

heavier tissue paper than is commonly used for correspondence, and have 500 leaves each, numbered consecutively throughout the series, so that the number of a sketch sheet is never duplicated. In this system there are six books for copying sketch sheets, representing as many classes of work, and these divisions will readily suggest themselves as required for any particular case.

The use of these sketch sheets is especially for work which does not require to be often duplicated, and for giving quick dispatch to emergency work. A free-hand sketch can be made, copied, and issued in this way in ten minutes, while the regular process of drawing, tracing, blue printing, and waiting for the latter to dry, or the sun to shine, may consume hours. They have the additional advantage of being more convenient to handle and file away in the shop than blue prints, and they save multiplication of tracings and consequent drawer space. The copies being in book form cannot be lost and are easily indexed and consulted. Sketch sheets are convenient for rapid detailing of forging and small parts, and such parts need, therefore, to be merely indicated on the general or erecting plan, and reference numbers given of the sketch sheets. The sketch sheets will also all appear as items in the order list.

In addition to the stiff card sketch sheet, it is convenient to have a "Drawing Office Memorandum" blank. This is a copying-ink heading printed on a sheet of letter paper, and is used for order lists and all sketch matter sent abroad from the drawing office.

After copying, the sketch sheet, if for permanent use, is sized with a mucilage, composed of gum tragacanth and water, and then varnished with white shellac and alcohol. The sizing is to keep the lines of the sketch from running while varnishing.

Two necessary articles of office furniture are the drawing table and the blue-print frame. So many excellent forms of these have been devised that it seems hardly necessary to refer to them in this connection, but sometime hereafter occasion will be taken to describe types which have the merit of cheapness and effectiveness.

It is our practice not to finish original drawings, but to trace from them on tracing cloth. These tracings are used only to print from and are filed away in a fire-proof vault. Two prints are made of each tracing as soon as finished, one for the shop (or more if necessary) and one to file away in the drawers of the office. These drawers are 24 inches x 38 inches x 2 inches, and are each calculated to hold a maximum of 100 prints. In this way the tracings are preserved from risk of fire and loss and from the wear of frequent handling.

As a rule each draughtsman makes his own tracings, and only skilled draughtsmen are employed. The writer does not advocate the employment of cheap draughtsmen to trace shop drawings from the originals of the designer. If this is done the designer must finish his original to entire completeness before turning it over to the tracer, thus consuming additional time and running more risk of errors and omissions than if he traced it himself. A skillful draughtsman will merely block out his entire work on the original and give his whole thought to the perfection of his design. In the tracing he can re-arrange his drawing if necessary, and the time occupied in tracing is usually much less than that employed in working out and perfecting the design, and a draughtsman, worth \$120 per month, will usually trace twice as fast as one worth \$60, and do it better.

The titles on drawings are mainly done by rubber stamps giving the name of the company, the number of the drawing, and having spaces for the insertion of name, date and scale.

Some experimenting was done to find a suitable ink for tracing cloth. Printers' ink was tried, but it rubs off and does not dry satisfactorily. A special lithographic ink is used, which is similar to printers' ink, but with the addition of a dryer. It is applied to the stamp by a composition roller in similar manner to printers' ink and gives a black impression which blue prints well. The number stamp has movable type.

As a rule it pays to employ only high-class labor in the drawing office. A draughtsman puts his own impress on his work, his individuality goes into it, even if closely supervised, and it is upon the perfection of detail that the success or failure of a new design mainly depends; it is important that the draughtsman entrusted with it shall have the necessary skill and ability.

We have appliances for testing the efficiency of almost every known mechanism, but who can measure the efficiency of a draughtsman. We can appreciate the economic value of good steam distribution and the like, but too often is the efficiency of the draughtsman neglected, and thousands of dollars spent in the construction of work which would have yielded much better results if a little more brains had been used in its design.

In conclusion, the writer would say: Do not have so much system that it is difficult to work to or burdensome to carry out. A few simple rules, faithfully adhered to, are better than the most elaborate system which is loosely or imperfectly carried out. The object of a system is to define the duties of each man and to fix the responsibility of dereliction of duty.

#### MONTREAL WATERWORKS IMPROVEMENTS.

The large new pumping engine and battery of boilers for the Montreal waterworks, referred to in recent numbers, have been installed, and the pumps were tested within the last few days by Prof. J. T. Nicolson, of McGill College, and J. E. Vanier, hydraulic engineer, of Montreal. The figures of the official test were not officially passed up to the time of going to press, but we are in a position to say that the tests were highly satisfactory. This addition to the equipment of the Montreal waterworks gives a steam-pumping capacity of 28,000,000 gallons and a water-pumping capacity of 9,000,000 gallons per twenty-four hours. With the present main pipes it would not be practicable to pump a total of 37,000,000 gallons, the full capacity of the engines, but the power is there in case of necessity or in case of accident to one of the engines. About the full capacity of the steam-pumping plant can be pumped if necessary under existing conditions, but it would not be safe to send more than 25,000,000 to 28,000,000 gallons per day through the present mains. Under the direction of A. Davis, superintendent of waterworks, a new section pipe has also been put in, so that pumping direct from the aqueduct may be done when the settling pond is closed off, thus providing an additional security against possible accident.

The new engine referred to is a Worthington High Duty Engine, and is illustrated herewith. It is installed at the low level pumping station. The test made by Prof. Nicolson and Mr. Vanier was conducted strictly in accordance with the rules laid down by the American