of which the chicks may get up on the raised platform. The following bill gives a list of all materials needed and their present retail prices:

For the Incubator.

8 230-volt 16-candle-power carbon lamps	\$1.60
8 porcelain receptacles	.48
1 thermostat	.75
1 thermometer	.10
2 single-pole snap switches	.30
1 piece 12 x 18 window glass	.20
Lumber, etc.	.15

Total \$3.58

For the Brooder.

6 230-volt 16-candle-power carbon lamps	\$1.20
6 porcelain receptacles	.36
1 sheet 14 x 20 tin	.15
Lumber, etc.	.05

Total \$1.76

The foregoing bill does not include the shaded lamp and fixtures shown on the outside of the incubator in Figs. 1 and 2. An ordinary 4-candle-power lamp so mounted is a convenience, but not in any way essential.

CONVENIENT DOOR HOLDER.

BY D. PENNINGTON.

A convenient door holder may be made from a barrel hoop, as shown in the accompanying illustrations, by cutting a piece about eight inches long and inserting a rubber-head tack (such as used in the plumbing trade) at each end, on the under side, as shown in Fig. 3. Two such tacks are also placed on upper face, spaced apart sufficiently to allow the bottom of the door to fit between them. The arched shape of the hoop will give sufficient friction between the door and floor to hold the door in any desired position.

If rubber-head tacks are not available, the ends may be covered with some soft material such as carpet and tacked thereto. In place of tacks, a notch may be cut in the barrel hoop equal to the thickness of the door, as shown in Fig. 4 of the illustration. The

HOME-MADE DOOR-SECURING DEVICE.

center of a barrel stave may be used instead of a hoop by cutting it to about the same width as the hoop.

BORING HOLES IN GLASS.

BY GEORGE J. MURDOCK.

Glass is universally conceded to be exceedingly difficult to work when cold, yet its fragile nature often calls for means of repair. It is also desirable sometimes to drill large holes in glass plate, or through a glass column, which is not an easy thing to do with any facilities hitherto developed for such work.

It is well known that turpentine applied to a small drill will enable one to drill through a piece of glass by persistent application and frequent grindings of the drill. This hole will often taper from a larger diameter at the top to a smaller one at the bottom, and besides it is quite impossible to drill two holes of the same size with the same drill. Instrument work of certain classes would be made better also if it were possible to tap threads in the glass of which the base or other parts are composed. In the opinion of the writer the best fluid to be applied to the glass so that the tool will take hold is that of the formula given below. It has been developed after many experiments with different mixtures, and will be found to be superior to anything heretofore known. With a bastard file wet with it, a piece of plate glass may be put into a vise and filed like wood; any other cut of file may be used, but where there is much glass to remove, the coarser the file the better.

For drilling small holes, a brass tube of the diameter of the hole wanted is better than a drill. The tube should be made smooth on the end that is to come in contact with the glass, and charged with carborundum powder, or what is better, diamond dust. In starting the hole a piece of wood having a hole drilled in it of the size of the brass tube should be cemented to the glass, the hole being located over the spot where the desired hole is to be made. A hole should be

made in the side of the tube by filing into it with a round file, and it may be turned either by a drill press or by one of the small, geared, hand drill-stocks used for small drills. With a small brush dipped into the solution as herein given wipe the hole so that a little of the mixture will run down inside the tube, and onto the glass where the hole is being made, and the tube will be found to enter the glass with surprising ease.

If it is desired to have the edge of the hole sharp where the tube comes through, cement a small piece of

Fig. 1.

Fig. 1.—APPARATUS FOR BORING LARGE HOLES IN GLASS. Fig. 2.—METHOD OF REPAIRING CRACKED PLATE GLASS.

glass to the under side of the plate being bored, and when the tube is through, continue the boring until it has entered the lower plate slightly. Glass cut with the diamond will often break unevenly, and fail to fit a window sash; circles cut out for the dials of instruments of the clock class, circles for static electric machines, glass covers for galvanometers, ammeters, and many other instruments are often thrown away, when a touch with a file wet with this solution would save them. It is especially recommended to glaziers to remove the sharp edges of the glass cut with the diamond, which often cut the hands. For boring large holes in plate glass the jig shown in the sectional view, Fig. 1, is very handy, in fact almost essential if correct results are required. It can be easily modified to hold the cutter for boring circular work, such as glass columns or concave surfaces, where circumstances require such variation. The frame is an iron casting having feet J, and is bored out to receive a steel bushing C, which may be hardened after a central hole is made to receive the shank B of the cutter bar. The top of the cutter bar or shaft is squared at A so that a bit stock may hold it, or it may be held by the chuck of a drill press. The bottom has a flange and a pilot L, which fits in the hole of a small emery wheel G of the kind used by toolmakers on universal grinding machines for lapping out small holes.

The lead bushing in the wheel should be cut out on the side that is to do the boring, and the pilot L must not go entirely through the wheel, but be cut at least $\frac{1}{8}$ of an inch short of the wheel thickness. The wheel may now be cemented to the cutter shaft by heating it, and also the wheel slightly, so as to melt some gum shellac which has been sprinkled on the top side of the wheel. After it is cold mix up a stiff paste of liquid glue and emery of about the same grade as the wheel, and fill the bottom of the hole P even with the wheel. In drying it will shrink slightly, and the paste may be applied again, and until the surface is flush with the side of the wheel.

The feet J of the frame have thin rubber F (known in the stores as "rubber dam") cemented to their under sides with bicycle tire cement, so that when placed on the glass the jig will not slip around, but can be easily held in any desired location.

The place where the hole is to be made having been ascertained, a ring of putty D is stuck to the glass to form a cup; and after the wheel shaft is inserted in the bushing, the apparatus is placed with the face of the wheel over the spot to be bored, with the feet J resting on the glass. Before beginning operations a piece of double-thick window glass H is cemented with French copal varnish to the under side of the plate to be bored.

The formula for the fluid to be applied to the tools is as follows:

Pulverized camphor oz. ii.
Sulphuric ether dr. vi.
Enough oil turpentine to make a six-ounce bottle full.
Apply the bit stock to the shank A of the shaft, then pour enough of the fluid into the putty cup to cover the lower side of the wheel G.

When the wheel is turned it will immediately enter the glass, boring a very smooth and true hole. If a drill press is used, the speed should be slow to avoid throwing the fluid out of the cup or heating the wheel, the last being especially avoided, as all of the constituents of the fluid are very volatile, and it will evaporate quickly if much heat is present.

When the hole is nearly through moderate the pressure, but keep on drilling until the wheel has entered the plate H slightly. A slight tap with a hammer will now knock the window glass off, and the wheel and shaft may be removed through the hole. Do not attempt to remove it through the top unless the hole is very clean, or you will pull the wheel off the arbor.

Fig. 2 shows how a cracked plate-glass window may be repaired. At the ends of each crack and where they intersect, a hole is bored to receive a bolt. The nut Z of the bolt is made thin, and a rubber washer, made of engine packing, is held against the glass by a washer and screw. The dimensions given are those used some time ago in repairing a store window. The heads of the screws were located inside the store, so as to make it impossible to remove them from the outside. The window is still doing service.

A WAGON JACK.

BY L. G. BAYLEY.

For oiling wagon wheels, or taking them off, some kind of lifting arrangement is resorted to. For simplicity of construction and effectiveness the jack here-with described is unique. The whole, including the pegs or pins A, is made of oak, the best tough white oak being recommended.

The beam is made from 3- by 4-inch timber, planed down to the dimensions given. An eye or slot is cut out at the wide end, $1\frac{1}{16}$ inches wide by $4\frac{1}{2}$ inches deep. This end is rounded off to a radius of 2 inches. Five pegs, 1 inch diameter by 2 inches in length, are driven into the upper side. The holes are 1 inch deep and should allow the pegs to have a driving fit.

The upright is 27 inches high to the center of the

A WAGON JACK.

fulcrum, made from 3- by 3-inch stuff. The end is rounded off to a radius of $1\frac{1}{2}$ inches, and a slotted hole is cut in, as indicated in the detail view.

The lever is cut from 1-inch board, 6 inches wide by about 33 or 34 inches in length. It should be laid out accurately to the dimensions given in the larger scale view. When correctly made, and the slot in the upright cut likewise, the two holes for the pegs A will be in a vertical line, when the lever is pressed down, as shown in the upper general view. The pegs A should have a loose fit, and be furnished with small wooden pegs or nails, to keep them in place, when the parts are assembled.

To operate the jack, the lever is raised, as shown in dotted lines in the lower general sketch, and the beam slipped in place under the axle of the wagon, which should rest between one of the small pegs in the upper face. Bearing on the lever, it is pressed down into its lowest position, as shown in the upper sketch, raising the wagon wheel from the ground and securing it in that position indefinitely, without the least chance of its slipping back.

Swelling ground cannot be held by timber; means must be provided for relieving the pressure of the ground from time to time. It will cause little trouble if spaces are left between the lagging, through which the pressure may be eased at intervals by removing some of the material. Expedients such as packing with straw are valuable only until the swelling becomes sufficient to pack tightly the cushioning substance. When this becomes packed solidly it transmits the pressure to the timbers.