Mechanics.

DIAMETERS AND NUMBER OF TEETH FOR GEAR WHEELS

Rule 1.—As the number of teeth in the wheel + 2.25 is to the diameter of the wheel, so the number of teeth in the pinions ÷ 1.5, to the diameter of the pinion. Example : The number of teeth in the wheel = 210 ; the diameter of the wheel = 25″, and number of teeth in the pinion = 30 ; to find the diameter of the pinion : As 210 ÷ 2.25 is to 25, so is 30 + 1.5 to 3.7102, the diameter of the pinion.

Rule 2.—To find the distance of centres between two gears (or gear and pinion). Rule: As the number of teeth in the wheel + 2.25 is to the diameter of the wheel, so is half the number of teeth in pinion + half the number of teeth in wheel, to the distance of their centres. Example: The number of teeth in wheel = 210 ; the diameter of the wheel = 25″; and the number of teeth in the pinion = 30 ; to find the distance at which their centres should be placed. As

$$30 + 210$$

210 + 2.25 is to 25, so is $\frac{30 + 210}{2}$ to 14.1342 inches, the distance of their centres.

I also give some rules as to velocities. When wheels are applied to communicate motion from one part of a machine to another, their teeth act alternately on each other ; consequently, if one wheel contains 80 teeth, another 20, the one containing 20 teeth will make three revolutions while the other makes but one. From this the rule is derived, namely: Multiply the velocity of the driver by the number of teeth it contains, and divide by the velocity of the driven—the quotient will be the number of teeth it ought to contain. Or, multiply the velocity of the driver by its diameter, and divide by the velocity of the driven—the quotient will be the diameter of the driven.

If the velocity of driver and driven are given with the distance of their centres : The sum of the velocities is to the velocity of the driver multiplied by the velocity of the driven as the distance of centres is to the radius of driver multiplied by the radius of driven.

Example 1.—If a wheel that contains 75 teeth makes 16 revolutions per minute, required the number of teeth in another to work in it and make 24 revolutions in the same time.

$$\text{Here} \frac{75 \times 16}{24} = 50 \text{ teeth : the answer.}$$

Example 2.—If a wheel 64 inches in diameter, and making 42 revolutions per minute, is to give motion to a shaft at the rate of 77 revolutions in the same time, required the diameter of a wheel suitable for that purpose.

$$\text{Here} \frac{64 \times 42}{77} = 34.9 \text{ inches ; the answer.}$$

Example 3.—Required the number of revolutions per minute made by a wheel 20 inches diameter, when driven by another of 4 feet diameter and making 46 revolutions per minute.

$$\text{Here} \frac{48 \times 46}{20} = 110.4 \text{ revolutions.}$$

Example 4.—A shaft, at the rate of 22 revolutions per minute, is to give motion by a pair of wheels to another shaft at the rate of 15½ ; the distance of the shaft from centre to centre is 45½ inches ; the diameters of the wheels at the pitch lines are required.

Here 22 x 15.5 is to 22 as 45.5 is to diameters required.

$$\frac{22 \times 45.5}{22 \times 15.5} = 26.69, \text{ number of inches radius of the driven wheel,}$$

which, doubled, gives 53.38 inches, the first diameter required, and 45.5 inches − 26.69 inches = 18.81 inches is the radius of the driver, which, doubled, gives 37 62 inches, the second diameter required.—*T. W. McCabe, in American Machinist.*

THE EFFECT OF IGNORANCE.—A correspondent of the *British Medical Journal* states the diphtheria is raging among the peasant children in Southern Russia. In some localities no child under 12 is to be seen. Filth and ignorance are doing their work. "When a child dies of diphtheria a little cake is put into its mouth and left there a few moments, during which every one present makes the sign of the cross. It is then taken out and administered in tiny morsels to the other children of the family."

SUCCESSFUL DEVICE FOR GRINDING CHILLED IRON CAR-WHEELS.

The desirability of having car wheels perfectly round is conceded by all railway men. As a matter of fact, it is doubtful if any of the chilled iron wheels in use are perfectly round, and new wheels will often be found to vary 1-16 to 1-8 of an inch, and even more, from being perfectly true. Wheels in service, also, are far too frequently flattened by being slid, as a result of carelessness on the part of the brakeman or of the engineer in control of the air brake. Of course, when a wheel is not perfectly round, there is much more danger of its being held by the brake and flattened.

On the Virginia & Truckee road, in Nevada, it has been found that 85% of the chilled wheels condemned as unfit for service were flattened wheels. This, of course, is an unusually large proportion, as the curves and grades are extremely severe and numerous on this road, but on even the most level roads the number of wheels flattened in a year is astonishing.

A process of trueing wheels by grinding, invented by Mr. J. H. Gowan, formerly master mechanic of the Virginia & Truckee Railroad, and owned by the Chilled Car Wheel Grinding Company, has been adopted by the road named, and 16 pairs of wheels trued by this process were placed in operation on October 1, 1877. These wheels have made upwards of 100,000 miles, and still appear in perfect order, although subjected to unusually hard service. This is a remarkable showing, and indicates the possibility of a very great economy in railway operations. If flattened wheels, instead of being melted up for old iron, can be trued and again placed in service, it is evident that the saving will be enormous—the inventors of this device claim nearly 50%. The grinding is done by placing a pair of wheels, after being fitted on the axle, upon solid bearings and slowly revolving them while a solid emery wheel, 18 inches in diameter, is revolved in the opposite direction against the face of each iron wheel at a speed of 600 revolutions per minute.

One of these machines has just been put in operation at the shops of the Chicago, Rock Island & Pacific road. It proves that the best new wheels are very much out of true, and the company now proposes to have all its passenger car wheels ground down, being satisfied that the process will add to the smoothness of the cars in riding, will be easier on the springs and on the track, and will do much to prevent the flattening of wheels by the brakes. They will also have the flattened wheels ground, and expect to save a large number in this way which are now condemned as old iron.

It is expected that one machine will grind from four to six pairs of wheels per day. The royalty charged for the use of a machine is 50 cents for each wheel ground. A machine will cost about $750, and the cost of the emery is from 8 to 25 cents per wheel, according to the condition of the latter.

The invention has been in use over two years on the Virginia & Truckee road, and is also used by the Central Pacific road with very satisfactory results.—*Railway Age.*

ON DRILLS AND DRILLING.

The attention of many professional men and others interested in mechanical operations has for a lengthened period been directed to this subject. As must be well known, there are a great many descriptions of drills now in use—some good, some indifferent. The American twist-drills are now sold in large quantities, and for some purposes answer exceedingly well ; but at the same time there are points to be reckoned against them. Firstly, it is very difficult to grind both edges at the same angle, and if this is not done, the result will be that the hole will not be the true size of the drill used ; this will deceive a workman, and may probably spoil good work. And another objection to them is, that when the drill is about to come through the hole being bored, the quick twist causes it to worm through at such a speed that, in many cases, the drill is either broken, or the work forced up to the end of the twist, thus spoiling what might otherwise have been a smooth hole. We consider that the best description now in use is the straight-fluted drill, which was originally introduced by a Mr. Martin, of Charlton ; but this gentleman having for some long time ceased to make them, there arose a difficulty in procuring them. They are now, however, to be had more readily, and a set of these drills should certainly be found amongst the tools in every workshop.

With all the improvements that have from time to time been introduced in the various drills, in most factories, we have frequently noticed, that except for very large work, every work-