perly expended, and not diverted from their original purpose.

In concluding these remarks we do not mean to assert that they are applicable to every Mechanics' Institute in the Province of Ontario (Toronto and Hamilton are exceptions), but to the majority of them; but even where exceptions do exist, supervision and guidance is necessary. Nor would we in any way desire to exclude from being members professional and literary men or merchants and their employees; on the contrary, we should feel it an advantage that they should work harmoniously together—only, that in lieu of their controlling the institutions, and having the disbursement of the funds in their hands, they should simply be honorary members, and only entitled to control, say two-thirds of their own subscriptions, to be laid out in the purchase of such works as they would like to read, subject, however, to the approbation of an Inspector, so that no works of a light character could be introduced.

We trust that this subject will be earnestly and carefully looked into; it is one in which the interests of a large portion of the community are deeply concerned.

TEETH FOR GEAR WHEELS.

[T. W. McCabe in "American Machinist."]

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

Rule 2.—To find distance of centres between two gears (or gear and pinion). Rule: As the number of teeth in the wheel plus 2.25 is to the diameter of the wheel, so is half the number of teeth in pinion plus half the number of teeth in wheel, to the distance of their centres. Example: The number of teeth in the wheel =210; the diameter of the wheel =25 inches; and the number of teeth in the pinion =30; to find the distance at which the centres should be placed. As 210 plus 2.25, is to 25 so is 30 plus 210 divided by 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; consequently, if one wheel contains 60 teeth and another 20, the one containing 20 teeth will make three revolutions, while the other makes but one, From this 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 the 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 contains 75 teeth makes 16 revolutions per minute, required the number of teeth in another to work in it, and makes 24 revolutions in the same time. Here 75 multiplied by 16, divided by 24 =50 teeth; the answer.

Example 2.—If a wheel 64 inches 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. Here 64 multiplied by 42, divided by 77 =34.9 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. Here 48 multiplied by 46, divided by 20=110.4 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 plus 15.5 is to 22 as 45.5 is to diameters required. 22 multiplied by 45.5, divided by 22 plus 15.5=26.69, 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.

AN IMPROVED ENGINE LATHE.

We copy from the *Mining and Scientific Press* a description and illustration of one of Barnes' patent engine lathes (No. 6), improved pattern. This lathe swings 12 inches on the face plate, 6 inches over the tool carriage, and will take work 44 inches long between centres. It is a very powerful, back-geared lathe, and has all the necessary appliances for the rapid and accurate execution of light or heavy work. This size will best answer the requirements of those who want a lathe for general work of a heavier class than can be done on the No. 5 lathe, and yet within the range of foot power.

The head stock is very heavy, with a hollow steel spindle that will admit a 7-16 rod through its entire length. The boxes are of brass and are accurately fitted to the spindle, with provision to keep them true and take up wear.

The gearing is all cut from the solid metal, and can be combined to make some 500 different leaps of thread; at able is attached to head stock giving the combinations for all threads in ordinary use. The cone has four changes of speed, and is run by a one and a half-inch belt; this, with its back gearing and deferential pulleys, has a greater range of speed than has commonly been offered in a foot-power screw-cutting engine lathe for the price.

The tool carriage is a model of convenience and accuracy; it can be fed positively to either right or left as desired. The tool can be set to work at any position or angle desired; also to bore a taper hole or turn a ball, features not in ordinary movement tool carriages. All wearing parts are jibbed and can be tightened up. The feed screw is under the bed and behind the rack where it cannot be injured; a friction feed rod is also provided, which can be used instead of the screw feed, thus saving that part for accurate use in screw cutting. Either the screw or rod feed may be instantly started, stopped or reversed at will.

The tail-stock can be set over for turning tapers; the spindle is cast steel with a true taper hole for the centre; the centre is hardened and self-discharging.

The patent velocipede foot motion used on this lathe gives a very great power; no balance wheel is required, as the foot motion is reciprocating, and continuous, and there are no "dead centres" to overcome.

This lathe weighs 500 lbs., and the weight is all in the working parts, giving it great steadiness and strength.

SUBURBAN RESIDENCE.

Those of our readers who desire a suburban residence in which picturesqueness, elegance and simplicity of construction are successfully united will find the somewhat unique and beautiful design herewith presented particularly interesting and serviceable. The elevation has been so carefully drawn that a minute description of the exterior finish is rendered unnecessary. The construction, which can only be intelligently presented in the form of full detail drawings, is of such character as will secure the greatest beauty and durability at the least expenditure of labor and material, and by a careful attention to the importance of proper contrast of colors in the painting, the cottage can be made extremely attractive. A more harmonious and effective combination of curved lines, and a more beautiful range of light and shade, could hardly have been produced.

The excellent internal accommodations are explained by the following letters of reference on the floor plans: A, portico; B, veranda; C, main hall; D, library; E, dining room; F, parlor; G, kitchen; H, cellar stairs; I, servants' stairs; J, closet; K, water closet; L, bay window; M, butler's pantry; N, kitchen pantry; O, sink; P, range; Q, boiler; R, porch; S, hall; T, chambers; U, boudoir; V, balconies; W, bath room; X, closets; Y, roofs; Z, alcove.

This house is estimated to cost $4,500.—*Manufacturer and Builder.*

M. L. Collott has discovered the true *Phylloxera vastatrix* upon *Vitis caribbæa*, a wild species of vine found in the forests of Panama, far removed from any vineyards or localities where the true vine (*V. Vinifera*) is cultivated. This strongly confirms the opinion that the *phylloxera* is indigenous in America.