per annum, or very nearly $3,000,000 for each day in the year. The regular expenditure of more than 90 per cent of this vast sum stimulates other industries, and in this manner the volume of general business is increased in progressive ratio.

In these calculations no account has been taken of the large number of people forming the proprietary interest of this vast aggregation of capital, which comprises people in all classes and in all occupations, and scattered throughout all parts of the country.

The New York Central Railroad Company has 10,000 stockholders, whose average holding is about $9,000. If we take that sum as representing the average holding of all stock and bondholders in the country, the total number of such would be over 1,000,000, representing more than 5,000,000 persons with important interests in the success of the railroad system.

From these deductions a general idea can be gathered of the magnitude of the railroad interest, and how vast and widespread is the interest of our people in that system.

From the tables in the Manual it appears that during the past ten years the following percentages of profit have been distributed to holders of the share capital of our railroads. In 1879 the dividends paid averaged 2.5 per cent of the total amount of capital stock outstanding; in 1880, 2.8 per cent was paid; in 1881, 2.9 per cent; in 1882, 2.91 per cent; in 1883, 2.75 per cent; in 1884, 2.48 per cent; in 1885, 2.02 per cent; in 1886, 2.04 per cent; in 1887, 2.18 per cent; and in 1888, 1.77 per cent.

## BUHACH.

IN an article on the California insecticide known as buhach, which was mentioned in *Science* of May 24, the *Journal of the Society of Arts*, London, says this product is a fine powder made from the flowers of the *Pyrethrum cinerariæfolium*, largely used for the destruction of insects. This plant was originally a native of Persia, from whence it was introduced to Dalmatia and adjoining States of Herzegovina and Montenegro, where it has been almost exclusively cultivated until a few years ago. The importance of this industry was considered so great in these countries that special efforts were made to prevent the export of seeds and plants by the governments. The plant was first introduced into California about twelve years ago by a Mr. Mileo, a native of Dalmatia, who succeeded, after some trouble, in obtaining seed from his country. After experimenting for some time, in order to find a suitable soil and climate, this gentleman finally succeeded in growing the plant on an extensive scale, and in 1880, associating himself with other capitalists, established the Buhach Producing and Manufacturing Company. At the present time the company have about 300 acres of this plant under cultivation at their farm near Atwater, Cal., and own mills for grinding the dried flowers to powder at Stockton. The cultivation of pyrethrum requires careful and intelligent supervision, and it cannot be grown successfully without irrigation. It requires three years from the time of sowing to grow plants capable of producing a paying crop of flowers, and then they will bear from four to five years longer. It is at its prime, however, in its fourth or fifth year. The plant grows about thirty inches high, and is set out in rows four feet apart, and from fifteen to twenty-four inches apart in the rows. The flowers are harvested towards the latter part of May. The stalks are cut just above the roots, and the flowers stripped from them by passing the plants through a kind of comb. The detached flowers fall into a box below, and are carried to the drying ground, where they are spread on sheets and exposed to the rays of the sun during the day, being repeatedly turned over in the meantime. They are covered during the night to prevent their absorbing moisture, as the perfect drying of the flowers is most important in order to retain the volatile oil which gives the powder its insecticide properties. It is also very necessary that this operation should be done quickly, and that the flowers during the drying process should be protected from moisture. A slight dew falling upon the flowers at this time will injure their color, and reduce their strength as an insect destroyer. In this respect the California-grown flowers are better cured, and, consequently, more valuable than those produced in Dalmatia, it being acknowledged by experts that the particular conditions of soil and climate in California are extremely favorable to the growth and curing of plants rich in the essential oil which renders them so destructive to insect life. Like many other products, insect powders are liable to adulteration, and last year a large quantity made from the flowers of the Hungarian daisy, mixed with a small proportion of pyrethrum, was placed upon the market by unscrupulous dealers. Inferior powders are also manufactured from the stems and leaves of the plant, which possess, to a certain extent, the properties of buhach.

## SAWING STONE BY HELICOIDAL WIRE CORD.

A NEW plan of cutting stone by means of wire cord has been adopted in many European quarries. While retaining sand as the cutting agent, M. Panlin Gay, of Marseilles, has succeeded in applying it by mechanical means, and as continuously as the sand blast and band-saw, with both of which appliances his system — that of the "helicoidal wire cord" — has considerable analogy.

An engine puts in motion a continuous wire cord (varying from five to seven thirty-seconds of an inch in diameter, according to the work), composed of three mild steel wires twisted at a certain pitch, that found to give the best results in practice, at a speed of from fifteen to seventeen feet per second, the higher speed being adopted for the smaller diameter.

Instead of the stone being brought to the saw, the wire cord, which may be of indefinite length, is led to the stone, being guided by grooved pulleys, mounted on bearings with universal joint, which permits of their adapting themselves to any change of direction. The same cord, which is kept at uniform tension by a weighted truck on an inclined plane, may act upon any number of blocks, provided sufficient space be given between them to allow for cooling.

The pulleys are mounted in standards, and are fed down by endless screws rotated automatically if the stone be uniform, but preferably by hand if there is reason to suspect irregularities in its texture. Sand and water is allowed to flow freely into the cuts, the sand carried along by the cord in the spiral interstices between the wires causing a uniform attrition of the stone. The twist of the cord causes it, while travelling, to turn upon itself, and thus become worn evenly. A cord of 150 yards in length will cut about seventy feet deep in blocks fifteen feet long, or produce four hundred and ninety square feet of sawn surface before being worn out.

The sand must be sharp, and not used more than three times. The nature of the sand is determined by the hardness of the stone; thus, quartz sand will cut granite and porphyry, which it has hitherto been found impossible to saw, or indeed cut in any other way than by pick or chisel. An hourly advance of one inch in granite or porphyry and four inches in marble, is regularly obtained in blocks of fifteen or sixteen feet long. At the Brussels Exhibition of last year, where the system was awarded a prize, the same cord which cut marble also cut a block of concrete composed of quartz pebbles.

Not merely does the helicoidal cord saw blocks of stone, but it even cuts them out of the solid rock in the quarry. To do this, it is necessary to sink shafts of two or two and a half feet in diameter, in order to introduce the pulley-carriers. If there is a free side to start from one shaft is sufficient for a triangular block; but for a quadrangular one, which is preferable, two shafts are necessary. They are bored by a mechanical perforator, consisting of a hollow plate-iron cylinder, having at its lower end a slightly thicker collar which acts with sand and water in its latest development. The cylinder is made to revolve, at a speed of one hundred and forty revolutions a minute, by means of a tele-dynamic cable, advancing about an inch per hour in marble. An annular space is cut in the rock, leaving a core, which may be utilized as a column. The diameter of the shaftway depends upon the diameter of columns most in demand, provided a sufficient number be sunk, and the intervening angles broken down, so as to afford sufficient room for the pulley carrier.

In the case of stratified rocks, the shaft-cuts are carried down to a natural parting; but in unstratified rocks a nearly horizontal cut may be made with the cord, sufficient inclination being given to insure the flow of sand and water to the bottom of the cut.

Such is the method of working practised at the Traigneaux