THE MANUFACTURE OF "GREENBACKS."

The following description of the mode of manufacturing Government money appears in the Washington correspondence of the Cincinnati *Gazette*:—

To obtain access to the note-printing bureau requires a pass from the Secretary of the Treasury himself. For obvious reasons, it is a privilege rarely granted, and never except under the most thorough surveillance. No lady not employed upon the work is ever permitted, under any circumstances, to enter that part of the department. If for no other reason, the crowded machinery would make it dangerous.

THE MACHINE-SHOP

is the first room we enter. It is supplied with forges, lathes, planes and drills, capable of doing all the repairing necessary to be done to the machinery of the building, and to the setting-up and working of such new machines as are demanded by our extensive paper circulation.

THE PAPER MILL,

though not as extensive as one for general manufacturing, is sufficient for all the labor required in making the note-printing paper.

The manufacture of a paper combining the qualities of wear, and being splitless and unphotographic, was a much desired desideratum. Accordingly, it was resolved to make some experiments, which were entrusted to Doctor Gwynn. He has produced a paper as firm as parchment, smooth as satin, and of a combination of materials known only to himself, and secured to the exclusive use of the Government. He has introduced into it a fiber which cannot be photographed without discoloring the paper to which impressions may be transferred, giving it the appearance of a coarse, black spider-web. Being molded into the body of the paper, it is impossible to erase it, and it must be a great preventive of counterfeiting by the photographic process, which has lately been the most successful.

THE INK MILLS

are six in number, for making as many different colors. Each one is called a four-horse-power mill, though the whole six are driven at the same time by an engine which one could pick up with one hand. It not only turns these mills, but at the same time runs three Hoe-cylinder presses. It was made in the machine shop of the department, and derives its force from its great boiler capacity.

THE ENGRAVING ROOM

is of more interest than any we have yet been in. Here science and art are both displayed to perfection. There is, perhaps, no engraving so fine and requiring so much time to execute as that on the plate now being prepared for national note-printing. One, the size of a bill, on which the workman has been employed almost a year, is a copy of one of the paintings in the rotunda of the Capitol. The figures were of exquisite proportions, and the water-lines, though plain, extremely delicate in their tracery.

With the single plate, as it comes from the hands of the engraver, it would be impossible to do the printing required, and, as it is equally impossible to have a number of plates engraved, it becomes necessary to repeat them in another way. This is done in the following manner:—The engraving is done on a plate of soft steel just the size of the bill or bond, and the cuttings are indentations. When finished, the plate is hardened and taken to a "transfer press," where a roller of soft steel, just of a circumference to take in the size of the plate, is rolled over it, under heavy pressure, leaving the impression on the roller in a raised form. This roller is in turn hardened, and then any number of flat plates similar to the original are prepared, and receive in like manner the impression from this roller, and become *fac-similes* of the plate engraved; and we have produced in a few minutes what it has taken months with chisel and eye-glass to make!

THE PRINTING

is now done on the old-fashioned engraver's press, being nothing more than a simple iron roller, covered with cloth and paper, to press the printing paper into the indentures, placed in a strong frame, and turned back and forth by hand, by spokes placed in the end of the roller. Two persons work at each press, a man and woman, the former attending the plate, the latter the paper. The plate is kept warm while working, by a gas heater. The sheets, when printed, are each laid between other sheets of thin brown paper, to keep them from blurring, and sent in hundreds to the drying-room. The first process of bond-printing is numbering the coupons and the denomination with a yellow mordant, and as they fly from the press they are bronzed, as they appear when issued.

Yellow is used because it cannot be photographed without showing too plainly to be mistaken, as was remarked about the fiber in the paper. This discovery was made in the following manner:—When Mr. Clark was at the head of the Bureau of Construction, he had a map made for military purposes, which it was necessary to repeat. It was photographed, and an obscure road marked with a faint yellow line was discovered to be black in the copies. He then photographed a specimen sheet of inks or paints, and, of all the colors, except black, yellow was the only one which might not have been altered with ease with a touch of the brush. It was black as the black ink itself. Hence any attempt to photograph this color will only lead to the discovery—and, as it is the ground-work of bonds and other securities, and covered by the printing, it seems another security against fraud.

THE SERIES-NUMBERING

is the last process before trimming. The work is done by women, the machines being worked by a treadle. The figures are placed in the edges of six disks, placed side by side, and fastened to an arm worked by the treadle, something after the style of a Wheeler & Wilson sewing machine. The disks are turned by a ratchet, and will number from 1 to 999,999. For consecutive numbering, a little hook is attached to the ratchet, and the machine shifts itself. Otherwise, the disks are turned by the number.

THE TRIMMING AND CUTTING

was formerly done by hand, and of course very imperfectly and laborously. There were two things to be overcome in cutting by machinery—the inequality of the registry and the shrinkage. It was desirable that the edges should be trimmed, so they would wear well. If cut with a straight knife they would be beveled one way. As they are now cut, with circular knives, they have an edge beveled both ways.

The greenbacks are printed four on a sheet. One machine trims the margins, and another separates them. This latter is an ingenious contrivance. It slits them very fast, and lays them regularly in a box, each series of numbers separately. The notes are lettered A, B, C and D, and the numbers on each are the same: therefore it is essential they should be kept carefully apart. Each of the boxes that receives them has a movable bottom.

When the cutting for the day first commences, this bottom is near the top of the box, but as the cutting progresses and the number of the bills increases, a ratchet lets the bottom drop the thickness of a bill, so the box is kept just so full all the time, to make the bills slide in without doubling. It is intended that the cutting should be a criterion by which to judge of the genuineness of the bills, for every one must be the same width and length. If the end of a bill be placed on the center of another, there will be found no difference in the width—an exactness which cannot be given by the hand.

The currency-cutting machine is more complicated, as it cuts both ways, and files them in bundles of five dollars each, and I am not sure but it binds and seals them.

WET PRINTING

is the process now used in this establishment. The wetting is done by cloths instead of by dipping or sprinkling, as in newspaper printing. A room is prepared especially for this, with iron weights for pressing. Each man has his particular place assigned him; and all work in harmony, and with precision and celerity. Ordinary bills are wet and dried three times during the printing; but this process will soon be done away with, for preparations are being made to substitute.

DRY-PRINTING

in its stead, in which there will be at least two advantages—speed and better work. To do this some eighty heavy hydraulic printing presses are being set up, when what is called dry-printing, or printing on dry paper, will for the first time be successfully performed. There is a very perceptible difference between the present way and the one to be substituted. Specimen sheets show a clearer impression and a remarkable distinctness with which the faintest water-line is made to stand boldly out. This process, which is entirely new, has only been introduced after the most vehement and virulent opposition.

All sorts of stories were circulated of the building being crushed down, of there being an impossibility to take with a machine more than seventy-five impressions per day, and a hundred others of a similar character; but inviting men of judgment and skill in machinery to test the feasibility of the plan, Mr. Chase went on and instructed Mr. Clark to continue the experiments and perfect the system. The first tests were made with hand-pumps. Machine-pumps are now being rigged, and the whole will soon be in motion. There has been added to the pressure of the pumps a regulator in the shape of a weight, which is intended to take up their lost power as their force is exhausted, thus keeping up nearly the same pressure all the time.

THE CHECKS AND SAFEGUARDS

upon every one employed in this department, from the chief down to the lowest laborer, operate at every turn. Not even a blank sheet, much less a printed paper, is passed from one hand to another without being counted and receipted for, and unless there is collusion from one to another through every process through which the paper has to pass before it is money, through the entire range, there cannot be an over-issue. The paper is issued from one room, and is re-issued from that room sixteen or eighteen times before it is put into circulation; being counted, charged, and re-receipted for each time, and re-counted, re-charged, and receipted for through each process that it passes after leaving this room.

Five hundred persons are employed in note, bond and currency-making. It would seem as if this number ought, in a month's time, to turn out money enough to carry on half a dozen such wars as we have on hand. But a million of dollars in notes of the required denominations to do the current business of individuals, is an immense pile of paper, and when it comes to hundreds of millions, they grow into small haystacks as to size. By the present process of printing each pressman takes about five hundred impressions per day, By the hydraulic presses, it is expected that from three to five hundred impressions per hour will be taken.

RULES FOR FIRING CANNON.

We find a few things that may interest some of our readers in the volume of "Ordnance Instructions," adopted and issued for the guidance of officers in the United States Navy:—

RIFLE GUNS.

It is essential—

1st. That the base of every rifle projectile, especially the Parrott, shall be thickly greased before entering the gun. For this purpose common pork slush, prepared by several washings in hot water, may be used.

2d. That the bores of all guns shall be frequently washed, the grooves of rifled guns cleaned of all residuum and dirt, and a moist sponge invariably used. After firing the bore should be oiled with a sponge.

The attention of commanding officers is especially called to this requirement; and the bureau desires that the action of Parrott's and other rifle projectiles fired under the above conditions, may be carefully observed and reported; for it is believed that nearly all the failures in actual service result from the grooves being filled after a few rounds with a hardened residuum of powder.

It is also necessary that the shell shall be close "home" on the powder, otherwise the necessary expansion will not take place, and the shell will tumble immediately after leaving the gun, utterly destroying its range and accuracy.

If, however, a considerable interval should be left between the charge and the projectile, the strain upon the gun would be greatly increased and it possibly burst. For these reasons the rammer handle should be marked to verify this important fact in case of any accident to the gun.

It is very important that dirt, sand, or other

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foreign substances should not be carried into the gun on the sponge or the projectile, or by the wind in batteries on shore.

In using guns on shore a canvas muzzle bag or a soft wad, or tight stopper of wood, suggest themselves as a means of security during the interval between loading and firing the gun. The cover or stopper might be removed, or left to be blown away at each discharge.

The longer the interval above alluded to, and the higher the elevation at which the gun is kept, the more important will be the precaution here recommended.

Much care is taken to give the projectiles uniformity of size, and if the powder is of suitable quality, those now supplied will almost invariably take the grooves. Should difficulty in this respect, however, be experienced from any cause, it may be remedied by separating the brass ring from the iron at three or four points of circumference. This should be done with a cold chisel, very slightly, and not so as to interfere with the loading. It is only necessary to sever the contact of the two metals.

It should be observed that the projectile slides in the gun with very little friction, particularly when greased. The gun should therefore be elevated and eased out when firing to leeward, that the shot may not be started from its seat. An experiment to test this, showed that running a 100-pounder out with the force of its crew against the forward heurter, the gun being level, started the shot forward nearly two feet. If the gun were fired with the shot in this position it would probably burst.

The 100-pounder and 150-pounder guns being, respectively, of the calibers of the 32-pounder and 64-pounder, spherical shot, and fired with the same charges, these shot may be fired from them with excellent effect, particularly on ricochet. The round shot should be sewed up in canvas, strapped to a sabot, or snaked between two gromet wads.

Both percussion and time fuses are supplied for these guns. When the object to be fired at presents a sufficient resistance, such as masses of timber or earth, ships, or solidly built houses, the percussion fuses alone should be used from rifled cannon. They will, however, frequently fail to explode the shell at long ranges, owing to the shell nor striking on its apex; or, if fired into loose earth, which checks its momentum too slowly to allow the plunger to strike with sufficient force.

It has been observed that "time" fuses burn with greater rapidity in shell thrown from rifled cannon. Being in front they are subjected to greater pressure from the air. A similar effect is produced when the fuse is confined under a water-cap, as in the naval time fuse. Hitherto no reliable time fuse has been arranged for rifled cannon.

DRIFT.

This is a deviation caused by the direction of the rifling, and is always *to the right* when influenced by the wind, and is always to be allowed for.

The *drift* is in practice confounded with the *deviation* produced by the direction and force of the wind, which may either annul or double it, according to whether it blows from right or left across the line of fire. At long range it is also necessary to consider the motion of the vessel across the line of fire. Suppose the vessel was moving at the rate of six knots, and the gun elevated to 50°, the time of flight would be by the tables, 18*s*., and the deviation arising from this cause would be upwards of 60 yards. It is therefore of great importance that the captain of the gun shall be carefully instructed in making this adjustment of the eye-piece.

The Sugar Beet in Illinois.

The *Prairie Farmer*, published at Chicago, Ill., gives the following account of the introduction of the sugar-beet into Illinois, and of the arrangements which are being made for the manufacture of the sugar:—

"There was a very general interest manifested throughout the North, in the experiments in the growing of sugar-beets and their manufacture into sugar, inaugurated in this State, last season, by the Gennert Brothers, at Chatsworth. We did what was in our power, to give the enterprise that position before the public that its importance demanded, and we know that very many men of capital watched its progress with eager interest, ready to embark in the business should it be clearly demonstrated to their minds that it was a success. As it is well known, the crop was successfully grown. The yield was all that was desired—the quality of the beets superior, and the cost of growing entirely satisfactory. On account of the scarcity of mechanical labor, it was impossible to secure and get ready for operation all the machinery necessary for manufacturing the large crop into sugar, though enough was done to satisfy those who examined into it most closely, of the feasibility of profitably growing the beet for sugar, upon our prairies. But the great public that, very justly, demands the strong proof of complete success, demonstrated by actual figures, of so many acres grown, at so much cost, and producing so much sugar, was not fully convinced, and hence the beet-sugar question is still an open one.

"But interest in the matter has not subsided, and further progress is closely watched. Messrs. Gennert's premises are frequently visited by gentlemen from various parts of the East, and there is much inquiry from all quarters concerning the prospects the present year. In order to keep our readers as fully posted as possible upon this subject, we recently addressed Mr. T. Gennert, the manager at Chatsworth, concerning it, to which he replies, that his present crop planted upon land where beets were grown last year, is in first rate condition, even better than last season at this date, and the beets far sweeter than at a similar stage of growth in Germany. Whether this is owing to the difference in the season, or to a somewhat different and better cultivation, he is not prepared to say. Everything so far, fully meets the promise given last year, of the perfect adaptability of prairie soil to the sugar-beet crop.

"With regard to machinery, Mr. G. informs us that with the exception of a single piece, everything is upon the spot, and most of it already in its appropriate place. The remainng piece is being made at St. Louis, and is nearly completed. He assures us that everything will be in complete running order by the time the beets are ready to work up, and that he has experienced help engaged to attend to each process in the manufacture. He intends to commence manufacturing early this season—certainly by the last of September—and thinks he shall be able to work up his entire crop of twenty-five acres, in about four weeks.

"Mr. Gennert also planted out last spring a large quantity of his beets grown in 1863 for producing seed. They did well and give every promise of a large yield. His idea is to experiment with this so as to compare the beets produced with those from imported seed, a quantity of which he expects to arrive as early as October or November. In order to test the value of home-grown seed, he will furnish to parties, binding themselves to faithfully report to him the result, a half pound package of each—his home-grown seed and the imported—at the mere cost of growing and of importation.

"For ourselves we can but repeat our former expressed conviction of the paramount importance of this enterprise considered with reference to its future bearing upon the agricultural and commercial greatness of the West, if successful, and our own unshaken faith in its final and speedy success."

BONES.

On the 31st of March a lecture was delivered on bones before the Society of Arts, in England, by Dr. F. Grace Calvert, F.R.S., F.C.S., from which we take some valuable extracts:—

BONES OF YOUNG AND OLD.

The composition of "green bones," or bones in their natural state, may be considered under two general heads, viz: the animal matters, consisting of a substance called osseine and a few blood-vessels, and the mineral matters, chiefly represented by phosphates of lime and a few other mineral salts. The composition of bones has been examined by many eminent chemists, but the most complete researches are those published in 1855 by Mr. Fremy, who examined bones, not only from various classes of vertebrated animals, but also from different parts of the same animal.

The first conclusion drawn by Mr. Fremy from these researches, is that he found a larger proportion of mineral matter than is generally admitted by chemists. Secondly, that there is no material difference in the composition of various bones taken from different parts of the man, or of any one animal, but that age has a very marked influence on composition. Thus, in the bones of infants, there is more animal and less mineral matter than in the adult, whilst in old age there is more mineral and less animal matter than in the middle-aged man. The mineral substance which chiefly increases in old age is carbonate of lime. Lastly, he could find no marked difference between the bones of man, the ox, calf, elephant, and whale; while in the bones of carniverous animals and of birds there is a slight increase in the amount of mineral matter. Allow me now to call your attention to a most interesting query. I hold in one hand the mineral matter only of a bone, which you can see retains perfectly its original form, and in the other hand I have the animal matter only of a similar bone, which also retains the form in which it previously existed, but is flexible instead of rigid. The question, therefore, arises, whether the strength and hardness of bones proceed from these two kinds of matter being combined together, or are their respective molecules merely juxtaposed? The answer is, the latter; for, as you see by this specimen, the mineral matter has been entirely removed without deforming the animal texture. Further, in the fœtus it is found that the bones contain nearly the same proportions of animal and mineral matters as those of the adult. Also, it has been observed by Mr. Flourence and other eminent physiologists, that the wear and tear of bones during life is repaired by the formation of a new bone on the exterior surface of the bone, while the old substance is removed through the interior duct, and that the composition of the new layer is the same as that of the original bone.

WHERE THE PHOSPHORUS IN BONES COMES FROM.

The animal matters are chiefly represented by phosphate and carbonate of lime. Berzelius was the first to establish the fact that phosphate of lime was the only substance possessing the properties necessary for the formation of bone, owing to the extremely simple chemical reactions which cause the soluble phosphates to become insoluble. Let us trace shortly the sources from whence we derive the large proportion of phosphate of lime which exists in our frames. Several of our most eminent chemists have proved the existence of phosphorus in sedimentary and igneous rocks, and the important part played by phosphorus in nature cannot be better conveyed to your minds than by this extract from Dr. Hofman's learned and valuable 'Report on the Chemical Products in the Exhibition of 1862':—"Large masses of phosphorus are, in the course of geological revolutions, extending over vast periods of time, restored from the organic realms of nature to the mineral kingdom by the slow process of fossilization; whereby vegetable tissues are gradually transformed into peat, lignite, and coal; and animal tissues are petrified into coprolites, which, in course of time, yield crystalline apatite. After lying locked up and motionless in these forms for indefinite periods, phosphorus, by further geological movements, becomes again exposed to the action of its natural solvents, water and carbonic acid, and is thus restored to active service in the organisms of plants and lower animals, through which it passes, to complete the mighty cycle of its movements into the blood and tissues of the human frame. While circulating thus, age after age, through the three kingdoms of nature, phosphorus is never for a moment free. It is throughout retained in combination with oxygen, and with the earthy or alkaline metals, for which its attraction is intense."

THE WAY TO MAKE SUPERPHOSPHATE OF LIME.

Bones are generally used for manuring in one of these three forms:—1st, As ground green bones; 2d, As ground boiled bones (that is, bones nearly deprived of their osseine by boiling under pressure); 3d, Superphosphate of lime.

Green or raw bones have been used on grass land for a long period, but their action is exceedingly slow and progressive, owing to the resistance of the organic matter to decomposition, and the consequently slow solubility of the phosphate of lime in carbonic acid dissolved in water. What substantiates this view is that boiled bones are far more active than the above. It is found that from 30 to 35 cwt. per acre of these will increase the crops on pasture land from 10 to 20 per cent in the second year of their

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