or five years since wherein the traverse movement of the spindle was performed by power; that is, the lateral adjustment was performed by the machine itself through the means of friction clutches. This involved quite a complication of mechanism beneath the spindle without any equal object in adjusting the bit; an operation that requires but little power and has in the end to be governed by hand adjustment; in short, it is as easy to adjust the bit and spindle as it is to adjust the friction clutches. A compound vertical machine with two spindles having 12 inches traverse and 16 inches vertical movement of the spindles, was arranged, and is now building by Richards, Kelly & Co. for J. Dripps, C. E., Superintendent of Motive Power, Pennsylvania R. R. Co. This machine is framed in iron, weighing 1500 lbs. with traversing table.

(To be continued.)

ENGINEERS AND MACHINISTS.

BY J. RICHARDS, M. E.

THE manufacture of machinery can, and perhaps should, be divided into three branches: engineering, machine fitting, and the commercial department. In this country a person or a firm, in order to found a successful business, must, in some degree, compass all of these things; they must generate designs, carry them out in the construction of the machines, and then negotiate their sale. To theorize on the subject without considering the history of the mechanic arts, there would seem to be a legitimate division of these separate branches, and no doubt such a conclusion would be correct if it were practicable to divide them with the present degree of knowledge possessed of the forms of construction and means of fitting. And it is safe to assume that the necessity of this combination is found in the imperfections of the art. Designs have to be qualified by experiment, and sales negotiated that are contingent upon successful performance, and in order to meet these conditions the whole must co-operate together.

That the principle is the same in a general way that leads to a division of labor in the shops, cannot be denied, the object being to systematize and produce cheaper. Any manufacturer that is not trammelled and worried by the care and risk of making designs and plans, and can give his entire attention to shop manipulation,

can make machines better and cheaper than if he attends to both. Again, relieve him of all commercial care and responsibility except the purchase of material and his pay roll, and the result must be that no mongrel business could be done to compete.

In England we have an indisputable evidence of this in the manufacture of staple articles, at Birmingham and elsewhere. The manufacturers go to London and contract for a season's production with some commercial house, to whom all their goods are sent. They then go home to give their attention solely to the details of their shops. The plans and designs have been fixed by custom and experience and the goods are sold by others. The consequence is that the cost of production has decreased until they can defy competition.

The great engineering firms of our own and other countries, it is true, have been founded and conducted on a different principle, and their example offers a strong argument for its continuance; but at the same time there are faults attending the most successful that must not be overlooked, one of which is that such shops are generally the product of a one-man power—some one endowed with an extraordinary ability and a versatility of talent that enables them to plan, build, and sell. This focal one-man power is to be found in nearly every successful engineering firm in existence, and the result is that when this power fails and is not supplanted by one similar and equal, there is soon a want for an epitaph. In fact, the ordinary ranks of mankind furnish but few men who can master and execute the details of a successful engineering business as now conducted.

There is against the system a powerful argument found in the fact that efficiency can only be attained by strict attention to one thing; and while we have a few first-class shops that do attain it in all departments, we have for each one such a score that make a miserable failure. Look over our country and no shop will be found however small, or no matter how much risk is being run in the use of a limited capital, but that is trying to produce something new and startling, some new modification of machines, or novel experiment that belongs to the engineer and not the machinist. It is even common for persons to advertise as engineers and machinists who have not the least capacity, education, nor means to generate designs nor to calculate plans; the result is generally failure—the inevitable failure to succeed in engineering, and the consequent fail-

ure of the machine shop for want of means squandered in experiment.

What is true in this respect with regard to engineering is equally true in reference to the commercial department of the machine business. As our shops are now organized, a machinist, to start business, must have all the adjuncts of a counting-room—a complication of accounts, a correspondence all over the country—he must advertise, travel—in short, expend on a business, no matter how small, the same amount that would be needed if he were doing ten times the business. This is the result of our conglomerate system of machine manufacture. And while it must be accepted as a necessity growing out of the unfortunate state of the art, it can do no harm to understand it and talk about. And while circumstance must perforce for a time maintain this state of affairs, our highest good and greatest success must ultimately grow out of a different system, in which the engineer is responsible for designs, the machinist for his work, and the commercial man for the contracts.

BELTING FACTS AND FIGURES.

BY J. H. COOPER.

(Continued from page 271.)

A Large Leather Belt.

“At the New Jersey Zinc Co.’s works at Newark, N. J., is a quadruple leather belt of unusually large dimensions. It is 102 feet long, 4 feet wide and weighs 2200 lbs. The outside layer consists of two widths, the second and fourth layers of three widths, and the third layer of four widths; all the layers being rivetted and glued together, and the end joints of the pieces forming the several layers are lapped to give the greatest tensional strength to the whole.

“It runs on an engine band wheel 24 feet diameter, with straight face 4 feet wide of smooth turned iron and over a driven pulley on the line shaft of 7 feet diameter having similar face, the centre of which lies 5 feet above the engine shaft.

“It has been in use three years, is doing well and giving no trouble, even when doing its heaviest work.