longer ranges. Judged by the muzzle velocity and muzzle energy, the new United States weapon stands easily first; but judged by the standard of energy per ton weight of the gun, it will be seen that the Krupp weapon has a considerable lead. It would be interesting, in this connection, to note how Krupp obtains these results with a gun so comparatively light in weight. It is possible that this gun is constructed of nickel-steel, and that an abnormally high chamber pressure is allowed.

COMPARISON OF 12-INCH, 40-CALIBER NAVAL GUNS.

	Weight in tons of gun.	Weight in pounds of projectile.	Muzzle velocity feet per second.	Muzzle energy in foot-tons.	Foot-tons energy per ton of gun.
United States, Naval	53·7	850	2,854	47,994	893
German, Krupp	48·9	981	2.592	45,662	934
British, Vickers	50·3	850	2.600	39.848	792
British, Armstrong	50·8	850	2.580	39.233	772
British, Naval	50·0	850	2,481	36,290	726
French, Naval	45·9	644	2,625	30,750	670
12-INCH GUNS OF 35 AND 50-CALIBER.					
*United States Naval, 35-caliber	45·2	850	2.300	31.170	689
Krupp, 50-caliber	62·4	981	2.953	58,205	934
Krupp, 50-caliber	62·4	771	3.330	58,205	934

* Old pattern as used on "Iowa."

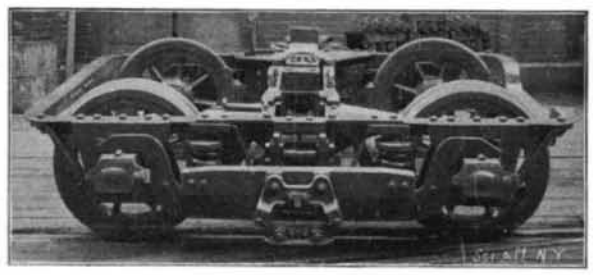
Following the table of the 40-caliber guns are placed three guns of 35 and 50 calibers, the first being the type of 12-inch gun at present in use in our navy, and the 50-caliber guns being two of the 1899 Krupp models, which the company state have actually been manufactured and tested with the results herewith shown. The enormous energy of 58,205 foot-tons is obtained in the first of these two weapons with a 981-pound projectile having a muzzle velocity of 2,953 foot-seconds, and in the second by a 771-pound projectile driven at 3,330 foot-seconds velocity, the energy of 934 foot-tons per ton weight of gun being, as far as we know, the greatest efficiency yet obtained with any gun, experimental or otherwise. As this gun is over 50 feet long, however, it is altogether too unwieldy for service on shipboard, at least according to the present accepted ideas on the subject.

THE THIRD-RAIL EQUIPMENT OF THE MANHATTAN ELEVATED RAILWAYS.

Experimental runs are still in progress with the new six-car motor train which has recently been completed for the Manhattan Elevated Railroads, and the results are so satisfactory that the traveling public may look for a vast improvement in the speed and frequency of the train service on this great system. The experimental train is made up of four standard 18-ton cars and two 35-ton motor cars, one at each end. The motor cars, as far as passenger equipment is concerned, are duplicates of the ordinary cars, but the front end of each consists of a roomy cab with glass on the front and sides, and doors opening into the cab from the side and from the aisle of the car. One of our illustrations is taken from the front of the cab, another shows the motorcar and train, and a third represents one of the motor trucks and shows the sliding shoe by which the current is received from the third-rail. This rail is carried outside the tracks, and is safeguarded by two deep longitudinal guard-rails.

The two motor cars, each of which weighs 35 tons, are strengthened beneath the floors by longitudinal plate steel sills, which, it is claimed, will prevent telescoping in case of end-on collisions. Each motor car is equipped with four 150 horse power General Electric motors, one on each axle of the trucks. The eight motors are operated in parallel, the current being controlled by an equalizing switch in the cab, which performs the same function as the equalizing bus-bars in an electric power house. The placing of the power at the ends of the train has the advantage of providing a more even motion in starting, the combined pull at the front and push from behind getting rid of the uncomfortable jerking effects which are at present noticeable on elevated trains. Current is taken from the third-rail by means of the shoe of the front motor truck, and, after passing through the motors in the forward car, is carried by insulated wires to the motors of the rear car. The third-rail is of very heavy section, 100 pounds to the yard, and it was rolled with a special view to its electric conductivity.

The train is fitted throughout with the air brake,



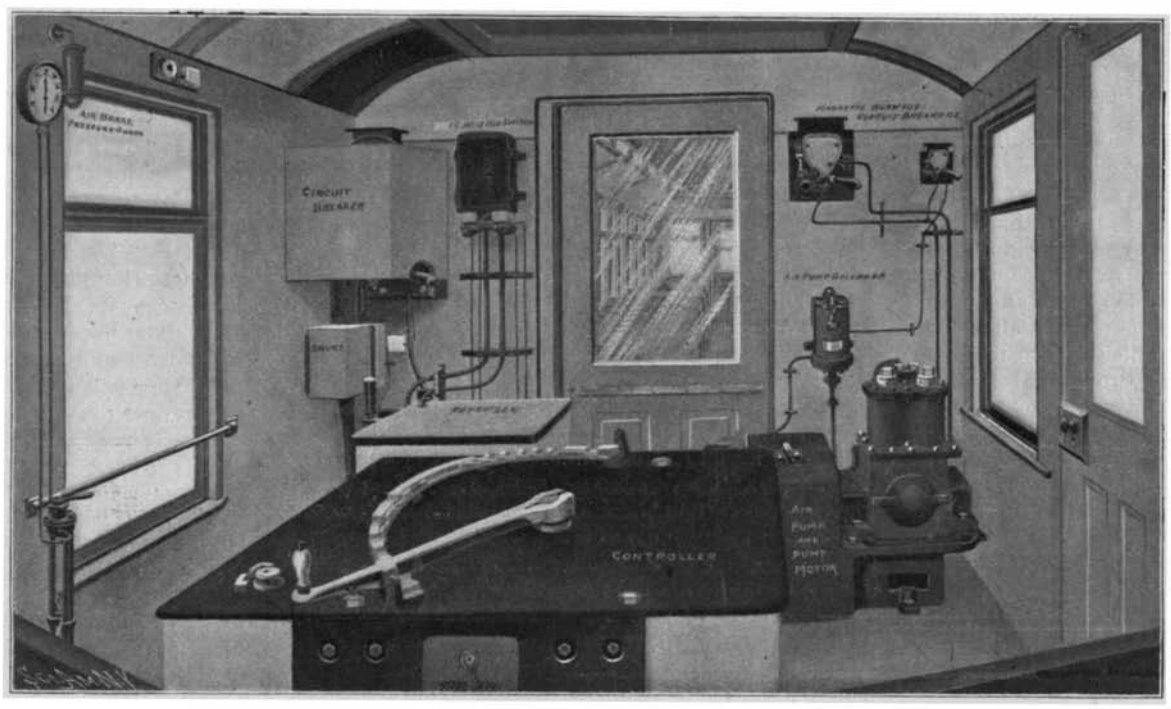
A Motor Truck, Showing Third-Rail Contact Shoe.

which, when the whole road is equipped, will replace the vacuum brakes now in use on the elevated trains. The air brake is of the standard type used on trunk roads, with the difference that the compressors are operated by an electric motor which is automatically controlled by the air pressure. The electric pump and air pump governor are clearly shown in our drawing of the cab. The governor consists of an air cylinder and piston with a vertical stroke, which is so arranged that when the pressure rises to the working pressure of 90 pounds to the square inch, the piston is driven upward against the pressure of a helical spring, and opens a switch controlling the pump motor. As the pressure falls, the springs drive the piston down, and a suitable connection closes the switch and starts the pump. Above the air pump on the rear wall of the cab are the circuit breakers, the one to the left controlling the heat and light of the cars, and the small one to the right controlling the air pump motor. The main circuit breaker is located on the opposite side of the cab, and adjoining it is the equalizing switch already referred to. Below these is the reverser for use in an emergency stop. By throwing over the lever, the current is reversed, and the whole force of the motors is employed to check the train. The controller is located immediately below the front windows of the cab. The air brakes are sufficiently powerful to stop the train, when it is running at the rate of 35 miles an hour, within three or four car-lengths. The reverser and the powerful air brakes combined render the possibility of a collision very remote.

The highest speed of trains will be 35 miles an hour. The averagespeed, including stops, will, of course, vary with the conditions, being lower where the stations are frequent and the traffic heavy, and higher when traffic is light or the stations more widely separated. How great the acceleration will be is best shown by the authorized statement of the company that the present running time of forty-nine minutes between the Battery and One Hundred and Fifteenth Street on the Sixth Avenue line will be reduced to about forty minutes.

For the present, power is being furnished from the Sixty-sixth Street station of the Third Avenue Railroad, a 500-volt current being used at the motors. A large power house is being erected at Seventy-seventh Street for the service of the whole system, which will have a maximum capacity under overload of fully 100,000 horse power. It is estimated that 400 motor cars will be required for the equipment of the whole system; and as the trusses of the elevated structure have lately been thoroughly overhauled and strengthened, they will be in thoroughly fit condition to stand the heavier loads and higher speeds of the new service.

The New Motor-Car and Train.



Interior of Motor-Car Cab.

THIRD-RAIL EQUIPMENT OF MANHATTAN ELEVATED RAILWAYS.

Telegraphing and Telephoning Simultaneously.

The Rysselberge system of telegraphing and telephoning simultaneously over a single wire is meeting with considerable success in Germany, the Berlin fire brigade being equipped with it.

There are fifteen brigade stations in Berlin, each of which is served by a special network of fire alarms. From these stations underground wires radiate in all directions, each wire being connected with a great number of alarm pillars. The alarms are arranged for automatic working, and to each is fitted a key for telegraphing to the station. As it is, however, a very great advantage to be able to maintain during the progress of the fire a good connection between the alarm pillars nearest the fire and the brigade station, exhaustive trials have been made with a specially adapted telephone which have resulted in the general introduction of the same. To the Morse apparatus at the station a stand is attached, from which a microtelephone fitted with a battery switch and a second receiver are suspended. The remaining apparatus is inclosed in a flat box and placed under the table. This box contains an induction coil, a condenser, and a circuit key. As it would be expensive to equip each of the fire-alarm posts with telephone apparatus, a portable set is used, which may be attached to the posts by means of a plug and socket provided for the purpose. Such a portable set is carried by each of the brigade carts, there being some eighty now in use. The brigades' cycles are also equipped with sets which are very compact in design. Experience with the system has shown that the switching in of the telephone apparatus in no way influences the telegraph service. During simultaneous telegraphing and telephoning a slight knocking is perceptible in the telephone, which, however, does not destroy the audibility.

THE assay authorities at Birmingham, following the example set by London and Manchester, have decided not to stamp any hollow gold articles in future, where the thickness of the gold is less than No. 36 gage. This decision will seriously cripple the cheap trinket and mock jewelry trade, where the keenness of the competition has resulted in the employment of rolled gold of such extreme thinness that the presence of the gold can scarcely be detected.