

steel as rapidly as possible, and they deserve great credit for their patriotic enterprise.

After the steel was secured, it next had to be converted into forgings. This work was handled in a small way at the Arsenal, but many difficulties were experienced by the firms who undertook to execute it on a manufacturing basis. Again the Nova Scotia Steel Company was one of the pioneers and the Canada Forge Company also took the work up energetically and rendered good service in obtaining successful production. An interesting example of the universal desire to assist in the work was afforded when the Nova Scotia Steel Company, who commenced forging on one of their large hydraulic presses, Fig. 3. required additional capacity. The Canadian Pacific designed, made the patterns and castings, and constructed and shipped complete four 250-ton presses with 45-inch stroke Fig. 5. and one 300-ton press with 36-inch stroke Fig. 4. the first one in twenty days from the time the order was originally discussed and the last one ten days later.

The machining of the first order for 18-pounder shells was distributed amongst ten firms and that for 15-pounder amongst five firms who, in addition to actually performing the machining and heat treatment, were required to assemble the various components into a complete shell that would satisfy the War Office Inspection. The actual machining was not particularly difficult as the limits of accuracy are not close. There are, however, a number of different dimensions to be gauged, each with a definite tolerance, while in certain cases the maximum tolerance could not be used on all of several different dimensions. It was interesting to witness the difficulties experienced by men, who regarded the accuracy specified as comparatively easy, when they were required to produce a piece to pass a number of different gauges in the hands of an inspection staff that cared nothing about a thing being "almost right." There were also a number of practical points that required experience but in all such things the Quebec Arsenal was an invaluable guide. The usual procedure was to visit the Arsenal, ascertain exactly how to do the work, come back, get into difficulties and go back to the Arsenal to find out what the trouble was. On the whole, given a proper forging, the machining troubles on shrapnel were comparatively slight. One firm did nose in a perfectly good lot of shells before inserting the disc, which cannot be entered after nosing, and several melted the bullets by overheating the resin, but the only real trouble occurred in the heat treatment.

At the time this work was commenced, heat treatment was only a theory in the majority of plants. In a few automobile and tool making shops, heat treating equipment was in use but even in those shops it was exceptional to require results of the exactitude demanded for a shell. It was specified that the heat number should be marked on each forging and stamped on the shell machined from it. The shells from each heat were grouped together and a test shell selected by the Inspector from each heat. Test pieces from this shell must give a tensile strength not less than 56 tons per square inch, an elastic limit not less than 36 tons per square inch