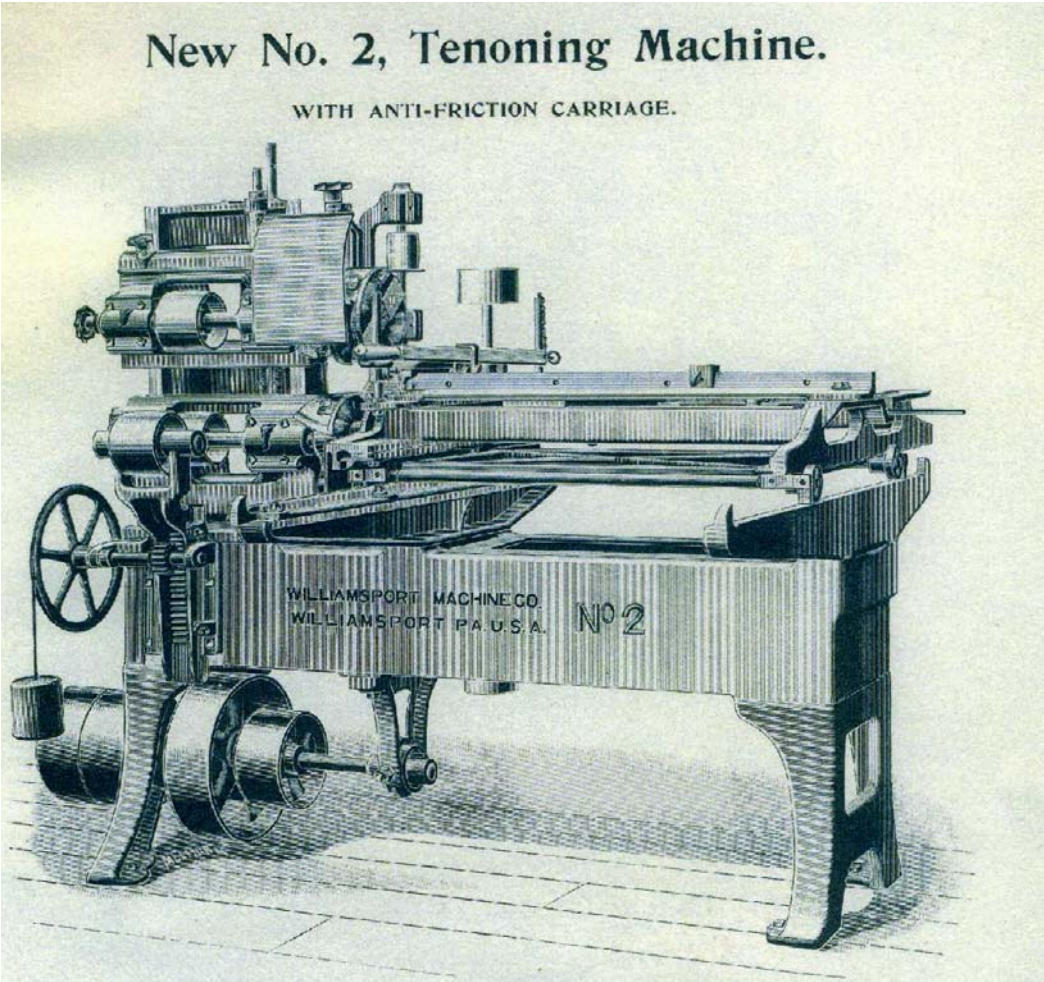
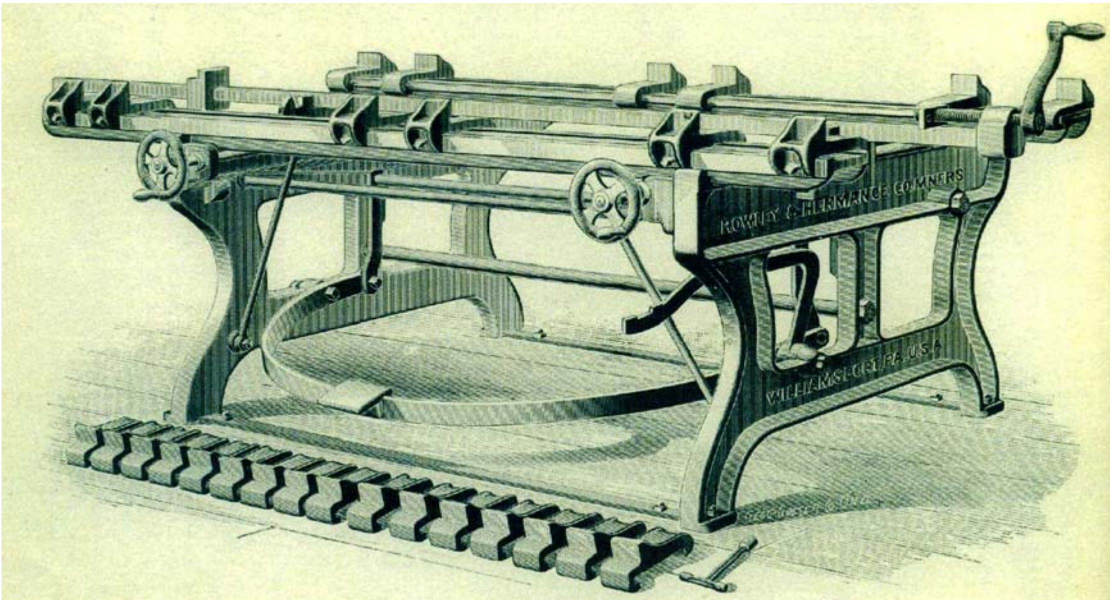


Tenoning Machine

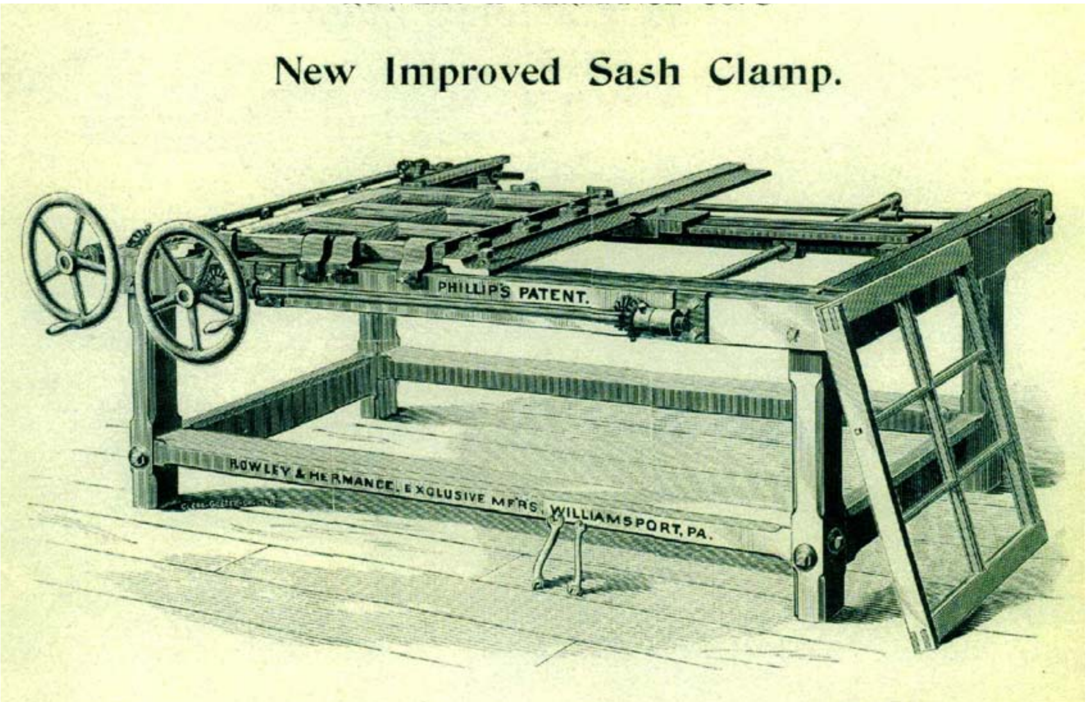
The enormously elaborate tenoning machine had a frame cast from one piece. The carriage of the new design was constructed with bicycle ball-bearings for its smoother operation. The machine would cut tenons of any required thickness and from ¼ inch to 5 ½ inches long, on one passing through the machine. The headstocks, both upper and lower, had an independent vertical adjustment. The top headstock could be adjusted horizontally to permit the shoulder to be cut at unequal distances from the end. The cope heads were attached in this machine so that the clearance by the heads could be increased without reheating the forges. The cutter heads were either single or double.



LADOW'S PATENT.

Door Clamp

The door clamp was advertised as having a circular groove and corner block that had a turned flange on the bottom to fit the groove, thus ensuring the corners swung in a true circle. There were two lugs on the corner block, one at a greater distance from the centre than the other to allow more pressure on stiles than on the rails. It could be set quickly for any size and would clamp the sash square.



Sash Clamp

This image was of a new and improved clamp, which the manufacturer advised it solved the chief difficulty with all machines heretofore: that they could not be depended on to clamp the sash perfectly square and that in changing from one size to another the machine had to be squared up each time – which cost valuable time. The manufacturer was certain that this machine was the first sash clamp ever made that was absolutely square at all times, with odd sizes that could be clamped as quickly as stock sizes.

How all this machinery was actually deployed in the building—that is, on which floor, in which configuration, and also assuming placement in a production line—is the subject of this section of the report.

Given the lack of physical evidence, and the absence of historical records for the Carberry factory, it is again necessary to base this commentary on information about other known operations of about the same size, and to some extent common sense.

We have assumed that most of the wood preparation—cutting, planing, mortising and tenoning, trimming, etc.—would have occurred on the main floor. The long drive shaft suggests this. The elevator lift seen in that key interior photograph suggests that materials were then lifted to the second floor where door and window assembly took place – we note that one of the drive shaft belts pierced the ceiling of the main floor, so there must have been some machinery also on the second floor that required a significant power source.

The jointer/planer would have been a staple in any such woodworking establishment. Primarily it would have been used with its gauge set perpendicular to true the edges of boards to be glued into panels, but it could also be used to chamfer, by changing the angle of the gauge, or to do certain kinds of moulding work by substituting contoured blades for the straight ones used in normal work.

Cutting the boards to length initially, and trimming them to final size after gluing would be the job of a circular saw. For general purpose work, there would something like a combination saw/dado machine, comparing to today’s workshop staple, the table saw. This machine would saw, mitre, and dado.

Interior of a sash and door operation in Quebec, ca. 1890. Notice the line of work stations.

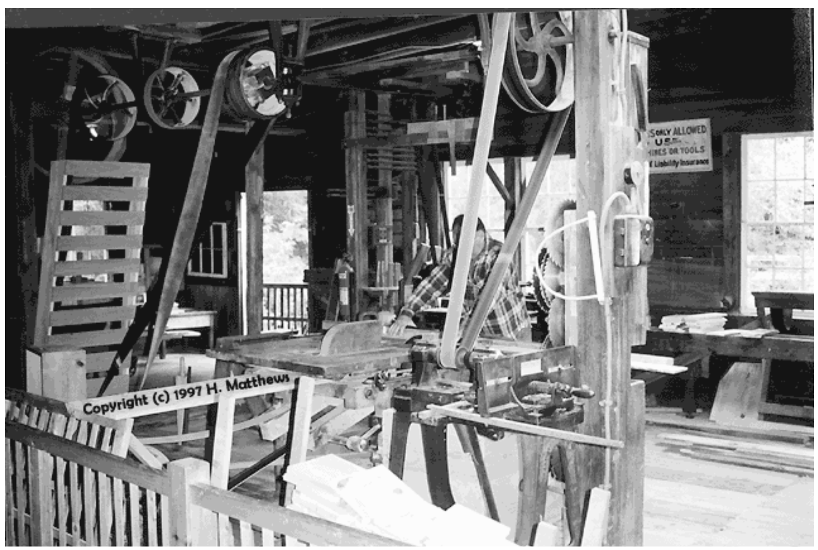
There were also machines available—planer/matchers—that would speed the process by surfacing boards on all four sides in a single pass, and for a manufacturing operations where large numbers of similar pieces were needed, they would be worth the extra money, and the extra space on the shop floor.

Because of wood's grain structure, there are differences between cutting with the grain (ripping) and cutting across the grain fibres (cross-cutting). A cross-cutting saw needed finer teeth, and would be set up so as to cut pieces to length, but those pieces would by then have been at least roughed to size at an earlier stage – in White's case, that would be the job of the planing mill. The pieces that were to become rails and stiles would have been finished down on a matcher, and would then be profiled in a "sticker." At this point, rails and stiles would have the same profile.

For the purposes of batch production, it is most likely that a cross-cut cut-off saw would be set up to cut a supply of stiles and of rails prior to further operations. A stop on the carriage would be set to ensure all the pieces were cut to the same length.

A stack of stiles would then be taken to the mortising machine. As the nineteenth century ended, most mortisers were essentially U-shaped chisels that were driven in a reciprocating motion and nibbled their way along until the mortise was long enough. The chisel's width was the mortise width. Usually a starter hole would be made with a drill or a brace and bit. Some mortisers carried a drill spindle for this starter hole. In an 1898 catalogue we find the mortise machine, with its manufacturer extolling his new scheme (quoted here with original capitalizations): "The novelty of this machine consists in the peculiar formation of the chisel, which is square, and is fitted with an auger made to revolve inside it. The End of the Auger projects slightly beyond the edges of the chisel, and when brought up to the timber it bores a round hole. The Chisel following it, and simultaneously squaring out the four corners and sides, and with no jarring to the machine. A finished mortise of any length, from ½ inch to 1 inch square, and free from chips, is thus made."

In fact, this is how modern mortisers have come to work. Mortises of any length can be cut by cutting a square hole at each end, and then cleaning up the intervening space in stages no longer than the width. Note the highlighted advantages: no jarring—the reciprocating chisel must have been bone-jarring both to itself, the shop floor, and the operato —and a mortise free from chips; the problem of chip ejection must have been horrid, with the razor-sharp chisel pounding up and down, and no compressed air to blow out the hole. Indeed the whole problem of chip ejection and collection would have been a major concern in the woodworking industry. Chips and dust are flammable, a sometimes carcinogenic lung irritant, and interfere with the craftsman's view of his work, and also will bruise the work and throw off the accuracy of a jig if trapped between the work and the machine. On the bright side, in the days of steam they could fuel the engine.



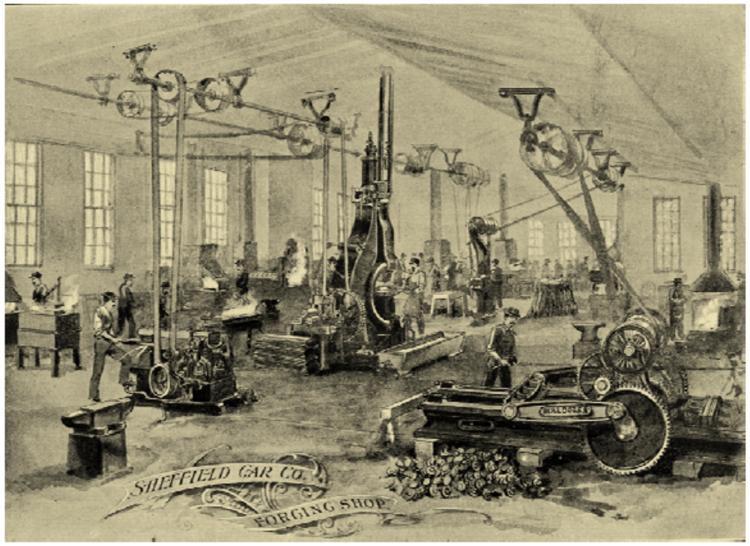
Interior of a small sash and door operation. Notice the drive shaft, sheaves (wheels) and belts that powered the wood-working machines.

Back to making doors. The stiles having been mortised, the rails could be tenoned. Because of the constraints of mortising, the tenons would be fitted to the mortises rather than the other way round. The tenoner would cut away the top and bottom cheeks of the tenon and cope both sides. All that remained would be to shorten the tenon from the full width to the length of the mortise. The glued up panels would need to be "raised," i.e. the edges would be narrowed to fit into the dado, leaving the centre of the panel larger, and with a profile that catches the light attractively.

Now that we have stiles, rails and panels we come to the fun part — assembly. The glue in use at the turn of the twentieth century would have been hide glue, which is made from the skin and connective tissue of animals, particularly horses (sent to the glue factory). This material has a number of properties that make it a good glue, but one that creates some interesting problems for the manufacturer. The glue as shipped is in granules, which are mixed with water until they reach a gelatinous state, and they are then heated to about 140° F and no further. Overheated glue loses its strength. Applied with a stiff brush or a palette knife, the glue is quite tacky. It forms its bond as it cools, and it doesn't take very long to cool (especially in winter in an unheated shop). As a result, the assembly of a set of mortise and tenon joints must take place quickly, with force enough to overcome the tackiness and speed enough to get everything into place before the glue sets up. Don't forget that the panels are loose until captured in the assembly once and for all. The panels must remain loose in the assembly to allow for expansion and contraction. Glue should not touch them. The industry had some very interesting assembly clamps. In the ones illustrated above, the operator (or most likely operators) would set up the rails and squeeze the panels between them using the crank at right, then start the tenons into the mortises of the stiles, dash around with the hot glue pot and coat the tenons' tops and the mortises' bottoms (that's a guess, but it gets glue all around the joint without trying to brush from below) and then quickly go to the big treadle and pull the assembly together. It wouldn't take long before the pressure could be released and the door taken out and trimmed. It is a mercy that the glue bond is reversible with heat, and that the bond can be weakened with water, so if you didn’t succeed the first time there was hope. You didn’t have to throw the material away, but the foreman was sure unhappy.

So how would a shop like this be laid out? White was forward thinking and inventive, as proved by his use of a powered lift to the second floor, so we can be pretty sure he did it neatly. We know from the photographs taken when the factory had become an automobile repair shop that the engine was on the east side of the ground floor, about half way down the shop, and the ground floor line shafting was down the west half of the building. There was a countershaft over the engine, and there was a tall stack that could equally have been steam or internal combustion exhaust. In the initial setup, steam would be the most likely; it was more readily available in 1902 and the boiler could use the wood chips from the milling operations.

Milled lumber would come through from the planing mill on the west side. It seems likely that the assembly would be upstairs over the boiler, but beyond that, it’s all speculation. There has to be room at both ends of any machine handling long planks for infeed and outfeed. A glance at the picture of a machine will give you indication which way it should stand relative to the drive pulleys. Some machines need extra countershafts to keep the belt out of the work area. It has been estimated that the change to self-powered machines from drive-line systems saved about 40% in space requirements, and allowed much more simple workflows, since machines could be sited where they were easiest served, rather than where they could draw power from the drive line. Still, sound layout and a good millwright could make a world of difference in the usability of a factory.



This rendering, of the Sheffield (England) Car Company has been featured to more clearly show the use of drive shafts, assembly lines and connections by belts to the sheaves on the line and thence to the individual pieces of machinery.

James White and staff. While it is likely that this image dates from the time of the facility's operation as a automobile engine repair shop, it is also likely that the men pictured here also worked in the sash and door factory. James White is at the right; from the left: Max Whiteside, Reg Pilcher, Wes White, Viner Cooper, Mr. Freeborn and Mr. Beswatherick.

THE FACTORY'S PRODUCTION

So what of the product of all of this Victorian-era mechanical ingenuity, of James White's ambition, and of the skill and craftsmanship of his employees – the actual windows and doors?

What did they look like? Where did they go? Where are they?

Certainly much of his production ended up in the homes, businesses and churches of Carberry and the surrounding area. But to determine more accurately what was a White window or door, and thus to suggest where else the White production line was used, we need some additional facts and details.

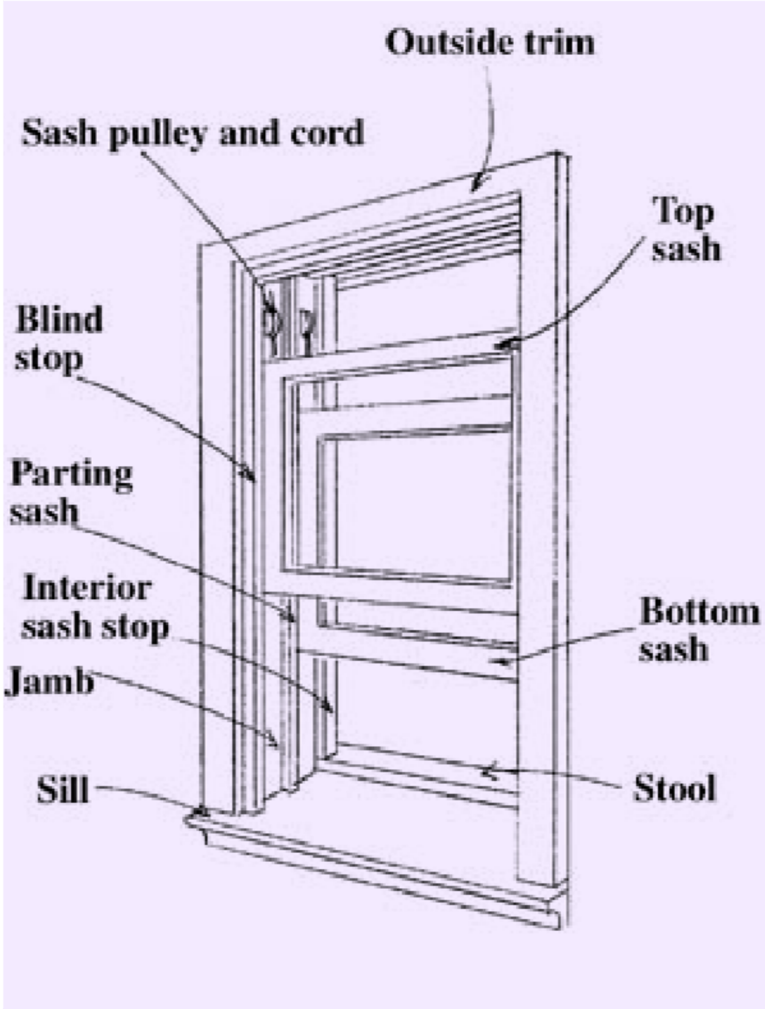
And even before that, it would be useful to understand how windows and doors were put together in the late nineteenth and early twentieth centuries.

Windows first.

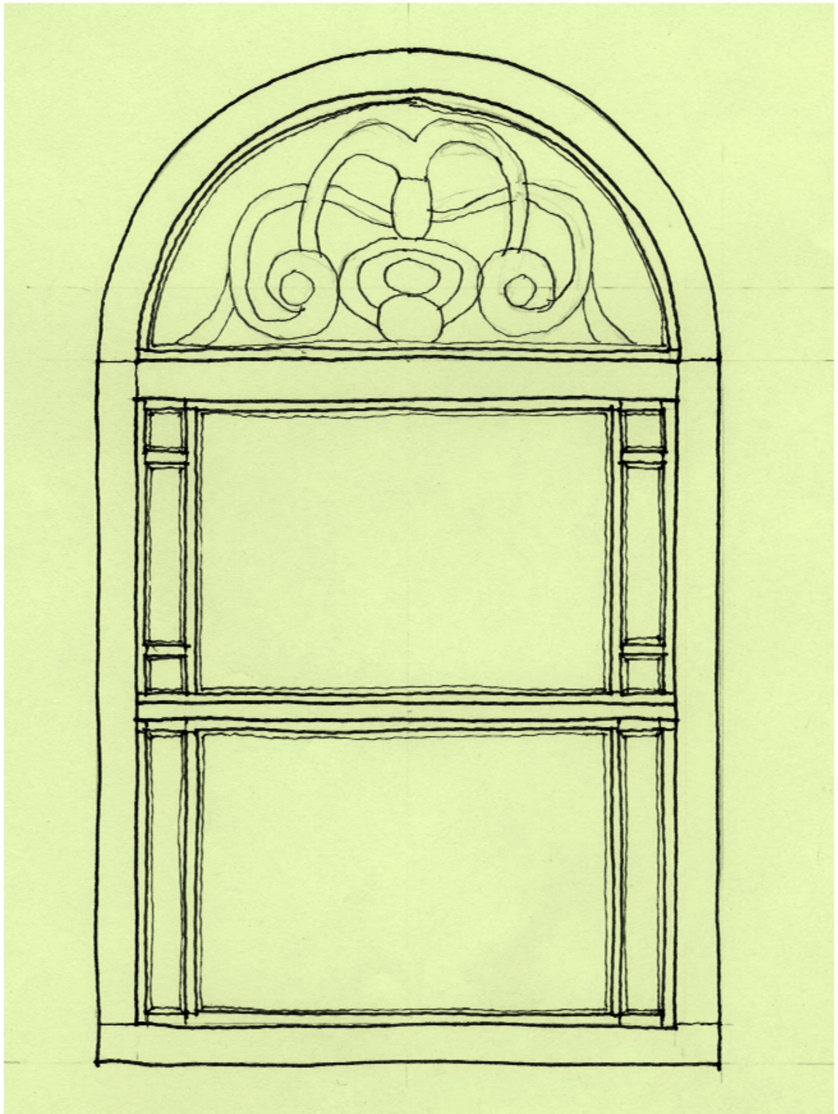
The sash window that came into popularity in North America in the late nineteenth century consisted of an upper and lower sash section that slid vertically in separate grooves in the side jambs. This type of window provided a maximum face opening for ventilation of one-half the total window area. Each sash was provided with springs, counterweights, or compliant weatherstripping to hold it in place in any location.

To facilitate operation, the weight of the glazed panel was usually balanced by a heavy steel, lead, or cast iron sash weight or counter-weight concealed within the window frame. The sash weight was connected to the window by a sash cord or chain that ran over a pulley at the top of the frame, although spring balances were sometimes used.

Construction of the window frame was usually of softwood, like pine, and units were generally single glazed.



This rendering suggests the complexity of window construction and operating technologies. It is presumed that the production of the James White factory would only have provided the simplest of sash windows – mostly without pulleys and weights.



A sketch of one of the windows still present in the White Sash and Door Factory. Some of James White's windows can be identified by the common use of side glazed panels that created a frame around the sash, And then to the doors.

Wood is a material that has some interesting properties that dictate how things will be made from it. For a start, it 'moves'—shrinks and expands with changes in humidity—more in one direction than another. Its length is fairly stable, but its width can be quite variable. Consequently, any large surface to be made of wood is usually made with all its edges having lengthwise grain. In a door, the vertical pieces are called stiles, and the horizontal pieces rails. These are the basis of "frame and panel" construction. The rails and stiles both have a groove or rabbet in which the panel is captured. The panel is made somewhat undersize, so that it can expand without pushing the door members apart, and the door will (hopefully) always fit its jamb. The border around the panel is usually some sort of moulding, and the panel is said to be "raised" when its main central part is thicker than the rabbet in which it rides.

Where the rails and stiles meet and form a corner, the mouldings must meet without exposing the piece underneath. Simple mitres are difficult to make well enough, so the commonest practise is to cope rather than to mitre. This means that one side of the joint is cut away (coped) in a shape to match the moulding it is meeting. Sash and door makers would have coping cutters in the inverse of the shape of each of their moulding cutters.

The joint between stile and rail could take many forms, but the commonest was the mortise and tenon joint. A rectangular hole, or mortise, was cut in the stile, and a matching rectangular tongue was formed on the end of the rail. Tenons could pass all the way through the stile (a through tenon), or stop somewhere in the body of the stile (a blind or stopped tenon). Most sash and door work used through tenons; they are simpler to keep clear during manufacture, and allow an easier glue-up. They are also somewhat stronger.

Once rails, stiles and panels were prepared, the assembly was glued up in a jig that would keep the elements true and supply sufficient clamping pressure to form a good