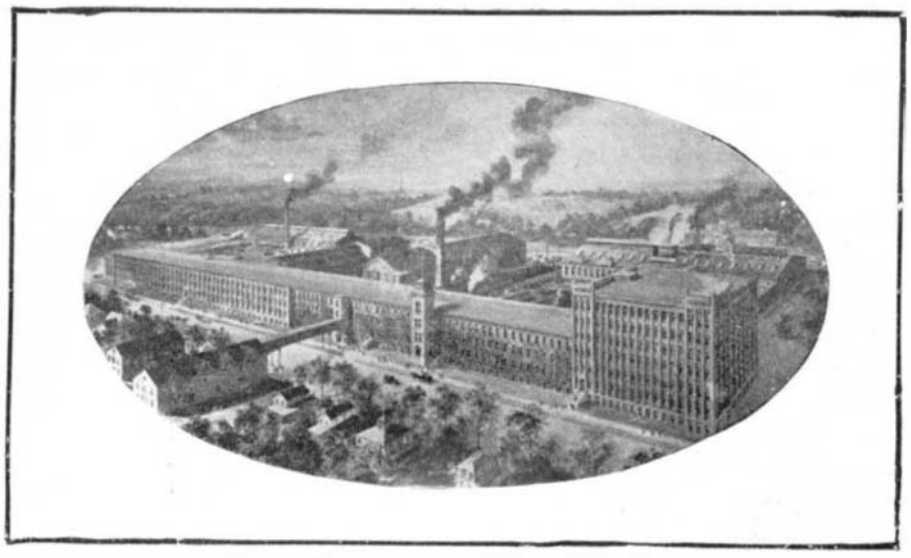


The Plant.—Reduced from a Water-Color Drawing.

The Finished Machines.

A TYPEWRITER A MINUTE.

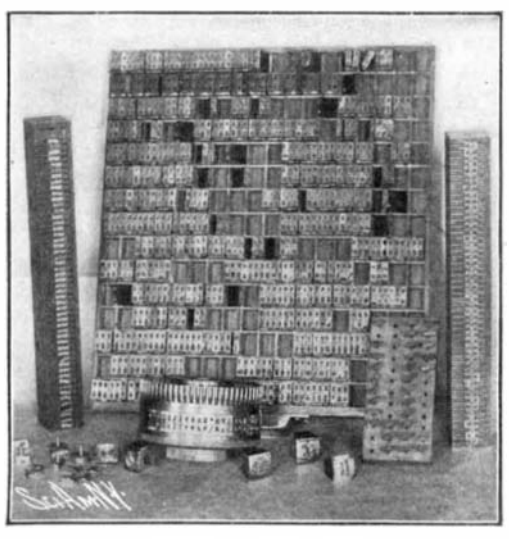
It is a far cry from the monkish calligrapher, working in his cell or the "scriptorium" in silence, to the brisk "click, click" of the modern writing machine, which in a quarter of a century has revolutionized and reformed business. The typewriter seems to have entered all arenas, until now even the sermon is apt to be transcribed on a machine. Its introduction marks an era of progress not inferior to that brought about by the telegraph and telephone.

In its economic aspect it has not only made a new vocation—especially for women—but has also enormously increased the potentiality of production. Such results are the direct product of American invention; without this invention the result would have been barren; and without the enormously clever machinery, mostly automatic—also of native growth—it would have been impossible. A typewriter of the kind we are describing consists of many hundred assembled parts, all of which must pulsate in unison, and when they are produced at the rate of one a minute, it is a twentieth century marvel. With a revolver this is easily understandable, although remarkable; but with parts which originate in foundry, forge shop, machine shops, tin shops, rubber factory, glass works, and the shops devoted to the dozen and one other allied industries, the results are extraordinary, and presuppose a perfect organization and mechanical equipment, coupled with the best skilled labor attainable. A typewriter is a most complex machine intended for performing for a period of years the duty of the amanuensis, and if it is not made with accuracy, the net result is a failure. Parts are gathered together, inspected, assembled, and finished in detail, and finally the completed machines are turned over to the shipping department, at a rate which would seem almost too large to credit. It is only by a very close application to the laws of supply and demand and the rules governing costs that such a result is achieved.

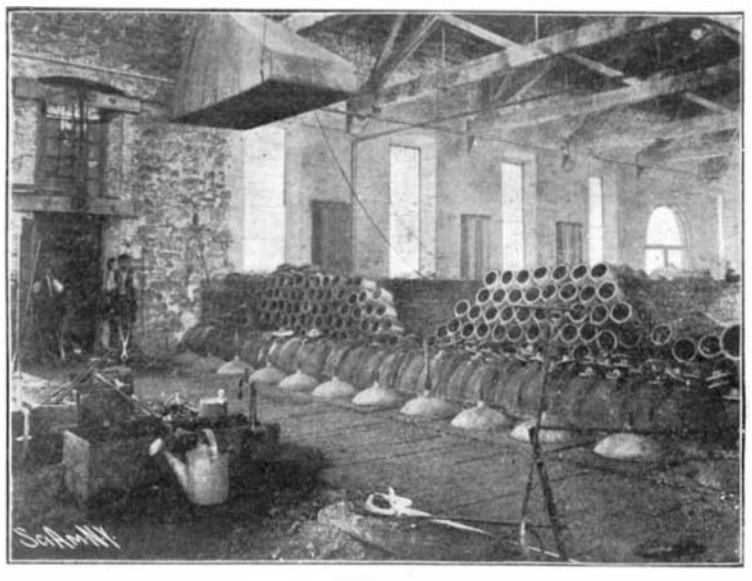
Pneumatic Molding Machine.

It is particularly appropriate that in this journal of scientific and industrial progress should appear the first published description of the great Remington

Making Coiled Springs.

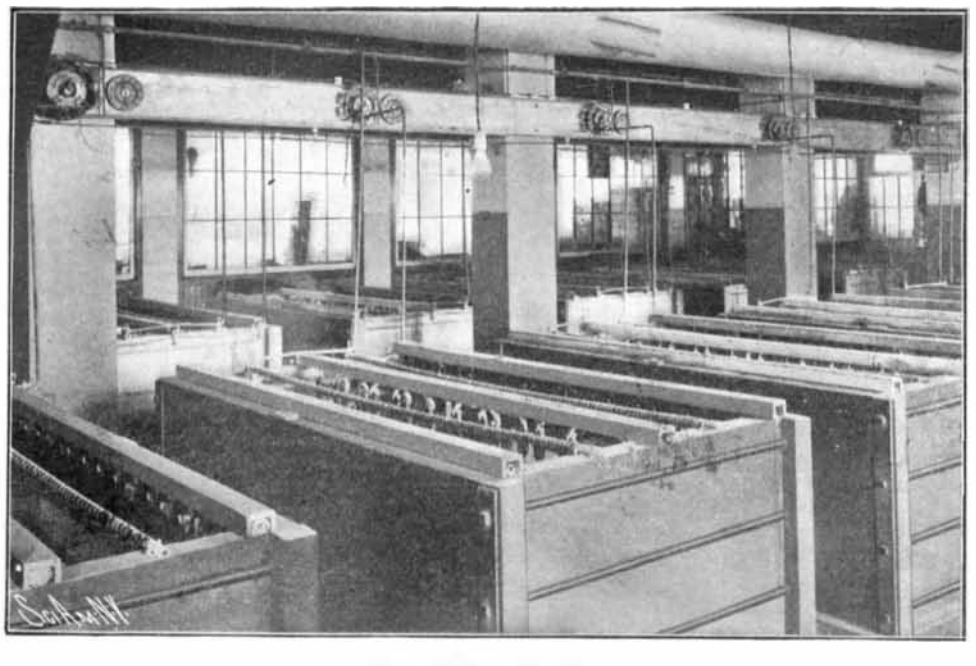


Blanks, Dies, Type.



A Corner of the Brass Foundry.

Wiring Articles for Plating.



The Plating Tanks.

THE MANUFACTURE OF TYPEWRITERS.—THE REMINGTON MACHINE.

standard typewriter factory; for it was an editorial, published in the Scientific American during the year 1867, describing the "pterotype" (winged type), a machine invented by one John Pratt, of Centre, Ala., and pointing out the great benefit to mankind and profit to the successful inventor that such a machine would confer, which encouraged C. Latham Sholes, a Milwaukee printer, and Carlos Glidden, an Ohio ironmonger, to adapt a contrivance of their own for writing figures to record letters and words.

It was, however, not till six years later, in 1873, after many unsuccessful models had been constructed by Mr. Sholes, that the resulting crude machine, seeking a manufacturer, was brought to the notice of E. Remington & Sons, the famous gun-makers of Ilion, N. Y., in whose works at first, and afterward from 1886 in those of Wyckoff, Seamans & Benedict, under the fostering care chiefly of W. K. Jenne—the honored dean of typewriter-makers—it was mechanically improved till it became a world-famed product.

From a small and doubtfully-regarded venture, in 1873, occupying an inconsiderable corner of the old Remington gun works, it has grown to a vast selling and manufacturing enterprise, the Ilion factory of which, in the beautiful Mohawk Valley, can employ over 2,000 people and covers 6½ acres with its buildings alone.

The latter are equivalent to a building 60 feet wide, one story in height and more than a mile long, and have a capacity of a machine a minute.

The factory product embraces a variety of machine sizes and models which, with the various ingenious attachments for special purposes, such as tabulating, retail and wholesale billing, card indexing, etc., are capable of writing lines from one to twenty-five inches in length, in all the characters and styles (among the later additions are the Burmese, Armenian, Laos, and Arabic characters) of type required by many languages and the various technical branches of the same.

If it were asked how a machine composed of several hundred parts which undergo an infinite number of operations could be sold at a fair price, the answer would be "system"; for these works are dominated by system. There is also not a step in any process where inspection is not in force. Gages and templates are used throughout the plant, and every part is certain to join every other part without a hitch of any kind. The inspection is from the raw material to the boxed machine, swaddled in its flannels and hung head downward from the top of the wooden box. The typewriter is born in the pattern shop and foundry, and enters real life on the final inspector's desk.

To produce, in an economical and satisfactory manner, a machine so compact in form and simple in operation, but embodying devices adapting it to the countless varieties of work that the Remington is called upon to perform, division of labor is carried to an extreme, and "production engineering" of the most scientific character is required. The various parts are produced in the "Parts Factory," on a vast wholesale scale, and systematically stored on perpetual inventory in a well-oiled condition in the special stock-room cabinets; while typewriting machines are assembled in the machine factory from these parts in all the styles and varieties called for.

THE PARTS FACTORIES.

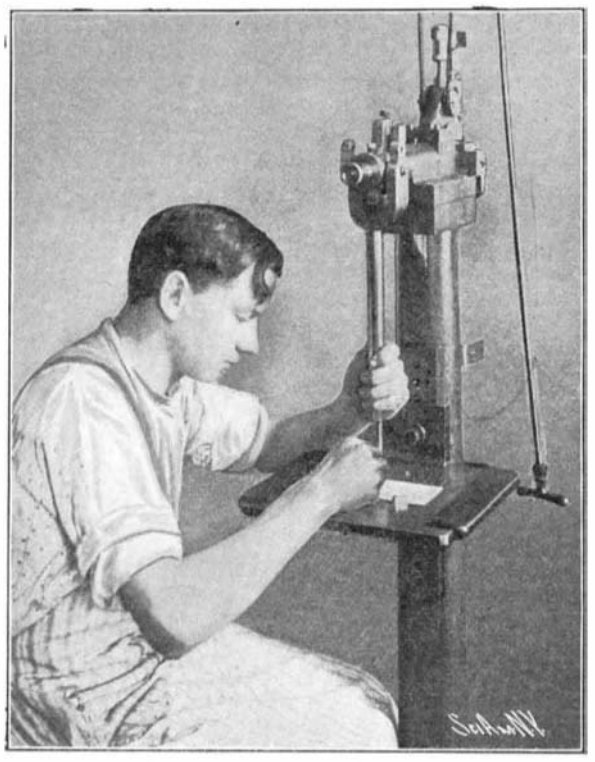
Beginning at the raw material stores in our tour of the factory, we find that countless varieties of these have to be procured with regularity and systematically stocked, besides a vast quantity of consumable factory supplies.

All the castings required are made in the company's foundries. The brass foundry with fourteen melting furnaces furnishes the various bronzes and alloys of copper, zinc, aluminium, and nickel, which are necessary for the lighter but severely-handled typewriter parts. The castings, whether of bronze or cast iron, are produced entirely by the use of twenty-three Tabor pneumatic molding machines, hand molding having been completely superseded by the cheaper, cleaner, quicker, and more accurate machine process with very finely-adjusted metal patterns. The castings of various metals after pickling, tumbling, and inspection are started on a systematic journey of the shortest possible length and with minimum handling, along with stamping, screws, and automatic machine products.

In the case of the removal of material without regard to exact gaging, belt-grinding supplies a cheap and satisfactory method of getting into and around the corners of pieces; while the drilling of one hundred holes at once in the top-plates by special automatic drilling machines in three and a half minutes, one man only being required to attend to each three machines, is perhaps the acme of labor-saving in this direction.

Each of the various distinct parts, after being drop-forged, machined accurately to gage in costly fixtures, ground, polished, annealed, plated, buffed, japanned, assembled, compounded, and finally inspected, is stored in a well-oiled condition on perpetual inventory in the cabinets of the finished parts stock room.

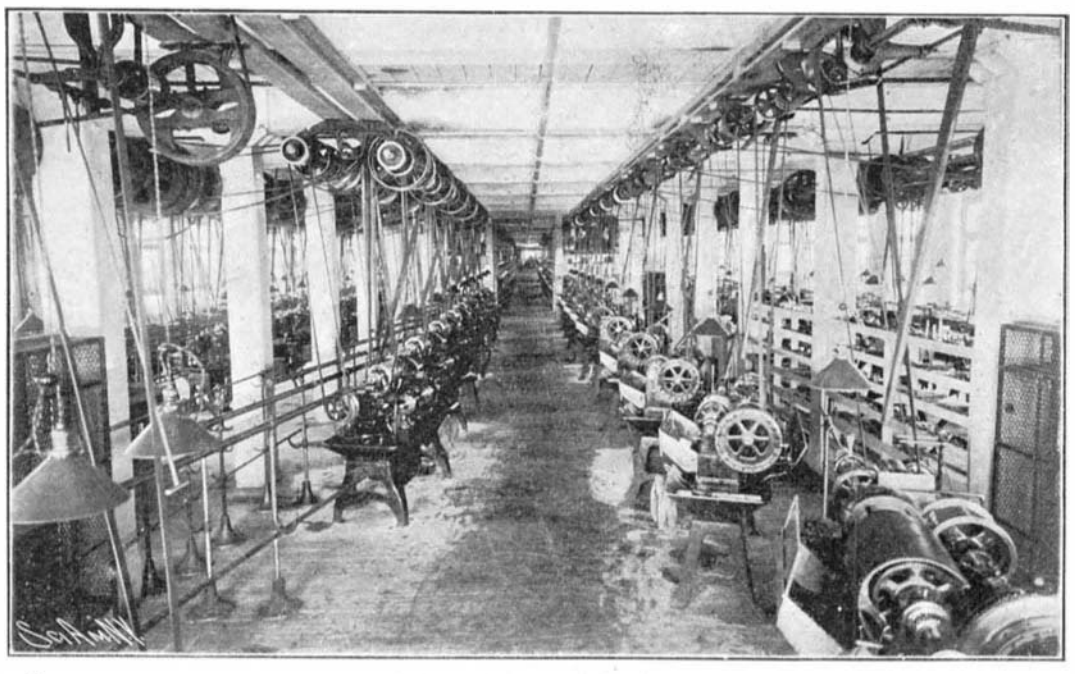
At all the stages enumerated, departmental inspection insures that every single piece with the slightest defect is promptly thrown out, and nothing but first-class work passes forward for further treatment.



Reducing Pantagraph for Making Letter Dies.

So much for the metallic components. The parts composed of glass, rubber, wood, leather, felt, etc., are similarly passed through an effective and economical routine, being shaped, gaged, and inspected after the same manner; the governing consideration being the maintaining and increasing of Remington supremacy in the matters of quality and durability of product.

Wire-cutting and spring-making are interesting special processes, while the manufacture of the type supplies some surprises for the uninitiated.



Automatic Screw Machines.

THE MANUFACTURE OF TYPEWRITERS.—THE REMINGTON MACHINE.

From an engraved plate twenty times full size, the reducing pantagraph engraving machine produces a hollow die of the true size, which when set with other dies in the type wheel and rolled under pressure over a "form" of specially-prepared soft steel blanks, furnishes a complete set of double-lettered type. These, when trimmed and hardened, are stored ready for use in machines, when called for.

THE MACHINE FACTORY.

Up to this stage in our tour we have seen nothing like a typewriter, but instead a bewildering series of unfamiliar-looking pieces passing through a routine of mechanical treatment in thousands and tens of thousands lots. In the great machine hall (60 feet by 340 feet), which we now visit, we find 3,000 typewriters of all varieties from United States Domestic and Russian to Arabic, which writes backward, in all stages of assembly. There we see the machine, after receiving a registered number, rapidly grow under our eyes in the hands of several hundred of skilled assembling experts to a frame consisting of a base, four posts, and attached top-plate with type bars in position. The rodding, first aligning, and wiring follow quickly. The "pull-cut" to synchronize the wooden key-levers is succeeded by the assembling and fitting of the ribbon movement and escapement. All this time the machine is progressing to the east along the south side of the hall, occupying after each operation open shelves specially made for it, and never once touching the floor. At this stage it meets the carriage, which has been in course of assembly from individual parts, and with the fitting of the carriage the machine can, for the first time, be made to write, and thereby show beyond a doubt to experts what rapid adjustments are needed.

A very particular "touching up" of alignment follows, and then the ordeal of final inspection and adjustment is reached, and seldom passed without criticism, as the standard is very high. The machine, at first an inert mass like any other mechanical product, receives now the very real but hardly definable qualities of "touch," responsiveness, resilience, and synchronic action, which show themselves after the "tuning-up" process is complete, and which it is the object of the shipping department to maintain intact while the machine is on a long and risky journey to New Zealand, the Philippines, India, and "the ends of the earth."

One of our engravings shows the end of the manufacturing process—a machine a minute passing out of the machine assembly hall into the packers' hands, from which it emerges to go into the packing box for shipment, every portion being firmly and delicately tied and padded against the risks of concussion and disturbance. We are indebted to the manager of the factory, Mr. John Calder, for courtesies in the preparation of the present article.

Concrete Building Blocks that Defy Detection.

So many improvements have been made in the machinery for manufacturing concrete building blocks as a substitute for building stone, and so generally have these blocks been accepted by the public, that it is only natural that the inventor should devote his attention to the material itself. Hitherto, concrete blocks, while vastly cheaper than stone and just as efficient in every way for the purposes they are used for, have been practically of a uniform color which detracted, in the eyes of some prospective purchasers, from their value as a material for making houses. In an attempt to introduce the coloring matter into these building blocks, it was found in most cases that the strength of the block itself was lost, to a great extent. Lately, however, a new material has been found which, when mixed with the concrete, will produce an almost perfect imitation of the stone that is used as a sample. Granite, with all its specks and black dots, can be imitated so that an expert will find it hard to differentiate. Indiana limestone can be made to look so nearly like the object of nature that at a few inches' distance even, the imitation cannot be detected from the original. At a recent experiment, and using an automatic Hayden machine, twenty blocks per minute were turned out with ease, and the result was so strikingly like the original stone which was used as a model, that there is no doubt whatever that the time has come when persons of moderate means will be able to build imposing houses at less than one-sixth the cost of building them of real stone.

A boat has recently been put into service on the Lake of Geneva which is driven ordinarily by a 45-horse-power Diesel engine, running at 260 revolutions per minute, but electric power is made use of at starting and for reversing. At starting the Diesel engine is disconnected from the propeller shaft, and drives only the generator and the exciter. The motor is then switched on and its torque and speed are adjusted by regulating the excitation. When full speed has been attained in this way, the motor is switched off, and the Diesel engine is directly coupled to the propeller shaft.

PORT ARTHUR FLEET: THE TRUE STORY.

SCIENTIFIC AMERICAN

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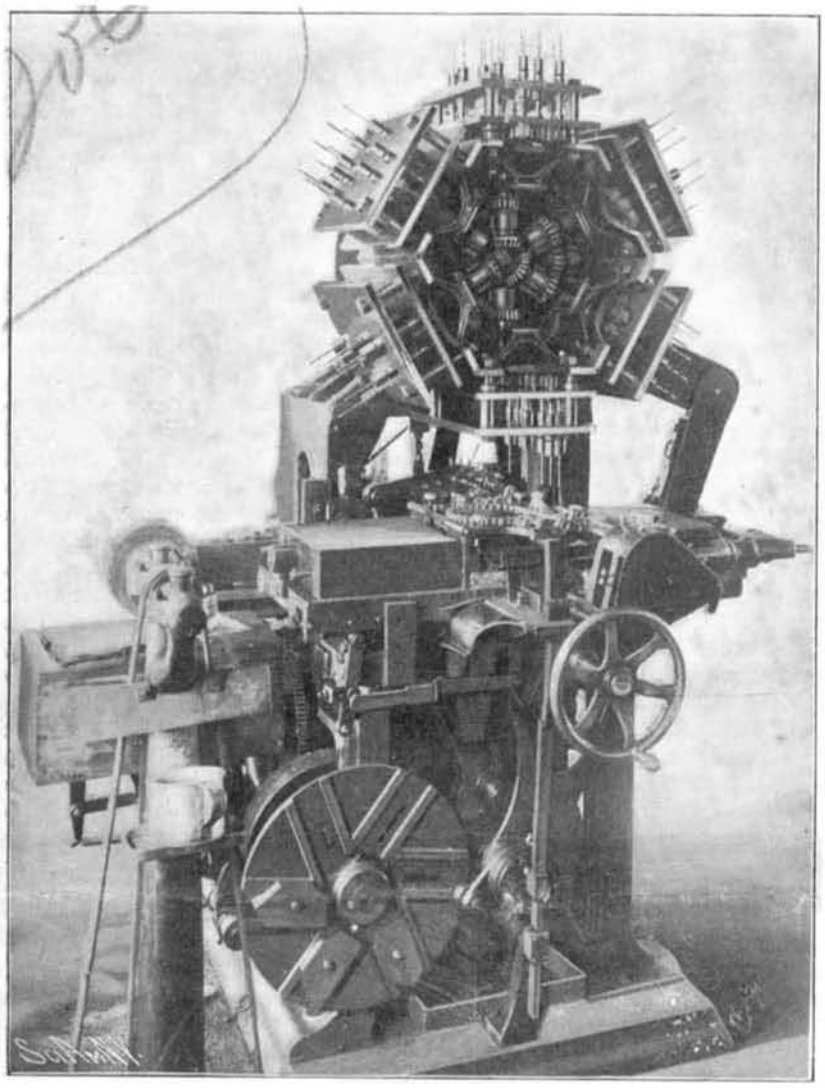
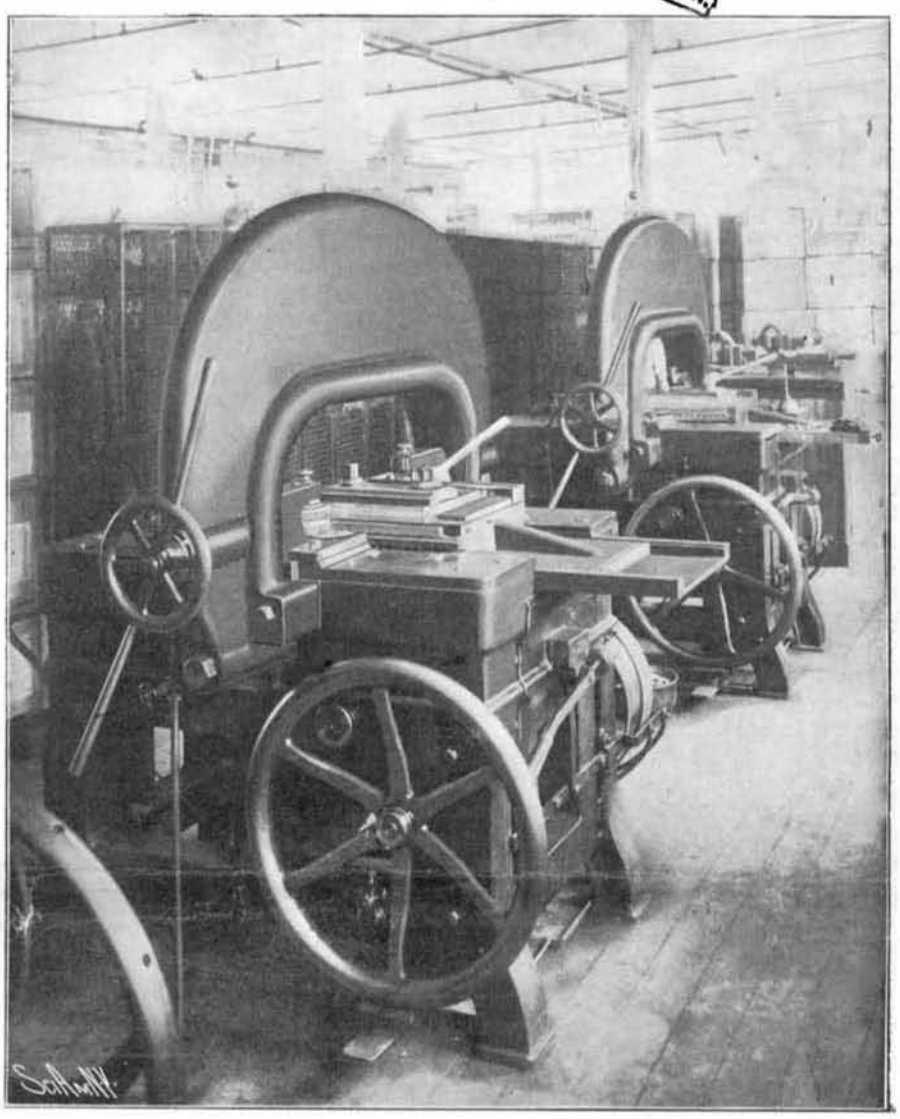


Automatic Multiple Drill Boring 100 Holes in Three Minutes.



Rolling Press For Making Type.

Assembling the Typewriter.—Machine Ready for Carriage.

THE MANUFACTURE OF TYPEWRITERS.—THE REMINGTON MACHINE. [See page 201.]