the eye sockets are filled with wet tow in order to soften the lids. On the following day the tow is removed and the eyelids rounded. Glue is then applied to the interior of the eye sockets and glass eyes are inserted—yellow, blue, red, brown, or black, with round or oval pupils, according to the species. As commercial glass eyes made for the same species often vary in size, they must be carefully measured and assorted into pairs of eyes as nearly alike as possible.

The preparation of birds is less difficult than that of mammals, but the preservation of their brilliant colors necessitates certain precautions. If stained with blood they are first washed with soap and water, dried with a fine towel, and dusted with plaster. When this has hardened it is removed, and the operation is repeated until the feathers have regained their original luster. Bird lime is removed by rubbing with olive oil or fresh butter, scraping with the scalpel, washing successively with strong potash lye and pure water and drying with fine plaster. The removal of grease exuding from wounds demands still greater care. Several methods are given in technical works. The best, according to Boitard, consists in brushing the spot lightly with turpentine and washing it successively with potash, alcohol, and water. If all this fails, the damaged feathers must be replaced by feathers taken from another bird of the same species.

The cleaning finished, the bird must next be carefully measured before skinning, in order to preserve the correct proportions in the mounted specimens.

In France, the incision needed for skinning is made along the median line, from the gullet to the abdomen. The skin is detached with the scalpel, scraped to remove grease and bits of flesh, and brushed inside with arsenical preservative.

After it has received a skeleton, consisting of a wire running from the head to the tail, with branches for the wings and legs, the skin is stuffed, beginning with the neck. The bird is now said to be "*en peau*," or "in its skin." If not mounted at once it is wrapped in paper to protect it from insects, dampness, and, as far as possible, desiccation. If it is kept for several months it must be softened before mounting, in order that it may be posed effectively, with wings raised, tail spread, etc. Whatever the attitude chosen it is maintained by linen bandages until the specimen has become quite dry.

The bills of some birds, notably the immense bill of the great toucan, fade slightly after death and must be retouched. The same applies to the brightly colored feet of certain species.

Snakes are usually extracted from their entire skins through the throat, but first, if the species is venomous, the fangs are drawn and the poison glands are seized with pincers and cut off with scissors as close to the jaw as possible. Sometimes it is necessary to make an incision a few inches long in the belly in order to remove all the flesh and viscera. After the skin has been treated with preservative it receives a spine made of wire wrapped with tow and is then stuffed, sewn up, and bent into the form desired. It is next washed with water or alcohol, dried with a towel and freshened by brushing with turpentine. After receiving glass eyes, wax poison glands, artificial fangs, and a coat of varnish it is ready for exhibition. Lizards are prepared in a similar manner.

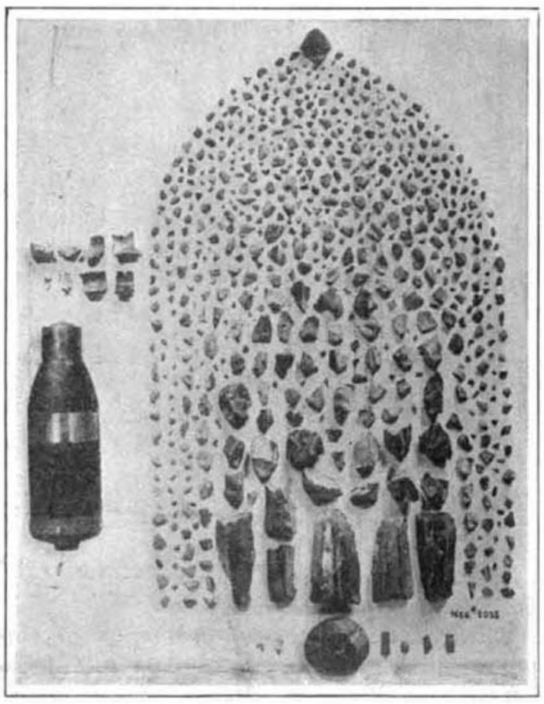
Large fishes, such as the shark and the dogfish, are also treated in nearly the same way. Few small fishes are mounted in France, because there is at present no known method of preserving the brilliancy of their metallic colors. French taxidermists, therefore, prefer to preserve such specimens in alcohol or to prepare and mount their skeletons, which they do with rare skill.

Such, in brief, are the methods now employed in French taxidermy, which tends more and more to become a highly artistic science.

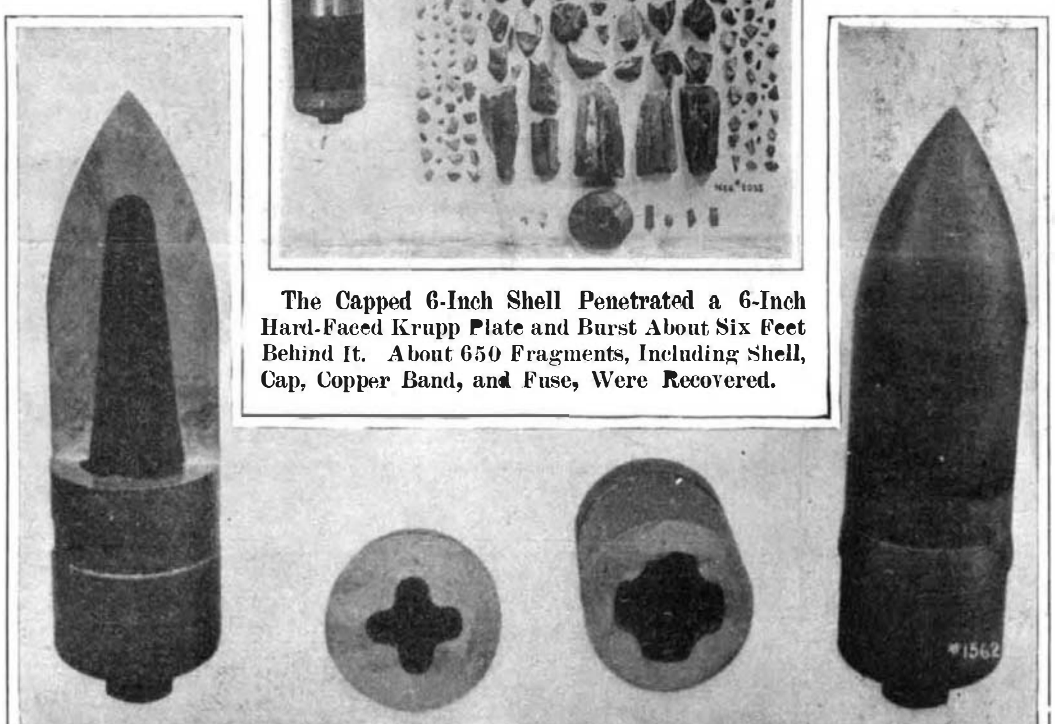
What is said to be the highest dam in the world has been built on the Salt River, Arizona, and will submerge and completely obliterate the town of Roosevelt. The work is well under way, and it is expected, says the Iron Age, that by 1908 the town will be 172 feet below the surface of the water. It is expected that the head obtained will be the means of securing abundant power. A temporary power plant, a cement mill, ice plant, lighting plant, and saw mill have been completed. A telephone line has been installed to the head works of the power canal, 18 miles above Roosevelt, and extended in the other direction to the site of the great dam, which is 30 miles from Phœnix.

NEW TYPE OF ARMOR-PIERCING SHELL.

We show illustrations of a new type of armor-piercing shell which was tried recently at the proving grounds of the Bethlehem Steel Company, makers of the shell, and gave remarkably good results. The problem confronting the manufacturer is to make a shell and fuse which will penetrate modern face-hardened armor, and burst after it has passed through the armor and is within the ship or fortification, as the case may be. Three elements enter into this problem. First, to protect the head of the shell while it is forcing its way through the intensely hard, carbonized surface of the plate, and prevent it being shivered into fragments; secondly, to provide sufficient strength in the walls of the body of the shell to prevent their collapsing or crumpling up under the momentum of the after body of the shell; thirdly, to provide a fuse which will automatically delay its action until the shell is just clear of the plate and explode the charge at the critical moment, scattering the fragments



The Capped 6-Inch Shell Penetrated a 6-Inch Hard-Faced Krupp Plate and Burst About Six Feet Behind It. About 650 Fragments, Including Shell, Cap, Copper Band, and Fuse, Were Recovered.



The 6-Inch Capped, Ribbed-Cavity Shell Which Was Loaded with Black Powder and Exploded Six Feet Behind a 6-Inch Kruppized Plate.

NEW TYPE OF ARMOR-PIERCING SHELL.

among the crew and upon the light interior structure and mechanism of the ship or fort.

The lower photograph shows longitudinal and transverse sections through a 6-inch armor-piercing shell of the new type above referred to. It will be seen that instead of a circular cross section the interior wall has a ribbed outline. The ribbed form is adopted because of the belief that these shells are stronger for penetration and better able to withstand deformation or complete breaking up. The upper photograph represents 650 fragments, including shell, cap, copper band, and fuse, which were recovered from a 6-inch capped armor-piercing ribbed cavity shell loaded with black powder after it had passed through a 6-inch Krupp plate and burst about 6 feet to the rear of it. The original weight of the shell empty was 102½ pounds. The total weight of recovered fragments was 94 3-16 pounds. The weight of the largest fragment recovered was 10¼ pounds, and the average weight of the fragments was 2 5-16 ounces. We are informed by Mr. John F. Meigs, to whom we are indebted for our information and photographs, that not only have the ribbed projectiles proved better able to withstand the heavy end-on pressure, but the number of fragments into which the shell is burst is greater than when the shell cavity is circular.

A PUZZLING BIT OF FOUNDRY WORK.

BY C. METCALF.

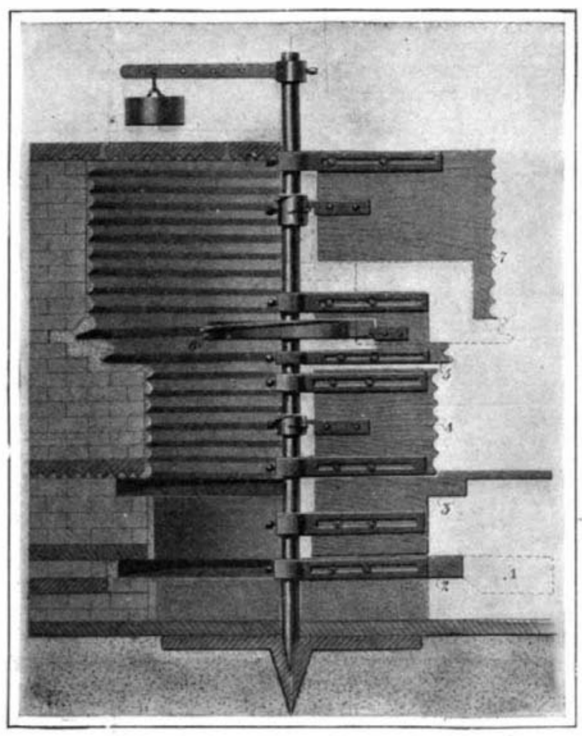
The job foundryman, whose work is usually of the most varied sort, occasionally meets with a particularly knotty problem. A case in point is illustrated in the accompanying engraving, which is a photograph of a double, grooved drum, recently made by the Metcalf Iron Works in South Brooklyn. It measures 5 feet 6 inches on the larger diameter, 4 feet on the smaller diameter, and is 4 feet 9 inches deep. The drawings and specifications for the drum were rather meager, but the work did not promise any special difficulties. However, the apparently simple drum proved to be much more troublesome than we had imagined it. This was due to the fact that a connecting groove was required between the two drum faces, also that a deep flange was necessary at each side of the groove to prevent the cable from slipping off when winding from one drum face to the other. No patterns for the drum were supplied, and the only thing we had to work from was a single blue-print. Our method of procedure is illustrated by the accompanying engraving, which is really a composite view showing at the left half a section of the mold after being struck up, and at the right half the sweeps used in forming the mold. The process of loam molding, while common among founders, may not be familiar to many of the readers of the Scientific American, and may, therefore, need a somewhat detailed description.

First a spindle plate was laid and a "transient" or removable spindle mounted to turn in a bearing in this plate. A board or sweep was secured to the spindle by means of a strap, and the spindle was then revolved so as to sweep up a bed for the bottom plate. On this plate the brickwork was built. The sweep 1, shown by broken lines in the engraving, was now used for striking up a bearing for the lifting ring. This sweep was fastened to the board 2, which was later used to strike up the recess for the lower flange of the drum. A "crab-iron" was laid over this flange, and the brickwork was carried up to the height of the second flange of the drum. This brickwork was well plastered with wet loam and then the board 3 was used to sweep up the belt face of the drum as well as the upper flange and the bearing of the next plate. The sweep 3 was now removed and sweep 4 was secured to the spindle. The outer edge of this sweep was cut, as shown in the engraving, to form the spiral groove called for in this portion of the drum. This edge was protected while building up the brickwork, by means of a strip of wood bolted to the sweep and overlapping it a fraction of an inch. The overlapping strip served as a gage for laying the bricks at the proper distance from the sweep. After the bricks had been well plastered with loam the protecting strip was removed, the set screws fastening the straps to the spindle were loosened to permit axial movement of the spindle, and the sweep was supported by a "finger" bolted thereto, and resting on a spiral thread or worm formed on a sleeve which was secured to the spindle. The sweep 4 was now revolved about the stationary spindle and was caused by the worm to follow a spiral course, forming in a single turn the entire spiral groove of the smaller drum face.

The process followed thus far is not unusual among founders. It was the next step that called for originality. The connecting groove leading to the larger drum required not only a spiral thread, but a scroll or snail to carry it from the smaller diameter out to the larger one. A snail cam was therefore made of the form shown in the photograph. On the edge of this cam a thread was formed of the same pitch as that of the worm, namely, 2⅝ inches. The layout of this thread was in itself quite a difficult task. The cam was made of wood, and the thread was smoothed up with a little oil and lead. Board No. 5 was now set to engage this cam 6, which was secured at the desired position on the spindle. The board was attached to a pair of straps by means of bolts adapted to slide in slots in these straps. This permitted the outward movement of the board, while the straps were free to slide on the spindle to allow for the necessary axial movement. A single turn on the stationary cam carried the sweep up to the position shown by dotted lines, thus completing the connecting groove. To insure easy working of this sweep a rope was tied to the outer end of the upper strap and fastened to a collar at the top of the spindle so as to support the weight of the sweep. After the connecting groove had been completed, another difficulty arose due to the flange called for at each side of this groove. If the groove were continued on the same pitch, one of these flanges would be cut away. The only solution of the difficulty was to change the pitch for the first turn of the groove on the upper drum face. The thickness of the flange called for was one inch. Hence, a worm of 3⅝-inch pitch was made and secured to the spindle. One turn was then made with this pitch after which the remainder of the groove was struck up with board 7, which was operated like board 4 on a 2⅝-inch pitch.

The spindle was now removed and the mold or "cope," as it is called, was lifted from the "drag" or bed. This was done by making fast to lugs on the lifting ring. The grooves were smoothed up and blackened, then treated with a coat of molasses water and lead and the mold was finally baked. The other details of the operation need no explanation. The core was swept in segments of one-sixth of a circle and pieces were bolted onto the sweep which could be taken off when a core was made so as to get the proper thickness at the connecting groove. The total weight of the casting was 7 tons.

A Double-Grooved Drum and Cam Used in Striking Up the Mold.



Method of Striking Up the Mold.

A PUZZLING BIT OF FOUNDRY WORK.

THE WALSCHAERT VALVE ON AMERICAN LOCOMOTIVES

America's contribution to the development of the steam locomotive during the past twenty-five years has consisted chiefly in a very successful effort to develop its power and keep pace with the ever-increasing demand imposed by heavier rolling stock and longer trains. Only those who have closely observed the growth of the locomotive have any idea of the extent to which its hauling power has been increased; and for many years past we have been far in the van among the great locomotive builders of the world in this one particular. We were the first to insist upon the fact that, whatever changes and improvements might be made in cylinders and general running gear, whatever type of driving-wheel arrangement might be used, the ultimate factor that will determine hauling capacity is boiler power. The result is that to-day, in spite of the fact that foreign builders have followed our lead and are everywhere increasing the size of their locomotive boilers, it is in this country that the most powerful engines are to be found. In the great mountain-climbing locomotive, now at work on the Baltimore & Ohio Railroad, which is capable of exerting a tractive effort of 42 tons at starting, and from 30 to 37½ tons at moderate speed, we have a locomotive which is not only by far the most powerful in existence, but has proved itself, in spite of its enormous weight and many novelties of design, to be an exceedingly satisfactory investment.

At the same time, in our effort to obtain power we have rather neglected the question of efficiency, whether it be sought in the direction of details of boiler design, in the use of superheaters, or in the refinement of the valve gear. This matter, however, is now receiving the attention of the master mechanics of our railroads and our leading locomotive builders. A notable improvement, which is making its way quickly in favor, is the introduction of the famous Walschaert valve gear, which has been doing such splendid work on continental railroads. It forms the characteristic feature in the handsome locomotive which we herewith illustrate, which has recently been put in service by the Pennsylvania Railroad Company, and assigned to the important duty of hauling the crack eighteen-hour train of that company that runs daily between New York and Chicago. A study of the photograph shows how the motion is transmitted from a supplementary crank on the outside of one of the driving axles to the valve. Those who are familiar with the Atlantic type of express engines which have been hauling the fast trains on this system for the past few years will see that the new engine, except for the valve-gear connections, is built on the same general lines as its predecessors. It is a simple engine with two outside cylinders 22 inches in diameter by 26 inches stroke, connected to four coupled driving wheels 80 inches in diameter. The boiler is run under a working pressure of 205 pounds to the square inch. The maximum tractive effort at starting is 25,800 pounds.

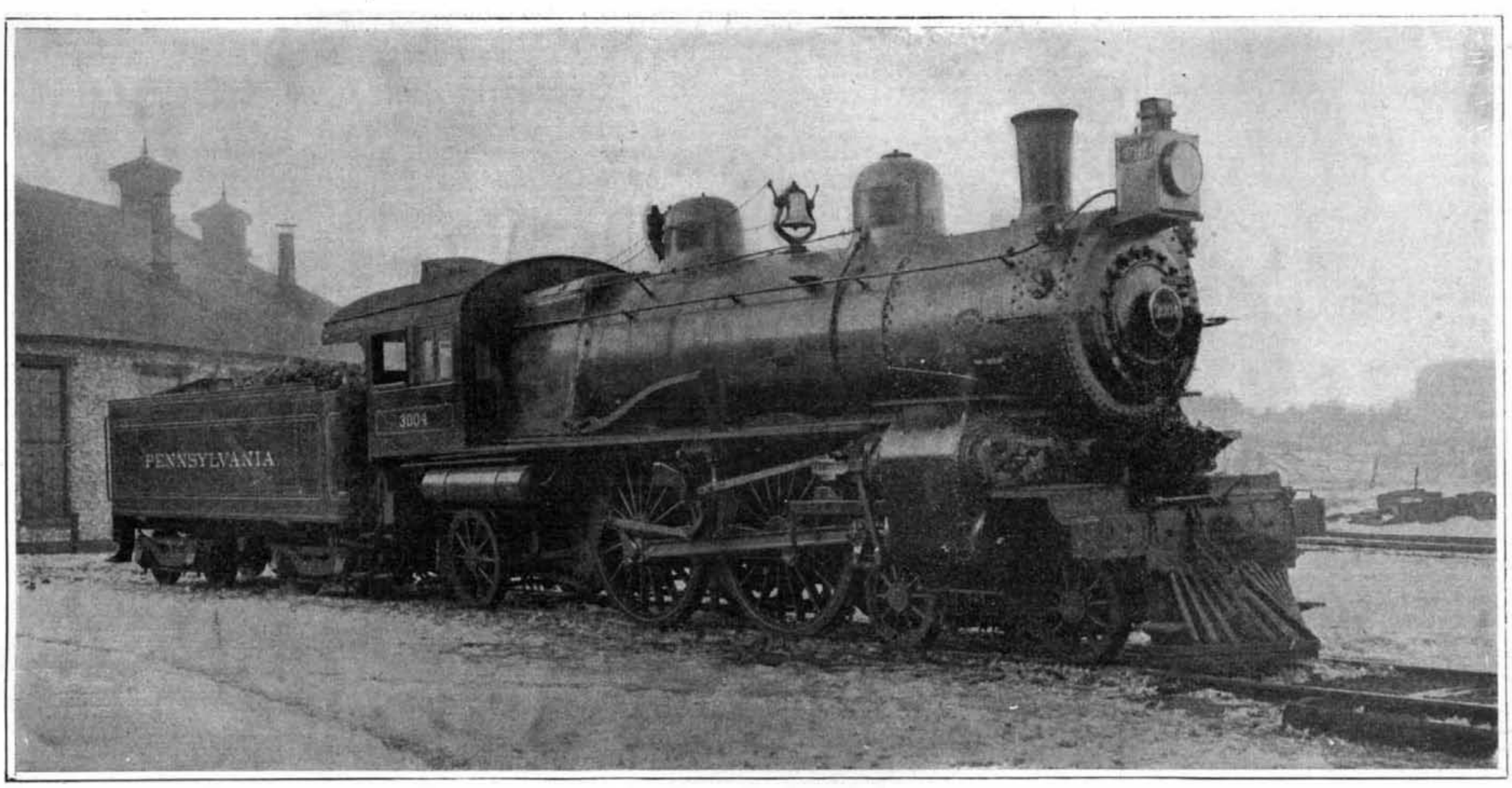
The Walschaert gear is not by any means a new device; in fact, it belongs to the earliest days of locomotive history, having been in use since the year 1844. About 90 per cent of the main line locomotives on the continent of Europe are equipped with it, and it was shown on twenty-five out of thirty-one locomotives exhibited at the Liége Exposition. As compared with the Stephenson gear, there are some advantages of steam distribution and control; but it is equally, if not more, on account of the advantages which it offers from a constructive and operative point of view that it has won its way to recognition by the leading manufacturers. It is more accessible than the Stephenson gear, especially on large locomotives on which the eccentrics are necessarily crowded and difficult to get at except when the locomotive is over a pit. Also in a heavy passenger engine there is a saving of as high as 1,745 pounds over the Stephenson gear. The Walschaert gear is also more direct in its action, the power being transmitted to the valve in comparatively straight lines instead of by rocker arms, shafts, etc., which are more or less yielding and liable to spring. It avoids the wear which is involved in the use of large eccentrics, to say nothing of the lost motion resulting from the rapid deterioration that occurs in the Stephenson links. Incidentally, moreover, the removal of the valve gear to the outside of the frames renders it possible to give the latter more efficient bracing.

Phototegy.—Something New in Photography.

"The Illustration (Paris) describes as follows a very curious process of photographic development called 'phototegy' (from the Greek signifying 'to dye'). Cleansing the plates with oxygenated water had already been tried, but the results obtained were both slow and irregular. The following formula expedites and regulates the action peculiar to this liquid, which is to remove from the negative thicknesses of gelatine proportionate to the opacity of the parts reduced, i. e., attacked by the light:

Water	100 cc.
Muriatic acid	10 cc.
Bioxide of barium	4 gr.

"We should exclude too astringent developers, and employ by preference ferrous oxalate or diamidophenol. After development and washing, the glass is placed in the solution of oxygenated water (in broad daylight, if we wish). The blacks come off in a few minutes, and we obtain directly a foundation composed of reliefs. The picture naturally absorbs quantities of coloring liquid proportionate to the thicknesses of the gelatine. We may then by a subsequent dipping give to the plate the hue that we desire; we shall be able, further, to obtain proofs of it upon paper by simple contact. Finally, in coloring the plate by brush with uniform tints the handling of the shades will be obtained automatically."



NEW PENNSYLVANIA EXPRESS LOCOMOTIVE FITTED WITH WALSCHAERT VALVE GEAR.

Cylinders, 22 inches diameter by 26 inches stroke. **Drivers,** 80 inches diameter. **Steam pressure,** 205 pounds. **Maximum tractive effort,** 28,500 pounds.