DRILLS AND DRILL BITS

From time to time electric drills show up in our shop, but the ones I've donated to F.A.H.P. number about six. There is one battery-operated drill with two batteries, handy to use but without enough power to do many jobs. There are 3 small 110 v. drills, one with right-angle drive (good for tight places), one "Master Mechanic" variable speed, and one Craftsman high speed. None of these drills will take a bit larger than 3/8". There is one large Milwaukee drill for the heavy jobs and large bits. We have an old Craftsman Drill Press, and Jim Personti got us an old but high-quality drill press of greater capacity.

We don't have any metric drill bits. Ours are in fractions of an inch or are numbered drills, and we use both. It is important to keep these bits in order and to put them back where they belong when your job is finished. Two small metal boxes, one gray and one red, contain new sets of fractional-size drill bits. I bought the gray one and someone else must have donated the red one. Many of the bits are missing from the red one. The sizes in these boxes run from ¼" to ½", and the sizes are well-marked within the boxes. It helps to be able to read a micrometer and to know decimals, but it's not absolutely necessary. Equating fractions to decimals is a big help, even if we still use the old English system of inches and feet.

Our smallest drill bits are the sizes used by dentists, running from #61 to #80. The only normal use is for small burner nozzles. Many drill chucks will not close down tight enough to secure these tiny bits. The sizes used a lot run from #1 to #60, with bit diameters ranging from .228" to .040". We keep these, several of each size, in "jobbers envelopes" in one of the drawers above the main bench. When you have used one, unless you break it or dull it beyond further use without sharpening, put it back in the correct envelope. If it is dull, put it in a box with other dull drills. Someone (maybe Chuck Erikson) will sharpen those worth sharpening with our Drill Doctor machine. If you are unsure of its size, there are two metal gauges hanging above the bench with marked holes. Match your bit with the proper hole, and you'll quickly find the size. Please note that #1 drill (.228") is just under ¼". These metal gauges also tell you what size drill bit is needed for machine screws of various sizes (screws and bolts will be covered in another place). For example, an 8-32 screw requires a #18 drill bit as a "body drill", making a hole large enough for the screw to fit through. According to the gauge, a #28 drill bit is the right size hole for an 8-32 tap (my experience has indicated that a couple sizes larger works better (#26). For a #8 wood screw or sheet metal screw, a #18 bit still makes the right hole for the screw to fit through, but a bit smaller than #28 will be desirable for making a hole in wood or for self-tapping. Information on larger and smaller screws than #8 will also be found on the metal gauge (a flat piece of steel).

There are some old sets, not necessarily complete, with bits measured in fractions of an inch. Seldom do I use these. For bits of ½" in diameter and larger, there is a special drawer with bit sizes running up to 1". In this drawer are also some extra-long bits of sizes 5/32, 3/16, 7/32, and ¼", each in its own envelope, but one disappeared. For holes exceeding 1" in diameter, a hole saw is recommended, and we have a drawer with sizes from ¾" to 2" or larger. Most of these will fit in one of the small electric drills, but sometimes the big Milwaukee works better

SCREWS AND BOLTS

There are basically two kinds of screws and bolts, (1) those that self-tap such as wood screws, sheet metal screws, and lag screws or bolts, and (2) those that have a straight thread requiring a tapped hole or the addition of a nut to secure the work.

In Category 1 above, except for sheet metal screws, these are used when screwing into wood or something of equal softness. Sheet metal screws, made of very strong steel bordering on stainless steel, are sometimes used in place of wood screws when extra strength is desirable. They are intended, however, for self-tapping into a piece of sheet metal. In nearly all cases, a pilot hole of smaller size than the screw to be used is drilled in the wood or sheet metal.

Lag screws and bolts are the largest. In our inventory, these start at ¼" in diameter and go up to about ½". Lag screws have a square head or hex head, never a head for a flat screwdriver, a Phillips head, or an Allen head, and therefore must be tightened with a wrench, ideally a socket wrench of the proper size to fit the head. Lag screws and bolts will be of various lengths, some up to 8" to 10" long. All other wood screws and sheet metal screws can be screwed in or out with some sort of screw driver. A flat head screw is one where the top of the screw is flat and the bottom of the head is tapered down to the body size of the screw. A round head screw has a rounded head for the screwdriver, and is flat on the back of the head. Binding head screws, most common on sheet metal screws, have a head that is a compromise between the other two. There are also less common heads like fillister head (not in the dictionary) screws, often used with a matching washer on more polished work such as the top of the hard wood strips on Stanley doors. Wood screws have an unthreaded distance between the head and the threaded portion of the screw; sheet metal screws are threaded all the way up to the head.

Lags, wood screws and sheet metal screws are described by the type of head, the diameter of the body, and the length. The number of threads per inch, although it does vary, is never mentioned (dry wall screws have a very coarse thread). Although wood screws can be had with fractional dimensions, such as 3/16", 1/8", etc., more common are numbered sizes, the higher the number being the larger screw. A small wood screw, therefore, might be #6 by ¾" F-H. A larger and longer screw might be #10 by 1-1/2" R.H. This describes the size of the body or shank, the length, and whether it is flat head or round head. It so happens that #10 is about the same as 3/16", and #14 is ¼". A very tiny screw might be #4 by 3/8", and screws larger than ¼" are found in flat and round head in addition to lag screws. These screws may be brass, steel or stainless steel. Except for some very small special screws, all our screws mentioned in this category are in bins in the wooden cabinet in the main garage.

In Category 2, machine screws, also called stove bolts, run from very small to very large. Our supply starts with a #2 screw, but we seldom use screws smaller than #6. Getting larger, after we pass #12, we get into fractional sizes like ¼", 5/16", 3/8", etc. These screws, too, may be brass, steel, or stainless. With machine screws and corresponding nuts, the number of threads per inch is also important. Standard threads came into practice nearly 100 years ago, and most screws are either "standard" or coarse thread, or S.A.E. (Society of American Engineers) or fine thread. These threads for most-sized machine screws are available in hardware stores or fastener supply houses. Examples: ¼-20 is a standard screw or bolt size, and ¼-28 is the S.A.E. fine thread. ½-13 is a larger coarse thread, and ½-20 is the fine S.A.E. thread. A chart on one of the cupboard doors in the main garage gives these much-used threads for all sizes of screws and bolts. This chart also shows the drill size required for a "body drill" (where the bolt fits through the hole) and a "tap drill", the size drill to use when you are making a hole to be tapped. In practice, I have found that I have to go one or two sizes larger than recommended for a tap drill (as mentioned under "Drill Bits"), or the hole is too small, and the tap turns so hard it won't start or breaks off. There are special threads, however, that are found in some of our work. Stanleys were great for 20 threads to the inch, regardless of bolt size. Example: most engine valve rods are 5/16-20, whereas 5/16-18 is standard and 5/16-24 is S.A.E. In our shop, these screws and nuts are stored in 3 places: the small screws and nuts are on the rack to the far left of the main bench in the shop. Mid-sized nuts like ¼-20 are in metal drawers across the shop near brass flare fittings, and larger bolts and nuts are in the wooden bins in the garage near the wood screws.

Like wood screws and sheet metal screws, machine screws and bolts have various shank sizes, lengths, and heads. In the larger sizes, hex heads or square heads prevail. Carriage bolts have a round head with no slot and a small square back of the head so they can be driven into wood and will not turn. Modified carriage bolts are used as wheel bolts on wood spoke or artillery wheels on most of our Stanleys (7/16-14 for 20-H.P. and 30-H.P. cars, and 3/8-16 for 10-H.P. cars) . In these larger bolt sizes, standard or coarse threads are more prevalent. In very few cases will the thread run all the way to the head of the bolt. The nuts used must match the bolt, and are mostly available as hex nuts, with some square nuts in our inventory. We also have flat washers and lock washers for most sizes.

If you have used the last of a particular fastener, or if the supply is running very low, please let Chuck Erikson know so he can re-order.

PIPING AND FITTINGS

For piping around Auburn Heights, for which we will have little occasion to repair in the future, I have kept some pipe and fittings from 1/8" to 1", and sometimes even larger. This has been mostly black and galvanized pipe, with some brass in the smaller sizes. We have pipe taps and dies on hand for these sizes, and a pipe vise in the basement of the shop. Like screws and bolts, taps and dies are standard for the various pipe sizes, and the number of threads per inch is also standard (only one "threads-per-inch" size) for each size of pipe. Pipe threads are tapered, not straight like bolt threads. This is how the joints are kept leak-proof when the threads are screwed together very tight. Although pipe is supposed to be measured by its inside diameter, this will vary depending on the wall thickness of the pipe, and the outside diameter will be considerably larger than the size in question. It does no good to measure the O.D. of a piece of pipe with micrometers. Example: ½" pipe measures approx. 7/8" O.D.

On Stanley cars, we use a lot of 1/8" and ¼" piping, and brass flare fittings almost exclusively when this small pipe is connected to flexible copper tubing. This tubing, unlike pipe, is measured on the O.D.; i.e., ¼" tubing will measure ¼" O.D. Except for some 3/8" tubing on inlet water lines and possibly to an after-market steam whistle, almost all tubing on a Stanley is ¼" or 5/16", with fittings that correspond to these sizes. Brass flare fittings in these sizes and several configurations are kept in stock, as well as flare nuts to match. Pipe fittings most used are nipples of various lengths, couplings (formerly called sockets), unions, elbows (L's), T's, street L's (old name: service L's), bushings, bell fittings, plugs and caps, with several of the above having female threads. In the case of bushings and bell fittings, these are stored under the larger size (a ½" to 3/8" bushing would be in the ½" drawer). Much of the original brass or copper tubing on a Stanley was 9/32" in diameter, a size no longer available. The original flare nuts to match this tubing were "short nuts" with a 37-1/2-degree flare. On most of our cars, these have been replaced with modern long nuts with a 45-degree flare, available at many hardware stores and plumbing supply houses (these are available at specialty houses with a 37-1/2-degree flare). However, on a few cars some of the original tubing has never been disturbed and the old system is in place, and many owners, wanting to make their cars as original as possible, have continued to use the short nuts with a 37-1/2-degree flare. Not being able to obtain 9/32" tubing, however, has led them to drill the hole in the nut slightly larger to accommodate 5/16" tubing. For many years, Art Hart supplied new brass short nuts to the hobby, and he and others have supplied new brass flare fittings to correspond. 5/16" tubing is needed on water lines and suction fuel lines, but on many other applications, ¼" is adequate.

Our pipe and fittings have special places in the shop and bins in the snack bar building. Small flare fittings are in labeled rows in a small metal cabinet with translucent drawers. Short nipples in 1/8" and ¼" sizes are also in this cabinet. The wooden drawers above and to the left of the main bench in the shop have other fittings from 1/8" to 1-1/2". There are also bins in the basement that have fittings from ¾" to 2". Special heavy-duty steel fittings, desirable for high-pressure steam, mostly in ¼", 3/8", and ½" sizes, are in bins in the snack bar building.

MOST-USED TOOLS IN THE SHOP

The big drawers under the main work bench, and the cabinets underneath, contain the tools we use most often. Please learn where these are kept, so they can be quickly found, and RETURN THEM to the proper place when the job is finished. PLEASE MAKE SURE THE TOOL IS CLEAN BEFORE PUTTING IT BACK. In the drawers, Mark Hopkins made dividers several years ago, which have been helpful. From left to right, starting at the end toward the bench grinder, the contents of the big drawers are as follows: 1) Electrical, 2) Punches, cold chisels, drifts, pry bars, 3) Hack saws, tin snips, 4) Small cutters, pliers, needle-nose pliers, vise grips, 5) Hand files, medium-to-large screw drivers, 6) Ball peen hammers, trowels, putty knives, 7) Adjustable wrenches, small-to-medium pipe wrenches, small monkey wrenches, 8) Open-end and box wrenches up to 1" in size, smaller wrenches in front of drawer, 9) Wood tools including claw hammers, wood chisels, squares, planes, 10) Pipe taps and dies, 11) Gauges and electrical meters, 12) Gauges and electrical meters.

The cupboards under the bench from left to right contain 1) Angle and bar stock, Stanley pumps, fuel filters, 2) Insulation, new wrench sets, 3) Sockets, wrench handles, screw and bolt taps and dies (sockets are of 6-point, 8-point and 12-point style- please keep 8-point separate, as these are used for square bolt heads), 4) Electric drills, whistles, gauge glasses, milling machine supplies, 5) Large drills and grinders, 6) Large drills and grinders.

Oils, glues, pipe dope, epoxies and the like are on the bench, left side, and in the open bins above. These bins contain many other things as well. The tall closets in the shop and the garage have a myriad of things, impossible to list here. Paint is stored in three places: on the new shelving in the garage with automotive paints on the lowest shelf, on top of the closet next to the wire brush wheel, and on a shelf in the shop to the right of the wash basin. Polishes and fuel and water additives are on shelves above the bench in the garage (to the left of the shop door).

Many specialty items for Stanley cars, Auburn Valley R.R., etc. are in bins in the snack bar building in the room ahead of the public rest rooms.

Chuck Erikson is our "shop manager" and he will gladly try to find things for you. After you have used tools or supplies, please return them to the place where you found them. Following work sessions, I always find some tools or supplies left where they were last used. All of us are guilty of not putting things back, but where 25 or so volunteers are now working in our shop, often at times other than work nights, this control of the things we have becomes especially important.

GROUPINGS OF TOOLS AND SUPPLIES

When Stanleys go off-site, it is essential to have certain tools, along with a fire extinguisher, in the tool box or other suitable place in the car. On week-long steam car tours, this list must be expanded, although some of the necessities can be carried in one of our trailers. In addition to "standard" tools, such things as a wheel puller, a propane torch, a nozzle pricker, a packing gland wrench, a small hydraulic jack, an air pump, flaring tools, diaphragms for automatics, copper tubing and fittings, and basic tire tools are necessary for touring. Pilot fuel and a small quantity of cylinder oil must be carried from Auburn Heights when our cars are far from their home base.

For those working on maintenance of way on the Auburn Valley R.R., it is desirable to have "track boxes" equipped with the supplies the gandy dancer needs to replace splice bars, cross ties, roofing nails, and brass screws and nuts, along with the tools needed to level, adjust, tamp, replace, or whatever is required to improve the section of track under repair. Since several people may need to use one of these track boxes in a given time frame, it is essential that after use they are restored to what they should contain, with removed fasteners thrown away (in the case of splice bars, they can usually be cleaned up, repainted and used again). Keeping this system effective greatly reduces lost motion and time on the part of volunteer track workers.

Tom 3/29/09