NOTES ON BELTING.

A LARGE proportion of the so called accidents to belts, in which they jump from one cone to another, or run into neighboring gears, are due to excessive pliability. Owing to their greater lateral stiffness, thick belts are much to be preferred to thin ones So much do I believe that the property of stiffness increases the life of belts that I make it a rule to use as thick a belt in all cases as the diameter of the pulleys will permit A manifest advantage of belts made of two or more thicknesses of leather lies in the fact that imperfection of the leather will produce but little effect in a double or triple belt, while in a single it is fatal. Messrs. Lewis Bancroft have, in their experiments, demonstrated the fact that " no marked difference could be detected in the power required to run a wide double belt or a narrow light one for the same tension as modern speeds. And again, we see ropes up to two inches in diameter transmitting power with great efficiency, and with apparently but little loss of power owing to their thickness. Therefore a thick belt will be practically no less efficient than a thin one on account of its stiffness.

Many experiments have shown that the pulling power of belting for a given arc of contact is almost independent of the area of the belt in contact with the belt, and that it depends chiefly upon the sectional area of the belt, and its total tension , so that a triple belt will transmit about as much power as a single belt three times its width.

With wide belts, and belts running at high speed, it is especially desirable that the thickness should be increased. If thin belts are used at high speed, they almost invariably run in waves on the slack side, particularly if the load which they are transmitting changes suddenly. These waves frequently continue in the belt while it is rounding the driven pulley, so that one can sometimes even see light in places between the belt and pulley rim when standing in the proper position. This wrinkling of belt, and the snapping that occurs as the waves straighten out, wears it very fast, and causes the splices to part, frequently in a few months. The remedy for this trouble I have invariably found to be an increase in the thickness of the belt. When a sufficient thickness is used, the belt settles down on the same pulleys and under the same conditions to a long, steady curve on the slack side, and the wrinkling and snapping cease.

It would seem also as though a certain ratio of thickness to the width of belt should be maintained, particularly in high-speed belts, otherwise the belt is apt to chase from side to side on the pulleys. This chasing would seem to be due chiefly to the oscillation of the belt around its longitudinal axis on the slack side, the belt being thereby tightened, first at one edge and then at the other, each side as it is tightened tending to run toward the center of the pulley This oscillation, and the resultant chasing, are almost sure to cease when the thickness of the belt is increased in proper proportion to its width As an illustration of this principle, the writer has in mind the case of a belt 78 inches wide and 0.16 inches thick, running about 5,500 feet per minute, which could never be prevented from chasing from side to side on its pulleys for any length of time without the use of an idler pulley This chasing was due to the oscillation about its longitudinal axis, which was caused by the small thickness of the belt in relation to its width A belt [illegible] inches thick and 72 inches wide, used on the same pulleys, was almost entirely free from the chasing, and I am convinced that an increase to 1¼ inches in thickness would have rendered it sufficiently stiff to permanently remove the trouble It should be noted that the thicker belt proved to be far more economical, durable, and satisfactory in every way than the thin belt If the principle is correct, of using thick belts on account of their lateral stiffness and consequent durability, it becomes of the utmost importance to determine the minimum diameter of pulley which can be used with a given thickness of belt, and still have the belt last well The writer is quite sure that the double leather belts ⅜ inch thick will last well and give excellent satisfaction on pulleys as small as 12 inches in diameter, as he has had many belts in use for years under these conditions For some time past he has had a triple leather belt 12 inches wide, 0.56 inch thick, running about 4,500 feet per minute, with an idler pulley pressing lightly upon it, and transmitting about 100-horse power to a pulley 12 inches in diameter. This belt has up to date given excellent satisfaction, and has already lasted much longer than the two double leather belts which preceded it.

Regarding the question of fastening the two ends of the belt together, I think it is safe to say that the life of belting will be doubled by splicing and cementing the belt, instead of lacing, wiring, or using hooks of any kind. When belts are subjected to the most severe usage, the spliced portion should be riveted, iron burrs being preferable to copper. For double belting, the rule works well of making the splice for all belts up to 10 inches wide, 10 inches long ; from 10 inches to 18 inches wide the splice should be the same width as the belt, 18 inches being the greatest length of splice required for double belting.

CHEAP POWER FOR MANUFACTURERS.

IN a suggestive article on " The Economics of Electric Power, which appears in Cassier's Magazine for March, Mr H. L. Lufkin, a prominent electrical engineer, draws a very striking picture of what has more recently been accomplished in the way of applying electric motors to the driving of machinery of all kinds. So much has been said and written in a general way of the convenience and economy of applying electricity to the driving of shop tools that specific facts and figures, derived from actual experience, are most welcome additions to the literature of the subject, and every power user must, therefore, needs appreciate the valuable reference data given in the article. One of the advantages of using electric motors is found in the fact that they may be connected to the machinery to be operated almost directly, without the intervention of long lines of shafting, whose friction losses alone often represent an appreciable item of expense Referring to this feature, Mr. Lufkin says .

The apparent losses in shafting had always been vaguely estimated until the advent of the electric motor, by which, with the aid of an ampere indicator, these losses are readily and accurately determined. As a result of a test in some thirty shops of varied descriptions, made in 1890, it was discovered that 68 per cent. of the average power applied in these shops was consumed in the shafting. Some data recently very kindly furnished to the writer by one of the large electric companies, which, by the way, is furnishing current for operating about four or five thousand horse-power in electric motors, cover seventy-one shops. The totals of these shops showed that 121,524 watts represented the average total energy supplied, and that 84,700 watts were consumed in the shafting, etc., being 69 2-3 per cent, of the average power, thus approximately checking the tests of 1890 These friction losses in shafting in the mills and factories before referred to have been partially eliminated by means of grouping tools in sets and otherwise, driven by electric motors, so that entire sets might be completely shut down when not actually in use without interfering with the remainder of the shops, and long lines of transmitting shafting and belting between floors or from building to building have thus been dispensed with.

An interesting example of the economy derived from this grouping of tools is found in a factory now being equipped with an electrical transmission system. A preliminary experiment in this factory showed that the saving in fuel alone will certainly exceed 50 per cent and possibly 60 per cent. In one recent instance a card, indicating fifty-nine horse-power, was taken from an engine driving a large machine shop, a blacksmith shop with pneumatic hammer, blowers, etc., a pattern shop, and numerous special tools on three floors of a building about seventy-five feet square This card was taken with all tools idle, thus showing friction only The same tools were rearranged and grouped into several sets, driven by electric motors, and under the conditions the average indicator card from the engine driving the dynamos which furnish the power for these same tools is about twenty-five horse-power, covering friction, power for the tools and all.

The convenience and flexibility of an electrical power transmission system are frequently commented on by present users, from the fact that single tools or small groups of tools may be efficiently operated in isolated locations, or locations at considerable distances from the main power plant. The great saving derived in an electrical system owing to the intermittent use of tools, was long since taken advantage of by the builders of traveling cranes, and to-day probably ninety-nine out of every hundred traveling cranes installed are operated entirely by electric power, an independent motor being used for each of the several functions of the crane. Many foundries now work their jib cranes with directly geared motors, taking current, in many instances, from the same dynamo which lights the shops.

HOW MANY FLOUR MILLS?

HOW many flour mills are there in the country? is a question quite frequently asked. The Minneapolis Record has been gathering some figures on this point. It places the number in Canada at about 1,000. There are probably all told about 1200 mills in this country. In the States the number is placed at beyond 15,000. Pennsylvania leads all other States in the number of mills, there being 2,200 ; New York follows next with above 1,300 ; Ohio 975 ; Missouri 810 ; Indiana 750 ; Illinois 700 ; Michigan 600 ; Wisconsin 575 : Iowa 500 ; Tennessee 490 ; Virginia, 460 ; Texas 450 ; North Carolina 405 ; Minnesota 390 ; Georgia 340 ; West Virginia 335 ; Kansas, 320 ; running down from that to 3 for the District of Columbia. While Minnesota is fourteenth in the list, according to number, the capacity is beyond the capacity of any other State, owing to the larger size of the mills. The daily milling capacity of Minneapolis is above 47,000 barrels, if run up to the highest possible limit This, however is impracticable, and during the last year the average production in this city was 67.8 per cent. of the total capacity. The average production of Duluth and Superior was 56.3 per cent. of the total capacity. The average production of St. Louis was 48.8 per cent. ; of Buffalo 55.9 ; Milwaukee 60.9. The average daily capacity of Duluth and Superior during 1893 was rated at 12,301 barrels. The year began with less than that, but several mills were completed in West Superior during the season, and at the beginning of this year Superior had a capacity of 12,000 barrels daily and Duluth 6,300 barrels daily ; St. Louis a daily capacity of 21,000 barrels ; Buffalo 11,000 ; Milwaukee 10,200. Baltimore has some 3,300 barrels total capacity ; Philadelphia about half as much ; Detroit about 2,000 ; Chicago some 4,000 ; Kansas City above 2,000 ; Cincinnati about 2,000 ; Cleveland 4,000, and Indianapolis about 5,000 barrels. Minneapolis in 1892 manufactured 9,750,470 barrels of flour. In 1893 9,377,635 barrels. The product of Minneapolis exceeded in both these years, all the flour producing cities separately. The production of this city was greater than that of St. Louis, Baltimore, Philadelphia, Buffalo, Milwaukee, Toledo, Detroit, Chicago, Duluth and Superior, Kansas City, Cincinnati, Cleveland and Indianapolis combined, and they are the leading flour cities outside of Minneapolis. The production of flour, to capacity, in Minneapolis, in 1892, was 71.6 per cent. of capacity ; St. Louis 51.1 ; Buffalo 64 ; Duluth and Superior, together, 51, and Milwaukee 71.3 per cent.

NOT ALWAYS THE CASE.

PERIODICALLY there floats through the technical press, says Power, an item to the effect that one-sixteenth of an inch of scale has been determined by accurate experiment to require 15 per cent. more fuel ; three-sixteenths, 23 per cent. While this may be strictly true for the boiler experimented upon, it can not, in the nature of things, be of universal application nor an index of the loss which may be expected upon another boiler from a given thickness of scale. A boiler with a meager amount of heating surface would suffer seriously from an impairment of the efficiency of that surface by scale, while a boiler with ample surface would suffer comparatively little. The item evidently started from a formula based by Nystrom upon the alleged fact that saturated scale has about one-thirtieth the conductivity of iron plate, and giving the diminishing values quoted as the amounts of heat transmitted through a given amount of heating surface.