actual procedure of re-covering the bellows unit is exactly the same as that used in re-covering the strike pneumatics. The strip of heavy bellows cloth is torn or cut to a width equal to the span of the bellows, then glued on in the usual way. After drying, it is trimmed and creased. The spring blocks or any other miscellaneous hardware are then replaced on the bellows boards and the unit is reassembled.

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The "accessory" devices are the last individual parts of the player action to require attention. Pianos which are equipped with pneumatically-operated "soft" controls will need repair on these devices. The repairman should keep in mind that these accessory pneumatics are operated and repaired in exactly the same manner as the rest of the pneumatic system. They usually consist of a good-sized pneumatic which does the work of moving the piano action part, a valve and pouch assembly to operate the pneumatic, a suction supply tube, and a control tube leading from the control rail. The pneumatic should be re-covered, usually with air-motor cloth, and the pouch checked, the valve cleaned, and the bleed cleared as usual.

The same procedure applies to the sustaining pedal pneumatic. Occasionally manufacturers used two valves to operate the pedal pneumatic, to provide extra-quick suction flow and prompt, responsive sustaining pedal action. This pneumatic should be re-covered with the medium cloth, and the valve, pouch, and bleed assemblies checked.

The final step in the complete rebuilding of a player piano is the installation, regulation, and testing of the player action parts.

The "accessory" mechanisms should be installed first, and connected to their respective controls. The lower bellows unit may then be installed and secured in its place, and the control rods may be connected to the bellows unit at this time. The pneumatic stack should then be lifted into place and fastened. Care should be taken to see that the striking fingers on the back of the stack and the parts against which they strike are in perfect alignment. Also, there should be no

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lost motion between the striking fingers and the upper parts. The piano hammers should begin to move toward the strings the moment the pneumatics begin to collapse, with no lost motion or free play. Some players have an adjustment to lift the stack slightly to take up any lost motion. On pianos which have no adjustment, shims can usually be installed to move the stack slightly.

The stack supply hoses should then be connected, and the air-motor supply hose attached. New supply hose should always be used, as it is false economy to attempt to re-use the old hose. If the piano is equipped with an automatic pedal, the sustaining pedal tube should be connected at the left end of the stack. The upper and lower units should be given a general check-over to see that no rods, hoses, or other things are left disconnected.

The repairman should now test the player action for tightness and its ability to hold suction. The tracker bar should be sealed off with masking tape. The control lever should be moved to the "play" position, with the tempo lever at zero. When the pedals are pumped, the action should build up a strong vacuum inside it. After this has been built up, the repairman can determine how long this suction will maintain itself by watching the reservoir. After a good vacuum has been created and the repairman has stopped pumping the pedals, the reservoir should not reach the entirely-open point for at least five seconds.

No player action can be made entirely airtight. Every substance has a certain amount of porosity, and wood and leather are among the most porous of all materials. Every player action will gradually lose vacuum by "seepage" through the pores of the materials of which it is built. How-

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ever, the natural losses of suction in a tight player action are such that it will hold a vacuum for at least five seconds, if the valves and all other external openings are tightly closed.

If the repairman determines that the action will maintain suction for approximately five seconds, he may congratulate himself on having performed a good job of rebuilding the player stack. However, if the reservoir opens in three seconds or less, the repairman should check carefully to determine whether any small leaks exist, which will rob the action of its suction.

If the repairman has a friend in the medical profession, he may be able to obtain a doctor's stethoscope, which is the finest instrument available for detecting and pinpointing vacuum leaks. A stethoscope of the open-end type is advisable, as the type with the closed diaphragm end is not satisfactory for detecting air-transmitted sounds. If a stethoscope is not readily available, a three-foot length of tracker bar tubing with one end inserted in the ear makes a usable leak detector, provided the other ear is plugged with cotton to seal out extraneous noises.

Assuming that the lower bellows unit was carefully tested before it was installed in the piano, the repairman can assume that the leak, if any, is in the upper action of the player, in the pneumatic control devices, or around the joints of the suction supply tubing. With the stethoscope or ear tube, every joint and seam in the pneumatic stack should be checked for leakage. The repairman should reach as far behind the stack as room will permit, to check the valves for hissing or leakage. The services of a second person may be put to good use while making these tests, as the repairman may find it awkward to try to pump the foot pedals, or even

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one pedal, while he is checking for leaks—though if necessary it can be done by one person.

If leakage is discovered around any joints or seams, the screws holding the leaking parts should be checked for tightness and if possible drawn quite tightly to eliminate the leak. If any cracks in wooden parts are discovered, they may be sealed by gluing a strip of thin pneumatic cloth over them.

If the leakage is narrowed down to one or more of the action valves, the repairman should run the test roll over the piano several times. Occasionally valves do not seat properly after they have been removed for cleaning, and often the quick repetition section of the test roll will seat the valves well. If this is not the case, and one or more of the valves still loses suction, the stack will have to be removed (if the valves are located in the rear of the stack) and the offending valve taken out, brushed, its seat checked, and re-assembled.

After the repairman has determined that the player action will maintain a vacuum for the required time, he should check the operation and repetition of each individual note, using the test roll. Every note should operate and repeat with approximately the same speed. If any note fails to operate, this means (1) that the tube leading from the tracker bar to the action may be pinched off or otherwise obstructed; (2) that the pouch for that note may have blown out or come loose from its moorings; (3) that the valve for that note is jammed or otherwise prevented from moving; (4) that the pneumatic for that note is punctured or damaged; or (5) the push-rod of the pneumatic is binding against some fixed part of the piano action. The repairman should first check for a pinched tube, and if this is

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found to be clear, the other things listed should be checked.

If any note makes a hissing sound while it is playing, this indicates that the valve is unable to seat itself completely against its top seat, due to dirt or some other obstruction. The valve will have to be removed and the foreign matter cleared.

If any note plays continuously and will not return to rest, this indicates (1) that the tube leading from the tracker bar is punctured or has pulled loose; (2) that the bleed is clogged, thus preventing the pouch and valve from returning to rest; (3) that the valve has somehow become jammed or stuck against its top seat and will not drop back again, or (4) that the pneumatic push-rod has jammed itself against some fixed part of the action, preventing the pneumatic from opening after its stroke. Occasionally dirt or foreign matter which is clogging a bleed can be loosened by vigorous pumping with a tracker bar pump; but if it is too firmly jammed into the bleed, the action must be dismantled to clean it out.

When all the notes are playing well, the air-motor and governor should be adjusted and calibrated. This is done using the test roll. After checking the top spool brake and adjusting it so that it maintains a moderate tension on the music roll during play, the repairman should put the test roll on the piano and begin playing it through, alternating every few seconds between very hard pumping and very light pumping. If the governor is adjusted properly, the roll will not vary in speed no matter how the piano is pumped. However, if any variation is noticed, the governor will have to be adjusted.

Governor construction varies immensely, and it is difficult

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to give a procedure for adjusting individual units. However, governors may be generally divided into two classes: governors with an adjusting screw which limits the collapse of the governor pneumatic; and governors which have no limiting screw but which have an adjustable spring tension.

If the roll speeds up when the piano is pumped hard, screw the adjusting screw out a turn or two, if the governor is of the limiting-screw type. If it is of the adjustable-tension type, decrease the spring tension on the governor a little bit.

If the roll slows down or stops when the piano is pumped hard, screw in the adjusting screw, or increase the spring tension.

Move the adjustments only a little at a time. Never make more than one turn of the screw or move the spring more than one coil before trying the piano's performance again. Four or five tries may be necessary before the air-motor runs at a perfectly constant speed. Spend plenty of time on this adjustment, if necessary, as it is very important.

After the governor has been properly adjusted, the tempo of the roll should be fairly close to correct. However, it should be exactly calibrated using the tempo-test section of the test roll. This is a measured section which should pass over the tracker bar in a certain time. A tempo of 70 means that seven feet of music roll should pass the tracker bar in one minute; likewise the number of feet at any other setting is obtained by dividing the tempo setting by ten. If the time is more than it should be, the roll is running too slowly; if less, it is running too fast. Adjustment is made at the rod which slides into the tempo box. Move the tempo lever back and forth and watch its linkage in the lower part of the piano. There will be leather-nut adjusters on the threaded end of

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the sliding rod which enters the tempo box. To speed up the roll, the sliding rod is *usually* adjusted such that it will pull farther out of the box; however, this varies on some pianos. One trial will enable the repairman to determine which way the adjustment is made.

After a final check of the "accessories" to determine whether the automatic pedal mechanism and the expression pneumatics are operating, the repairman is ready to sample the fruits of his labor. The piano should now play well—and the repairman can discover the glow of satisfaction and pride which comes from a job well done!