

travelling in a spiral path and with continuously diminishing velocity, reaches the orifices through which it is discharged. If the runner be allowed to turn freely, in nearly frictionless bearings, its rim will attain a speed closely approximating the maximum of that of the fluid in the volute channel and the spiral path of the particles will be comparatively long, consisting of many almost circular turns. If the load is put on and the runner slowed down the motion of the fluid is retarded, the turns are reduced, and the path is shortened."

If steam be admitted, the machine will work like an engine under expansion, but if the expansion be allowed to take place before admission, it will operate like a turbine, being driven by the impact of the rapidly-moving particles. Says the inventor:—

"The above description of the operation is suggested by experience and observation and is advanced merely for the purpose of explanation. The undeniable fact is that the machine does operate, both expansively and impulsively.

"When the expansion in the nozzle is complete, or nearly so, the fluid pressure in the peripheral clearance space is small, as the nozzle is made less divergent and its section enlarged, the pressure rises, finally approximating that of the supply. But the transition from purely impulsive to expansive action may not be continuous throughout, on account of critical states and conditions, and comparatively great variations of pressure may be caused by small changes of nozzle velocity.

"In the preceding, it has been assumed that the pressure of supply is constant or continuous, but it will be understood that the operation will be, essentially, the same if the pressure be fluctuating or intermittent, as that due to explosions occurring in more or less rapid succession."

One of the special advantages claimed by the inventor for his device is its ease and simplicity of reversal, which may be effected simply by turning a valve. He says in conclusion:—

"It is simple, light, and compact, subject to but little wear, cheap, and exceptionally easy to manufacture, as small clearance and accurate milling work are not essential to good performance. In operation it is reliable, there being no valves, sliding contacts, or troublesome vanes. It is almost free of windage, largely independent of nozzle-efficiency, and suitable for high as well as for low fluid velocities and speeds of revolution. The principles of construction and operation are capable of embodiment in machines of the most widely different forms, and adapted for the greatest variety of purposes."

The mechanically perfect turbine would be one which combined simplicity and cheapness of construction, durability, ease and rapidity of repairs, and a small ratio of weight and space occupied to the power delivered on the shaft. Mr. Tesla maintains that in the turbine which forms the subject of this article, he has carried the steam and gas motor a long step forward toward the maximum attainable efficiency, both theoretical and mechanical. That these claims are well founded is shown by the fact that in the plant at the

Edison station, he is securing an output of 200 horse-power from a single-stage steam turbine with atmospheric exhaust, weighing less than 2 pounds per horse-power, which is contained within a space measuring 2 feet by 3 feet, by 2 feet in height, and which accomplishes these results with a thermal fall of only 130 B.T.U., that is, about one-third of the total drop available. Furthermore, considered from the mechanical standpoint, the turbine is astonishingly simple and economical in construction, and by the very nature of its construction, should prove to possess such a durability and freedom from wear and breakdown as to place it, in these respects, far in advance of any type of steam or gas motor of the present day.

### Technical and Chemical Notes.

FROM OUR SPECIAL CORRESPONDENT.

#### New Inventions in Dyes and Paints.

A chemical firm in Germany recently succeeded in manufacturing a dye of an intensive yellow. It is obtained by heating up indigo with aromatic acid-halogenides with the aid of condensation agents, such as metals or metallic salts. There is a great future for the new yellow dye, as may be gathered from the following facts. The War Departments of all countries of the world are trying to find a suitable colour for new army uniforms. It is essential that these colours be fast. Dyes produced in the copper are much more durable than those made in the old way. It has, however, been impossible to obtain all shades of colours produced in the copper, since a pure yellow has been wanting. The new indigo yellow may be used with all other copper colours, hence being of untold importance in the dyeing of woollen goods. With its aid every shade of khaki, field-gray and field-green may be obtained. Any imaginable nuance may also be imparted to silk; at the same time the colours are faster than any yet produced. The new dye is also destined to play a leading part in silk weaving, since the copper dye may be subjected to precisely the same boiling as the silk.

Caseine colours are used in painting pictures, and also for wall paintings ("sgraffito painting"). Caseine paintings are not affected by time, and their colours possess considerable charm, fire and depth. They often have been done in the form of mural paintings in public buildings, churches, town halls, etc. Caseine preparations may be used to advantage as impregnating agents for rendering painting surfaces firm. There are other specialties in paints in the form of mineral colours, which are guaranteed to be acidproof, free from lead, and heat proof. Also, being rust and weather-proof, they may be used for painting bridges, gas tanks, corrugated iron structures, etc. One of the new paints, called "Preolit," stone protector, is a solution to keep stone from decomposing and to render cement floors dustless. "Kautscholeum" is the name of a permanent paint for indoor or outdoor use. It replaces oil paints and may be adopted for painting buildings, to protect them from pouring rains.

"Vitratin" is a brilliant colour for interior and exterior painting. Being germicidal, it is particularly of use in painting stables, butcher shops, hospitals, etc. To produce a durable brilliant green patina very quickly on copper roofs, steeples, etc., one should employ "Mathalit," which costs 10/- a liter, this being sufficient to cover 100 sq. yards.

Finishes are employed in the textile industry to give thread or finished fabric an appearance conforming to the demands of fashion. By using certain finishes, it is possible to impart to cotton material the character of linen; satin texture furnished with satin dressing is a good imitation of silk. Finishes also play an important part in the manufacture of woollen, half-woollen and worsted goods. Their composition depends on the nature of the material. Starch paste, dextrin, glue, soap, wax, kaolin, stearin, soda, gelatine, etc., are used in preparing the finishes, glycerine as a rule being added. Glycerine is a leading article of trade, and is subject to much speculation. The price of the refined product varies according to the quality, between £5 and £7 per 100 kilograms (2cwt.). Efforts, therefore, have been made to find a substitute for glycerine, for use in making the finish. And it may safely be said that there are excellent substitutes to be had at the present time. I will mention the products sold under the names of "Glycero-collo" and "Glycerine Substitute," which are much in demand.

There have been several kinds of dry plaster in the market for some time. They are to be had in all colours, and are used principally for making plaster for the fronts of buildings. Dry plaster is a mixture of pulverised slaked lime and a diluting agent, which is reduced to a plastic mass with water. It may be used as plaster if applied immediately, as it rapidly hardens. The lime must be slaked and ground up very carefully for producing a good plaster. Dry plaster may be stored for a long time without losing any of its binding power or depreciating in quality. When applied to walls, it is weather-proof, and may be cleaned by washing with water, soap-water, or diluted acids. The plaster may be obtained in various grains, different ones of which are to be preferred for smooth or fluted plaster. The press plaster process is an innovation in this field, the plaster being provided with relief designs, with stamps. If large surfaces are to be plastered, it is a new method to do the work pneumatically. The plant is portable, its principal parts being a pump forcing the plaster through a flexible tube at the end of which there is a nozzle. The plaster is blown out of the nozzle on to the wall like a rain of mud.

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#### A Substitute for Platinum.

Last year the price of platinum increased above £50 a kilogramme, so that it now amounts to almost £300. This is due to no new deposits of it having been discovered. It is found in the Ural Mountains and the Caucasus, in California, Australia and Sumatra. A second reason for its high price is that it is being turned to many uses. The chemical, incandescent lamp, motor car, and jewellery