come in contact more with the whites since the establishment of the city of Yuma. Their children, too, seem to make better progress in school.

These pictures and the accompanying remarks, though necessarily brief and cursory, will show, I am sure, that there is a great field for the physiognomists of every school among the Indians of the American Southwest.

Safety Exploder for Wet Guncotton Shells.

A new safety exploder for use with wet guncotton shells has been invented by the New Explosives Company of London, the use of which may affect the charges for heavy artillery. Wet guncotton has been generally regarded as one of the safest and most powerful explosives in existence. The only objection to its general use for shell purposes hitherto has been that, to insure complete detonation, a primer of dry guncotton and a fulminate of mercury detonator have been required, and both of these agents are too sensitive to premature ignition to be of any practical utility. The new safety exploder contains neither dry guncotton nor fulminate of mercury, but it will detonate wet guncotton with certainty and safety, and will not detonate itself under a temperature of 360 deg. C. It cannot be ignited by friction or shock, but at the same time it is brought into action with an ordinary detonating pellet such as is commonly employed in percussion or time fuses. The force then exerted will detonate in its turn any charge of wet guncotton, without leaving any traces of unburnt explosive or residue. The composition is very stable and stands an excellent heat test. At Ridsdale, the explosive experts of the British War Office witnessed a series of experiments with this material. The main bursting charges of a shell were made by a new process introduced by the company, whereby changes can be formed in one block instead of being built up of smaller pieces. The first trial consisted of ten rounds from a 6-pounder quick-firing gun. The total weight of each shell was 5 pounds 10½ ounces, the weight of wet guncotton bursting charge being 3.5 ounces, and that of the explosive in the safety exploder 138.8 grains. The shell was fitted with the ordinary Hotchkiss fuse, Mark IV. The target was a ¾-inch steel plate, and the range about 150 feet, and arrangements were made for securing the fragments of the shell. A 7½-ounce charge of ordinary cordite was used. The weight of the pieces of shell recovered on these ten rounds varied between 4 ounces and 8¾ ounces, and the number of pieces ranged between 81 and 337. Of three rounds the chamber pressure and muzzle velocity were respectively 11.28, 12.26 and 12.39 tons, and 1,800, 1,827 and 1,838 foot-seconds. A second experiment consisted of the bursting of a 6-inch shell at rest in a closed cell in order to show that the exploder would work without shock of impact at short range. The wall of the cell was burst open by the force of the explosion of an ordinary cast shell weighing 119½ pounds, fully loaded. The fragments recovered numbered 2,122 pieces, their total weight being 65¼ pounds. The wet guncotton charge weighed 6 pounds 9 ounces, and the explosive composition in the exploder weighed 10.5 ounces. The fuse was of the ordinary direct-acting pattern, and was fired electrically. Further trials showed that wet guncotton with this new safety exploder can be fired through the thickest armor plate without exploding until it had passed through.

A New Magazine Rifle.

It is said that the Danes have adopted a new magazine rifle for naval and military purposes. It fires, on the proving ground at least, at the modest rate of fifteen rounds a second, and allowing for reloading, 300 a minute. The magazine holds thirty cartridges. It is heresy, we suppose, to say so, but we are of opinion that there is an unnecessary fuss made about rapid-fire rifles. They have to be aimed to be of much service, and the time to aim cannot be reduced. The Danes, maybe, have read about the need of a ton of lead to kill a man, so propose to try and deliver the ton as quickly as possible. But, as the utmost a soldier can carry is 300 rounds, and supply is not easy in real war—ashore or afloat—there seems a fair chance of Danish warriors being short of their quota of the needful ton at critical moments. Afloat, this is beginning to be felt; and though the Vickers-Maxim firm, with the bare charge, have done much to save us feeling the "weight of ammunition problem," any advance in rapidity of fire seems likely to bring the problem back. Given a weapon that fires fast, men in battle are pretty sure to fire it as fast as they can.

Greatest Passenger Transportation in the World.

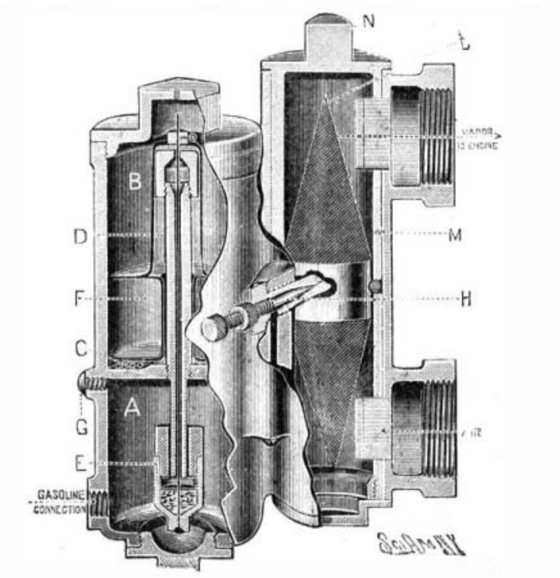
The elevated railroads of Manhattan and the Bronx are unmatched by any open-air steam railroad system in the world in the number of passengers carried each year. The report of the business done by these elevated railroads for the year that ended June 30 last shows that in that year 215,000,000 passengers (round numbers) were transported. It might have been added that they were transported without accident to one of these passengers excepting some trifling bruises.—Philadelphia Press.

AN IMPROVED VAPORIZER FOR GASOLINE ENGINES.

The cross-sectional cut of a gas engine vaporizer, or carbureter, seen in this column, shows very clearly its salient features, which are the invention of Mr. A. W. Olds, of Hartford, Conn.

The inventor's idea, in designing the vaporizer, was to do away with the needle-valve usually employed for controlling the flow of gasoline, and substitute for it an arrangement that would never fail owing to wear of the valve, such as sometimes occurs with the ordinary type. Mr. Olds had recourse to the difference in density of gasoline and mercury, in carrying out his idea; and the manner in which this difference is made use of, we will now describe.

The vaporizer is made up of two cylinders—the supply cylinder, filled with gasoline, and the atomizing cylinder, through which the air and vapor are drawn to the engine. The supply cylinder is divided by a horizontal partition, *C*, into two compartments, *A* and *B*, which are the gasoline feed chamber and the float-feed chamber respectively. A vertical tube, *D*, connects the two chambers, and a long, fine wire passing through this tube, is suspended from the bail of the float, *F*, by a collar and set screw, and carries at its lower end a cup, *E*, half filled with mercury. The gasoline, entering the small pipe hole near the bottom of the chamber *A*, rises through tube *D*, and, overflowing at its upper end, falls into chamber *B*. As this chamber fills, float *F* rises, carrying with it the mercury cup, *E*. When the surface of the mercury covers the bottom of the tube *D*, the gasoline forces some of



AN IMPROVED VAPORIZER FOR GASOLINE ENGINES.

the fluid up in the tube. This of course lowers the level slightly in the cup, allowing the end of the tube to become uncovered sufficiently for more gasoline to flow up in it, as a result of which the cup is again raised, and more mercury forced up the tube. A column of mercury is thus formed in the tube, and the gasoline bubbles up through it until its height becomes sufficient to balance the head of gasoline, when the latter will cease to flow. By this time the gasoline will have filled chamber *B* to within a short distance of the needle atomizer valve *H*, through which it is fed to the engine. When the engine is running, a small, steady stream of gasoline overflows from the top of tube *D* into the float-feed chamber, in order to keep up the level. That this stream is continuous, rather than intermittent, was demonstrated in a test made on a Westinghouse gas engine in the presence of the SCIENTIFIC AMERICAN representative.

Besides the mercury column for controlling the feed of gasoline to the float-feed chamber, the carbureter has a double valve in the vaporizing cylinder, for throttling the air inlet and vapor outlet. This valve consists of a sleeve *M*, adapted to be turned by a wrench on lug *N*. The sleeve has ports that match those in the cylinder proper, which are arranged with the lower one slightly smaller than the upper, so that there is always a slight vacuum in the cylinder, which tends to draw the gasoline through the needle valve *H*. By throttling both the vapor and air proportionately, the suction is always the same, and the mixture never varies, no matter at what speed the engine is run. The two wire gauze cones, *L*, serve to break up the gasoline and thoroughly vaporize it. These are not absolutely essential, however, and can be left off if desired.

The vaporizer is made of brass or aluminium, and will be found a most satisfactory article for use on all kinds of gas engines where absolute surety is wanted that there will be no leakage of gasoline. With it, an auxiliary shut-off cock is unnecessary, as the mercury column can always be depended upon for shutting off the gasoline flow when the engine stops.

Correspondence.

The Aerodrome.

To the Editor of the SCIENTIFIC AMERICAN:

My attention has been called to the communication of your Mexican correspondent, F. McC., in your issue of January 10, which is a fair criticism of the aerodrome illustrated by the writer in SUPPLEMENT No. 1399, for which is claimed the important characteristics of inherent stability and automatic control; also levity and translation through the air by a single physical action of aeroplanes operating under the simple law of the parallelogram of forces. He expresses the belief that the swivel support of the rider will not permit the rider's changing the plane of revolution of the aeroplanes by varying the center of gravity, and instances a floating barrel upon which a swimmer is trying to climb.

I may say that the reasonable assumption of your correspondent was anticipated and fully realized at the first conception of this type of machine years ago (caveat drawn in 1894), note taken, and provision made accordingly in such a way that, to a degree, a lighter, simpler, and cheaper combination resulted. A possibility was forestalled, and a fact, if fact it proved, curious as it may seem, was to be utilized to remedy a difficulty.

As to the barrel simile, your correspondent must admit that the boats and vessels of commerce, which approximate barrel shape, and probably descended from such primitive shapes, do not careen to such an extent as to render water navigation impracticable. Why? Because in the evolution of the art of boat building and operation, the tendency is minimized and rendered negligible.

It is hoped to show your correspondent and others whom it may concern, that notwithstanding his assumption of absolute prohibition, it will not be realized, or, more carefully stated, will not be apparent to a detrimental degree in the first machine produced, of the *type* illustrated.

As to steam power, it may be said this type of aerodrome lends itself to the adoption of steam prime movers very completely, and was so first designed, but set aside for a larger factor of safety. The trouble with it is, and always will be, the weight of water, or any substitute therefor, where lightness is a desideratum and considerable radius of action important. Condensation and the re-use of the water is, for the writer, entering too much into the refinements of this particular art at this stage. 'Tis best to follow the lines of least resistance. S. D. MOTT.

Passaic, N. J., January 12, 1903.

Irrigation in the Southwest.

There was recently begun in Texas what is planned to be the most extensive system of irrigation in the United States, for it involves the utilization of no less than 295,000 acres of land. A main canal will be constructed 100 miles in length, extending 30 miles from the town of Pecos in a southwesterly direction, crossing the Texas and Pacific Railroad 6 miles west of Pecos, and on to Toyah Lake, 7 miles south of Pecos, where one of the largest reservoirs in existence is to be constructed. From Toyah Lake the canal will run on and join the Williams Canal 30 miles farther down, finally emptying into the Pecos River 60 miles below Pecos.

The Cooper Hewitt Converter and Lamp in England.

The readers of the SCIENTIFIC AMERICAN are more or less familiar with Mr. Peter Cooper Hewitt's mercury vapor lamp. It will be gratifying for them to learn that it has met with no little favor in England. Lord Kelvin was unstinted in his praise of Mr. Hewitt's work. The Hewitt lamp, it will be remembered, resembles somewhat Macfarlane Moore's contrivance; but differs radically therefrom in the principle of its operation. Instead of employing rapidly alternating currents, Mr. Hewitt renders incandescent the vapor of mercury, for which purpose a low-pressure continuous current is employed.

Mr. Hewitt has also invented a new form of converter which it appears differs radically from the present machine for converting alternating currents into direct currents. In the course of his experiments with his mercury-vapor lamp, Mr. Hewitt evolved the present invention. From the meager details at hand we are unable to state precisely the form of the new converter, but we are informed that it is based on the discovery that certain vapors under peculiar conditions suppress certain portions of the alternating waves so as to change the flow into a direct current. The resulting current is pulsating, however, having the same frequency as the original alternating current. The apparatus is said to be very simple and extremely small as compared with the rotary converters now in use. It is also asserted that the new converter, in its present form, will handle voltages as high as 3,000, and that probably this figure may be increased to 10,000 upon further investigation and experiment.