DANGEROUS TO IRON SHIPS.

AN IMPLEMENT OF WARFARE THAT PROMISES TO BE VERY EFFECTIVE.

Experiments at Sandy Hook with Haskell's Multicharge Gun—What the Inventor Claims—Its Power Not Half Shown.

J. R. Haskell, inventor of the multicharge gun, the other day led a party of gentlemen, headed by Commodore J. G. Hill, down to the Sandy Hook station to witness the experimental firing of this new war implement. Beside the firing shed at the station, mounted high upon a tall red iron carriage, stood the famous gun, a huge mass of iron, 25 feet long and weighing 25 tons, looking like a gigantic section of an iron mast with four stupendous tumors grown in line upon its under side, and a rash of cranks, nuts, and handles broken out above and at its biggest end. The tumors indicate the pockets for the explosion of supplemental charges of powder, which are the distinctive feature of this gun. The bore of the gun is 6 inches in diameter and the pockets are each 22 inches in depth, their greatest diameter 11¾ inches, the width of each throat opening into the bore 4 inches, and their angle of inclination toward the muzzle of the gun 55 degrees. The entire interior of the gun, bore and pockets, is of steel, over which is a thick mass of iron. According to the calculations of Major-Gen. W. McKee, President of the Board of Ordnance conducting these trials, the gun should stand a pressure of 44,000 pounds to the square inch before the limit of elasticity is reached. That will be much more than twice what it has thus far been subjected to, only low pressures having been found necessary for the achievement of the surprising results.

In the bottom of each pocket, in the breech and about a foot back from the muzzle, pressure gauges are introduced. A little curiosity about gauges that recognize no lighter pressure than 18,000 pounds, and that are supposed to register four or five times as much, in the inside of a cannon, at the moment of explosion, is quite natural. There are two kinds of them, the Rodman and the "crushing," and, though the best devices yet discovered for the purpose, neither possesses anything more than relative accuracy, and both are subject to great errors. Both are based upon the effect of pressure on a soft metal—copper. The Rodman gauge determines the pressure by the depth to which a piston forces a knife blade into a copper disk of determined density. In the other, the compressibility, lengthwise, of a cylinder of copper ⅜-inch long and ¾-inch in diameter, enclosed in an air-tight chamber beneath a piston which is acted upon by the pressure to be guessed at in the gun, affords the required indication of force exerted upon it. It is this latter kind that is used in the multicharge gun. The delicacy of the reading of the information it imparts may be inferred from the fact that its compression under 19,000 pounds of pressure is only one-eighth of one-thousandth of an inch, and under 20,500 pounds only three-fourths of one-thousandth of an inch. Unfortunately, it is not possible, whatever the care exercised in preparing it, to obtain copper of such absolute uniformity of molecular construction as will give always unquestionably accurate results. Indeed, its record is sometimes glaringly inaccurate, as, for instance, upon the nineteenth shot fired in these trials, when the reading of the Rodman and pocket gauges in their order was as follows: 29,800, 20,200, 21,000, 22,600, 30,000. Manifestly, in the opinion of the ordnance officers, the first and last of these records were wholly wrong, and upon analyzation will be thrown out, as no other firing has given even approximate results of great value. It is not believed that the amount of powder employed, in the manner of its application, could have given such a pressure.

It was a rainy day, and after the visitors had taken the edge off of their curiosity about the gun and gauges they took refuge in the office, where Mr. Haskell told of the already attained results of the firings. "The shooting," he said, "thus far clearly demonstrates the correctness of my claim, and the value of the multicharge principle in ordnance. I can at present only say that the trials have been eminently satisfactory to those interested, as well as to myself. The theory of this invention is the gradual accumulation of power by a succession of charges of powder exploded behind the projectile as it passes along the bore. Our practice, not only with this gun, but with some fifty experimental guns, proves that the theory is as correct as it is simple and easy of comprehension. In the old-fashioned gun a single charge of powder does all the work, and the consequent strain upon the breech is enormous, the pressures in the single-charge gun running from 33,000 to 50,000, 60,000, and sometimes over 100,000 pounds per square inch. In the multicharge system, a small charge of slow-burning powder in the breech overcomes the inertia of the shot, and, the velocity of which, after its start, is easily accelerated by the successive explosions of subsequent charges of quicker burning powder, fired in the pockets by the gas of the breech charge following the shot."

Is there not a possibility that the projectile will be so fast toward travelling out from the muzzle of the gun that it will get away before the power of the supplemental or pocket charges is brought to bear upon it?"

"None whatever. The velocity of expansion of gunpowder gas is 7,000 feet per second, and it would be impossible for it to move any projectile with even an approximate speed. The instant that the throat of the pocket is uncovered by the passage of the shot, the red-hot gas in its rear, with a pressure of say 15,000 pounds to the square inch, is upon the instant surrounding every grain of powder in the pocket, converting it instantly into more red-hot gas, at an increased pressure, to in like manner flash upon and transform the contents of the next pocket, and so on until the combined power of all the powder in the breech and pockets has been utilized to keep up the speed of the projectile by these successive kicks in its rear and deliver it from the muzzle at the highest attainable velocity."

What claims do you make for your gun?"

"I claim for it that it will give to projectiles greatly increased velocities when fired with full charges; increased range in proportion to the greater velocity, and power to penetrate four calibres or four times the diameter of the bore through armor plates, with pressures very much less than in ordinary or single-charge guns. This is a gain over the old system of about 50 per cent. in velocity and range and 100 per cent. in penetration. Perhaps we will even show much more than that, but that is enough to claim for the present."

Why are the pressures in this gun less than in the ordinary gun, while the aggregate of all the charges of powder is much greater than that of the single-charge gun of equal calibre, and why those low pressures produce such infinitely greater results?"

"If you should make a diagram of the pressure produced by the explosion of a charge in an ordinary gun it would be like this:

"That dotted line represents the pressure. At the breech, where the explosion takes place, it is very high, but it falls down very rapidly and keeps declining to the muzzle of the gun with the effect, of course, of giving practically the whole impetus to the projectile that it is to receive, at the very moment of the explosion, and with little subsequent pushing power to accelerate its motion. Now, in the multicharge gun a small charge of slow burning powder, giving such a pressure as may be required, but always much lower than in the breech of an ordinary gun, is used for starting the shot from a state of rest. As the shot increases in speed in the bore, giving room for the expansion of the gas, the pressure is reduced, but when it reaches the first pocket a charge is exploded, which charge is regulated as to quantity so as to raise the pressure only to the point reached by the breech charge, and each subsequent charge operates in the same manner. Consequently a diagram of the pressure line in the multicharge gun would be something like this:

"It follows, of necessity, that while the pressures are all under control and not permitted to exceed a perfectly safe limit, the bore of the gun is filled with a very much higher average of pressure than in the ordinary gun, yet at no point is the pressure so great as in the breech of the ordinary gun, where a single charge has to overcome the inertia and give to it the required velocity. The pressure starts at a very high and frequently dangerous point, but near the muzzle there is very slight pressure, ranging from 2,000 to 3,000 pounds to the square inch. Falling in the multicharge system of mustering pressures at the same time maintaining a high average, as shown in the thirteenth experiment, all of which, at the muzzle, the pressure, even after the ball had travelled about twenty-three feet in the gun, was still over 50 per cent. of the highest pressure given. An additional advantage then presents itself in an economical point of view. The pressures being under complete regulation a bursting pressure need never be used, and the life of such a gun will be far in excess of that of a gun subjected to such enormous strains as the principle of the one-charge guns necessitates."

"Is there a definite point beyond which perfect combustion of the powder is not obtained in the multicharge gun?"

"No. There seems to be no limit to the amount of powder which can be effectively burned, which is not true of the old system. In all single-charge guns a certain quantity of powder, variable according to the calibre of the gun, produces the maximum result, and any addition to that amount decreases the velocity of the shot, because the extra powder is thrown out unburned, and is just so much extra weight to be moved in addition to the projectile.

"The term 'velocity' is apt to be misleading to the ordinary mind. A high velocity is occasionally produced by the one-charge guns, but velocity of itself has no effect on the mind of an ordnance expert. It is mere fancy work, and not such as is done in actual service, to get an excessively high velocity by firing an unusually large charge of powder behind an uncommonly light shot. A great velocity imparted to a heavy projectile produces the most effective work on an armor plate, and that is precisely what the multicharge gun is destined to accomplish. It is a difficult matter to draw comparisons between this and other guns because the data are so dissimilar as to weight of shot, charge and quality of powder, &c. This gun, in the thirteenth round, threw a shot of 109 pounds with a velocity of 1,735 feet, which is equal to 2,300 feet velocity with the 68 to 75-pound shot usually fired in single-charge six-inch guns, and the pressures in the multicharge gun were maintained at about 20,000 pounds to the square inch. The service charge of powder in the ordinary six-inch gun is 34 pounds behind a shot weighing from 68 to 75 pounds. If a shot weighing as much as that used in this multicharge gun in this series of trials were used in a single-charge gun of six inches calibre, the charge would either have to be reduced, with consequent reduction of velocity, or the pressure would run up to a dangerous point. In a report of the Secretary of War there is one instance at least approximate. A six-inch steel gun of Krupp's manufacture was fired with a projectile of 112 pounds, which is about 60 per cent. heavier than that used in service, producing a velocity of 1,676 feet per second under a pressure of 40,320 pounds to the square inch. In our thirteenth round a projectile weighing 109 pounds was given a velocity of 1,735 feet per second with a pressure of about 20,000 pounds, and in our nineteenth round we gave to an 111-pound shot a velocity of 1,832 feet per second under about the same pressure."

"You employ more powder than the six-inch single-charge guns use?"

"Yes, but with infinitely greater results in safety of the gun and velocity of the projectile."

"Consequently, it would hardly be fair to your new system to draw a comparison between it and the ordinary single-charge system in the results attained by each pound of powder?"

"Certainly not. My invention is not for the saving of powder, but the burning of more—the utilization of the power in a much greater quantity of powder than can be burned in an ordinary six-inch gun, behind such heavy shot as we use, without bursting it. Instead of projectiles two diameters in length, weighing from 68 to 75 pounds, we are firing now shot that are three diameters in length and weigh 109 to 111 pounds. Before we get through our trials we shall be firing solid shot four diameters in length, weighing 155 pounds, from our multicharge gun, at a velocity sufficient to penetrate 24 inches of solid wrought iron, or the armor of any war vessel that floats. No single-charge gun could throw that shot, but would burst in starting in all probability."

"Are not the quantities of powder you are even now firing from your multicharge gun practically bursting charges for single-charge six-inch guns?"

"Yes. If this rain will hold up just a little, you will see fired a charge of eighty-seven pounds of powder behind a 110-pound shot, which, if fired in a six-inch single-charge gun, would burst it higher than Gilderoy's kite."

Fortunately, the rain did eventually slacken a little, and the assistants began the work of loading. When everything was well under way the rainfall became a torrent, the wind a gale. But the work went on. Major George W. McKee and Lieut. C. W. Whipple—who had come down from the city that morning on the ordnance tug the Gedney—commanding the gun, twenty barrels of gunpowder, and Capt. W. S. Starring, who lives at the Hook and is always on hand, were the only members of the Board present. Mr. Haskell threw open the breech of the gun and the reporter peered through the swaying rain into a mouth as careful finished as the interior of any sporting rifle, with fifteen grooves 6-100 inches deep and one twist in twelve feet. The breech merited and received special admiration. It is entered and retracted by an interrupted screw, hinged to throw aside for the introduction of the shot, gas-check wad, and breech charge, and double locked by a simple and ingenious device that works almost instantaneously. The work upon it is as fine as that upon the mechanism of a good watch, and it can be operated with surprising celerity by the men accustomed to handling it. Mr. A. G. Sinclair, master mechanic, superintended the loading of the gun. Mr. Sanborn, who has official charge of all the powder, aided him. Mr. Sanborn has gray hair and beard, but stood in the storm quite unconcernedly, in his check shirt sleeves. "Have you anything under that shirt?" Major McKee asked him, in a tone of astonished curiosity. "Got my hide," replied the old fellow placidly. Foreman Pettingill helped Mr. Sinclair and Mr. Sanborn, and other men assisted those three. There didn't seem to be any too many of them. The big steel plugs containing the pressure gauges were firmly screwed into the bottoms of the pockets. Then, one by one, four other steel plugs, with handles on them like those on hand organs, were unscrewed on the upper sides of the gun and taken out. Into each aperture thus made was thrust a long copper funnel, through which the charges of powder were poured from tin cans into the pockets. 18 pounds in each, after which the organ-handle handled plugs were quickly screwed into place again. Into the pocket nearest the breech was put powder in grains as big as peas; into the second pocket grains half as large; into the third grains not more than quartered peas in size, and in the fourth pocket ordinary musket powder was used. These gradations in size were made because the finer powder grains are the more quickly they burn, and it is desirable to have a rapidity of gas development in the bore of the gun proportionate to the constantly and easily accelerating speed of the moving projectile. When the pockets were charged the breech was thrown open, and, through a copper shield, or guide, to carry it accurately into place, a conical shot—iron, banded with copper to take the rifling—weighing 110 pounds, having been dashed with grease and plumbago, was shoved into place, and, by means of a handspike, solidly rammed to the shoulder at the end of the breech chamber, where it must begin to be compressed to take the rifling. Behind it was fitted a gas-check wad, composed of disks of soapstone and copper, and greased like the shot. Last of all was slid into place a coarse flannel bag holding 15 pounds of powder in hexagonal grains as big as hickory nuts. Then the breech was closed and locked, a cannon primer, with electric wires attached, was shoved into a small central hole in the breech, and Capt. Starring ordered everybody into the bombproof.

When the reporter was receiving his first impressions of this locality, a few hours before, he was rather surprised to find that men of war had accustomed to guns were in the habit of dodging into a bombproof when they were going to fire an experimental shot. His attention was, however, directed to several piles of fragmentary iron, piled together so as to preserve something of the outlines of big guns, and these, he was informed, showed how guns frequently burst during trials. Just back of where the multicharge gun stands, between it and the office building, is erected a structure bigger in height and length than three of the largest freight cars piled up. It is built of great beams, and filled in clear to the top with gravel. This is to keep flying chunks of burst cannon from annoying the clerks and assistants in the distant offices. There were eighteen men in that bombproof, which is a substantial construction of enormous timbers, over which many feet of sand and gravel are heaped. The reporter fired the big gun, by permission of Major McKee. To do so he simply had to press a little ivory button in a box on the wall. Twice the primers exploded without firing the powder, each time making a report like a firecracker. The third primer did its work properly. There was a dull roar, nothing like so loud as had been expected by those who now heard it for the first time. But the recoil of the steel and iron mass from that shot was four feet, as a bullet test. On the two frames of electric wires, 100 feet apart, between the muzzle of the gun and the heavy barricade backed with sand which catches and saves the shot, the first was blown out, covered of every wire; the second just about had its wires.

The use of these frames is to test the velocity. He in the office, under the careful scrutiny of Mr. Henry A. Sinclair, the electrician of the Board, are the velocity recording machines. There are two of them, to act as a check upon each other. Sometimes they differ a little. On the twentieth round, for instance, one of them registered a velocity of 1,793 feet to the second and the other 1,759 feet. In such case the average is taken, and this shot went down at 1,791. The apparatus for measuring the flight of the projectile is simple, as it is accurate. A heavy steel rod, covered with a thin tube of soft metal, is held up by one end by magnetic attraction. The breaking of the wires in the first frame cuts off the electrical current, which destroys the attraction and the rod falls. When the shot goes through the second frame of wires, 10 feet behind the first, similar action takes place, and the dropping of a second rod initiates a knife that makes an indentation in the first falling rod. Another slight indentation is made by a second knife, iterated by a division of the current, that drops the second rod, which, by allowance for the time lost in the dropping of that short second rod to free its knife, gives accurately the time, resolved into distance between the slight nicks on the rod. Of the flight of the ball through 110 feet of space. The time occupied in making that distance by the projectile that the reporter turned loose was thus discovered to have been just 0.055839 of a second, and from that it was easy to compute, by the aid of certain accepted tables, that the velocity of the ball was 1,791 per second.

By the time Mr. Sinclair had jotted those figures down in the record book the little copper cylinders were brought in from the pressure gauges, and he began measuring them. They showed that the pressures throughout the bore of the gun had been surprisingly uniform, well sustaining Mr. Haskell's claim of ability to so control the development of force as to deliver the projectile near the muzzle with very nearly the same pressure behind it as at the moment of its starting. Their readings were: Breech, 20,200 pounds per square inch; first pocket, 19,000; second pocket, 20,200; third pocket, 19,000; fourth pocket, 20,500. It is believed that even greater uniformity of pressure will be attained, and rendered a certainty, as soon as correct knowledge of the densities and forces of the several kinds of powders now under experiment shall have been attained.

In the present course of experiments the first seven rounds were fired for the purpose of settling some preliminary questions, such as whether the shot had sufficient bearing to properly take the rifling and receive the twist, and whether the gas-check wad would prevent all forward escape of gas. Both were answered affirmatively in the most thorough manner, fully meeting the anticipations of the inventor. Then firing began, with various kinds of powder, to ascertain definitely the kinds and quantities and places of application that would give a uniform pressure of 20,000 pounds per square inch in the bore of the gun, maintaining it as far as possible toward the absolute delivery of the ball. To reproduce here the elaborate table of details obtained in these trials, relating to each pocket and the breech, would simply be to hopelessly entangle the general reader. In general terms it may be said that each addition of powder, either by increase of any previous charge or by adding a pocket charge, gave an increased initial velocity. This, and more of much interest to any one who chooses to look into the figures, will be found fully demonstrated in the following condensed table of the principal results, preliminary to the introduction of which it may be remarked that the ninth, tenth, and eleventh rounds were fired with but two pockets, the twelfth with three, and the others with the full allowance of four, but with very much less than the maximum of powder in all cases:

ROUND.	Weight of Shot. lbs.	Weight of Powder. lbs.	Pressure per sq. in. Breech. lbs.	Pressure per sq. in. Pocket. lbs.	Velocity per second. ft.
9	108	47	20,600	1,514	
10	110	50	20,000	1,568	
11	109	49	20,900	1,654	
12	106	66	20,400	1,673	
13	109	83	20,200	1,735	
14	110	86	19,800	1,761	
15	110	86	19,000	1,732	
16	110	86	19,000	1,717	
17	72	95	21,000	2,051	
18	71	95	21,100	2,101	
19	111	87	19,200	1,832	
20	110	87	19,500	1,791	

The pressures indicated in the first four rounds are those near the breech only, and not an average through the gun to the fourth pocket gauge, as are those following. From the full tables, out of which these figures are taken, the mathematicians of the Board work out divers conclusions, in which they have, of course, the assistance of the positive knowledge of forces and results already attained in the science of gunnery. Thus, for instance, it was shown that the nineteenth shot fired, the last calculated at the time of the reporter's visit, with its velocity of 1,832 feet per second, would have had a range of about 7¼ miles, would have gone through 18.82 inches of solid wrought iron, and that an energy of 2,608 foot tons was developed for the tossing of it. Mr. Haskell expects that before these trials are ended his multicharge gun will throw a 155 projectile fifteen miles, or through 24 inches of solid wrought iron armor.

CHURCHES AND LIQUOR SELLING.

Rules and Utterances of Various Denominations on the Liquor Traffic.

The Methodist Episcopal Church expressly prohibits members from manufacturing and selling intoxicating liquors. Its Book of Discipline, section 32, enumerates as among the things destructive of order "drunkenness, the buying or selling of spirituous liquors, or drinking them unless in case of extreme necessity." Further on, at section 36, the Book of Discipline says:

> Both science and human experience unite with the Holy Scriptures in condemning all alcoholic beverages as being neither useful nor safe. The business of manufacturing and vending said liquor is also against the principles of morality, political economy, and the public welfare. We therefore regard voluntary total abstinence and total abstinence as the true ground of temperance, and complete legal prohibition of the traffic in alcoholic drinks as the duty of the civil Government.

Under the heading of "Imprudent and Unchristian Conduct" occurs the following, at section 226 of the Book of Discipline:

> Neglect of duties of any kind, imprudent conduct, including making, selling, or giving away or trafficking in intoxicating liquors as a beverage, taking persons in favor of granting a license for the selling of intoxicating liquor, becoming bondsmen for persons engaged in such traffic, renting property as a place in or on which to manufacture intoxicating liquor, dancing, playing at games, of chance, attending theatres, horse races, circuses, dancing parties, or promiscuous assemblies, or taking such other amusements as are only empty of misleading or questionable moral tendency or disreputable to the character and profession of a Christian.

This section also provides for the punishment of the offender by reproof or expulsion.

The deliverances of the Presbyterian General Assembly on the subject of liquor selling have varied somewhat. As late as 1842 the Old School Assembly expressly refused to say that a manufacturer and vendor of intoxicating drinks should not be continued in the full communion of the Church. The Assembly put it that it would not sanction any new term of communion. Many vigorous efforts have been made to secure an unmistakable expression of opinion from the General Assembly on the subject of the manufacture, sale, and use of intoxicating liquors as a beverage, and in 1871 the Assembly adopted a deliverance, which said:

> The manufacture, sale, and use of alcoholic stimulants as a beverage, in the belief of the General Assembly, is contrary to the word and spirit of God, and inconsistent with the claims of a Christian duty. Those who knowingly rent their premises for the traffic or endorse licenses for the traffic are reprehensible as accomplices in the guilt of the same.

In 1877 the Assembly was even still more explicit, and said:

> The sessions of the churches are called upon to guard carefully the purity of the Church, by refusing to admit to membership or to retain those within the pale who are engaged in the manufacture and sale of intoxicating liquors as a beverage, or who derive their livelihood from the sinful traffic.

This and other deliverances of the Assembly have been reaffirmed in subsequent years.

The general attitude of the ecclesiastical bodies of this and other countries on this subject, as shown in a communication made by the Rev. F. H. Marling to the General Assembly last year, was found to be by no means decisively in favor of disqualifying liquor sellers from membership. It was found that of the ministers of the Established Church of Great Britain only one in eight was an abstainer. In the Free Church but one in three was an abstainer, and in the United Presbyterian Church but one in five. Although the temperance movement generally is in active progress in all the denominations there are ministers in all but the Methodist Church who defend the use of intoxicating liquor. In the Catholic Church the use of liquor as a beverage is not forbidden to the priests. In the Universalist Church there is no prohibition of membership to liquor dealers, and for many years one of the leading men in that Church in this city was a brewer. There is nothing to prevent liquor dealers from being members of the Protestant Episcopal Church. Neither can one be a good Quaker and be a liquor dealer.

COWBOYS ENJOYING THEMSELVES.

Shooting Into a Ranch and Making Targets of Bottles and Whiskey Barrels.

CHEYENNE, Oct. 28.—A large party gathered at a ranch on the Fort Laramie road, about eighteen miles north, intending to take dinner there. Among them were about a dozen cowboys, who had been drinking heavily and were ripe for any kind of riot or rollicking. After some horse racing, swearing, and shooting, one of the men rode up to the ranch, dismounted from his horse, and, placing the muzzle of his revolver against the house, discharged it. This was the signal for a general fusillade, and all hands opened fire. Some fifty rounds were fired, and the house was shot full of holes. Entering the barroom, they made targets of the bottles on the shelves, and one by one they fell until not a bottle was left. Then they turned upon a barrel filled with whiskey, and let it full of holes and let its contents run out upon the floor.

There were half a dozen men present besides the cowboys, but none of them were armed, and nothing could be done until the cowboys had satisfied their appetites for whiskey and fun. When the stage from Fort Laramie came in a cowboy drew his gun and threatened to shoot the driver, but was prevented by a woman who threw her arms around him, holding his arms down by his side. The cowboys withdrew to their camp for a fresh supply of ammunition, and, while absent, the doors of the building were locked; but the cowboys broke them open on their return. The Sheriff is in pursuit of the ruffians.

Was She Killed by Her Husband?

WESTFIELD, N. J., Oct. 30.—Mrs. Elizabeth Steadly, wife of Joseph Steadly of this place was taken ill about two weeks ago and removed to the house of her aunt, Mrs. McNairs in New Providence, where she died last Sunday. Before her death she told Mrs. McNairs and others that she had been cruelly treated by her husband and his brother Alexander. Dr. Cooper found many cuts and bruises on her body, and Coroner Fogerson ordered the Coroner, Dr. Lowery, to hold an inquest. Upon the evidence so far obtained the husband and his brother have been committed to the county jail in Elizabeth to await the action of the Grand Jury.

PLYMOUTH'S BLACK STONES.

WHERE THE FIRST GRATE FIRE OF ANTHRACITE WAS KINDLED.

Arks by which the Smith Brothers Sent the First Stone Coal to Market Down the Boring Freshets of the Susquehanna.

WILKESBARRE, Oct. 27.—Visitors to Plymouth, a mining town six miles below this city on the Susquehanna River, will, if they care to look for it, find there one of the first openings that was ever made to the anthracite treasures of Pennsylvania. It is in the side of a hill, whose base for nearly 100 feet is almost perpendicular. The opening is in the shape of the letter A, and is fully twenty feet high. It was made in 1807, and some idea of the vast amount of coal stored away in the hill may be formed when it is stated that this mine is still worked with great profit to its owners. There are probably few people of the present day who have any idea of the difficulties that beset the early diggers of anthracite coal. The pioneer in the business was Abijah Smith of Plymouth, who settled there in 1806. A year after Smith's arrival in the valley, he purchased seventy-five acres of coal land, for which he paid $500. At that time $500 was a big amount of money, and the persons who sold the land thought they were getting a good price for it. It could not be bought to-day for less than $3,000 to $5,000 an acre. The year following his purchase Mr Smith opened the mine described above, and began taking out coal. In the fall of 1807 he came to this city, bought an ark of a merchant, floated it down to Plymouth, loaded it with fifty tons of anthracite, which he safely landed at Columbia, in Lancaster county, late in the season. This was the first cargo of anthracite coal ever offered for sale, at least so the local historians assert. The production of 1807 was fifty tons; that of 1870, in round numbers, was sixteen million tons. It may be estimated that the production of 1883 will reach thirty million tons.

Anthracite had been used to a certain extent in the valley long before Mr. Smith began operations. As early as 1775 the blacksmiths here had discovered that the "black stones," as they called them, which they picked up on the surface of the ground, made good fuel for the forge. But for years nobody believed that anthracite could be used without an air blast, so the forges and furnaces had a monopoly of its use. It was the Hon. Jesse Fell of this city, one of the Judges of the Luzerne county courts, who first practically demonstrated the fact that anthracite could be used for ordinary domestic purposes. The revelation came on the 11th day of February, 1808, and in less than six months after the departure of the first cargo from the Plymouth mines. Judge Fell was then proprietor of a tavern on the stage turnpike to Easton, known as the Fell house. The greater portion of the old tavern is still standing. It is in the heart of the city, and is occupied as a saloon and variety theatre. The Judge being acquainted with the composition of anthracite concluded that all that was required to make it burn freely was a good draft. Accordingly he constructed a grate of green hickory saplings, and, putting it in a large fireplace in his bar-room, filled it with broken coal. Putting a quantity of dry wood under the coal, he set fire to it, and soon the anthracite ignited and crackled merrily until the whole body was a mass of glowing fire. The wooden grate was quickly consumed, of course; but the success of the experiment was complete. Subsequently Judge Fell constructed a wrought-iron grate, and had it fixed in the old fireplace with brick and mortar. Into this the "stone coal" was heaped, and for the first time anthracite was utilized without the aid of an air blast. The Judge made his announcement at the time on one of the fly leaves of a book entitled "The Free Mason's Monitor:"

> Feb. 11, of Masonry 5808.—Made the experiment of burning the common stone coal of the valley in a grate in a common fireplace in my house, and it will answer the purpose fully, making a clear and durable fire, at less expense, than burning wood in the common way.
>
> FEB. 11, 1808. JESSE FELL.

The experiment was noised abroad, and the farmers and others in the vicinity flocked to the old tavern. As the news passed, the circle deepened, and circle after circle gathered about the glowing grate in the low, rather-crowned barroom, where, over bowls of punch and mugs of flip the Judge's health was drank with enthusiasm. Soon the inhabitants of the valley introduced the grate into their homes in turn.

The important discovery made by Judge Fell led Mr. Smith, in the year succeeding his first shipment, to introduce anthracite coal into the market. In 1808 Abijah Smith's brother John came to the valley. He purchased the coal in a tract of land adjoining that of his brother, designated in the deed as "Potts of Coal," for $600. It was a tract of 120 acres. In those days the coal was sold in pots, or basins. The Smiths came from Derby, Conn. From the time they began mining coal in 1807, they did nothing else. Abijah dying in 1826 and John in 1852. While neither lived to see their anticipations realized, their descendants, who are still the owners of the land they purchased, are reaping the benefit of their measure of foresight. There is a very few of the men in the valley to-day who remember the struggles and sacrifices of these early pioneer operators. No powder was used in the early days of mining anthracite. It was all taken out with pick and wedge, a slow and laborious process. The price was $2 a ton to-day, receiving from 50 to 75 cents. From sunrise to sunset he toiled in the dark chamber, his product being about a ton and a half. Some breakers in this county can now bring to the surface 20,000 tons a day if necessary. From the point in one county the coal travels to the place of shipment in carts and wagons, and dumped on the banks to be pitched subsequently into arks in the time of the annual spring freshets of the Susquehanna. The ark was a rudely constructed craft, 90 feet long, 16 feet wide, and 4 feet deep, with a capacity of 25 tons. Each end terminated in an acute angle, with a stern post surmounted by a large oar, some 30 feet in length, requiring the strength of two stout men to ply it. Some 10,000 feet of lumber was used in the construction of the ark, and its total cost was $50. It took from five to seven days to navigate it to tide-water the cost of the trip being about $50. Only two-thirds of the arks started down the river ever reached their destination, one-third generally going to pieces on the bars and rocks. At cost $181 to get 50 tons of coal to market, or about $3 a ton. The perils of navigation increased the cost of transportation to fully $4. Added to this were commissions on sales, cost of transhipment and other expenses, bringing the whole outlay on a ton of coal up to $5. Coal sold at $8 a ton at the time, leaving a profit of $5. The Smiths never shipped more than 500 tons annually both together.

The coal business was continued in this small way until 1820, and as late as 1840 it was not regarded as a success.

A RATTLESNAKE CATCHER.

The Way a Sullivan County Farmer Captures the Reptiles for Menageries.

PORT JERVIS, Oct. 28.—John C. Geer of Long Eddy, a veteran rattlesnake catcher, has just shipped four rattlers, averaging over four feet in length, to a museum in Rochester. Mr. Geer does a lively business in rattlesnakes. He catches them for travelling shows and menageries, and sells them at a good round price. His method of capture is very simple. With his feet encased in a pair of heavy cowhide boots, through which the fangs of the snakes cannot penetrate, he goes out into the woods only a short distance from his farm house. Armed with a heavy cane, he walks along until he sees or hears a rattler. If it is coiled up a blow with the cane will straighten it out, and while it is uncoiled it cannot strike. Holding it firmly back of the head with the cane, he slips a small hood of thick woollen cloth over its head and ties it fast. The snake can then wriggle and strike as much as it pleases; it is harmless. After two or three are captured they are put into a bag and carried home. There they are placed in a specially prepared for their reception, having a front of thick plate glass. At first they are furious, and writhe and plunge about, striking at the sides of the box in a most extraordinary manner, but they finally quiet down, and take kindly to their new quarters. They feed three times a day regularly. Their food consists of frogs, mice, gophers, and sometimes small birds. Mr. Geer says August is the most dangerous of all months for capturing the snakes, because they are shedding their skins and cannot see, and so do not give the customary three alarm rattles.

"Snakes is curious," said Mr. Geer. "Snakes is curious, and no mistake. These varmints never think of biting at any other time of the year without calling out a warning first. Once at Port Jervis, I was there, they are fearful touchy. I suppose it's because, as they can't see, they are afraid of bein' hurt all the time. More people get bit by rattlesnakes in August than in all the rest of the year put together. You see, the varmints, bein' so blind, don't know where they crawl to, and often they curl themselves up right alongside of a road, and sometimes in the middle of it. They are very sensitive, and the minute they hear any one hear them they try to bite. That's why so many of these city folks who come up here in Sullivan county mountains for rest, as they call it, get poisoned, and once in a while die. Most of em dies from fright, though, 'cause with proper care they can always be cured. After dark is the meanest time, when rattlers is active. You see, generally the rattler goes to sleep at sundown, or if he is awake he is afraid and keeps quiet. But in August his tender hide and his eyes pain him so he can't keep well, and he is just as apt as not to stretch himself right out on one of the foot paths. If he does you can just bet that the man or woman who comes in his way gets bit."

MAKING 239 DAILY TRAINS SAFE.

The Interlocking Signals and Switches at Work in the Grand Central Depot.

Soon after the collision at Spuyten Duyvil in which Senator Wagner lost his life, the three railroad companies whose lines converge into the Grand Central Depot began the application of a system of safety signals and switches, which is now completed, and which, it is believed, will reduce the possibility of an accident to the minimum. There are 232 trains every twenty-four hours to be managed, besides an innumerable variety of movements necessary in the making up of trains of the three roads for freight and passengers, all of which must be done, or at any rate is done, within a very narrow compass of land. The dreadful accident in the tunnel attracted public attention to the daily danger that existed there, in view of the labyrinth of tracks and trains and the constant perils of collision.

The companies decided to adopt what is known as the Saxby & Farmer interlocking system of switches and signals, combined with the latest improvements of the Sykes system of lock and block signals, put up by the Union Switch and Signal Company. The general principle of these appliances is to hold each train in a safe place until it is safe to proceed, and to compel the united action of signal and switch men at a distance from each other before switches and signals are set. The pith of the interlocking system is to concentrate as many signal and switch levers together as can be worked conveniently from one station. The switches and signals of any danger point, however complicated, are connected in such a way that it is mechanically impossible that the position of the switches should ever be contradictory to that of the signals, or that incompatible signals should be given. The same lever that moves the switch also moves the signal, so that the engineer who sees the signal set may be positive as to the condition of the track. It is remarked as a proof of the perfection of the apparatus that a man might go blindfold into one of the signal stations and pull any lever at random, and the most misevoous he could do would be to detain the traffic. If he wrongly signalled any track clear, he would at the same moment warn every train likely to be endangered by the mistake. He could not produce such a combination of points and signals as would, if the signals were obeyed, produce a collision.

The switches and signals of all danger points, such as crossings and junctions, are controlled by a single operator from a cabin, in the Forty-seventh street cabin or tower at the Grand Central Depot there are twenty-four levers controlled by one man, who operates the thirteen tracks in the depot. Two blocks further on there is another tower, with fifty-six levers controlled by one man. There is a tower at Fifty-third street with twenty-four levers, one at Fifty-ninth street with twenty-four, and one at Mott Haven Junction with 32 with twelve. Several of the towers have more than one man, but each must be worked with one mind working in unison with towers each way.

When a train gets the signal "All right" to start from the Grand Central Depot, the engineer knows that he can only go to Forty-ninth street, where he must consult another signal. In other words, he is constantly blocked between signal stations. He is prevented from going into the forward block until the track is clear for him, and he is prevented from allowing the following train is prevented from coming into his block until he has left it.

It might at first be supposed that the concentration of so many switch levers in one tower would increase the probability of accident by putting too great responsibility on one man. But no switch can be set without at the same time setting a signal. Suppose, for instance, a train is coming to New York over the Spuyten Duyvil track, and the switchman at Mott Haven Junction has forgotten to arrange the switch so as to admit the incoming train. The moment he rings his day he has set the danger signal, which orders the engineer to stop, pointing its warning, a semaphore by day or a lantern by night. The only way to get the danger signal out of the way is to set the track right.

In the Grand Central Depot greater responsibility is thrown on the engineer. But his duty is made very simple. He gets two signals on approaching every station when there is danger. First, there is what is called a distance signal. This warns him to proceed cautiously, as the next signal may be against him. He comes to what is known as the home signal, which he may expect to order him to stop. Often, however, by the time the train has passed from the distance signal to the home signal the danger has passed, and the home signal has given the "all right" signal. In this way time is economized so that the traffic is kept going as rapidly as possible with safety. It is by the economy of minutes of time in this way that it is made possible to move many trains in safety on a single track.

One curiosity of the new arrangement is that when a train is in any block the signal which keeps it there is locked by the signal man ahead, so that the train cannot be released except with the consent of the signal man ahead. In order to set the switches to accomplish this the signals must be set to keep all other trains from all directions on the thirteen tracks. The new system saves much time by setting the signals and switches from a single lever. There are none of the old-fashioned running about, swinging of lanterns, waving of hands, and what not, but the semaphores by day and the colored lanterns and red signals, as they are called, by night, always in the same place, warn the engineers of the condition of the track, so that the trains move securely and speedily.

One of the most dangerous points at which this system was over-laid was at the East New York crossing of the Manhattan beach Railroad with the Long Island Railroad, where it crossed the tracks of the Brooklyn and Jamaica by a single track. This was the scene of the late busy summer and expedited traffic. Instead of feeling their way along as they approached the station, the engineers found that they could proceed with confidence, and thus much time was saved. The same system has been put in at the Hamilton avenue junction, Fifty-third, and Fifty-ninth street crossings of the elevated railroads, where momentarily crossing trains have been managed for a long time without accident. In fact, the possibility of an accident is reduced to the chance that an engineer will run against a gate or the plain and familiar warnings.

The old system required many hands; the new one requires but few. There was of course, much to be learned by the train and road hands in the management of the new system but it has not marred at the Grand Central Depot without much trouble and annoyance and many complaints from passengers of delayed trains. It was difficult enough to manage 232 trains a day under one system but the problem was complicated when the system of it came to working partly under one system and partly under another. But, as a fact it is done, and Signal Engineer Charles E. Johnson, under whose supervision the apparatus was put up says that in a very short time the hand and the people will be as much accustomed to the celerity and safety with which their 232 trains a day may be moved.

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