iron ore, coal, wheat, flour, and merchandise go to the steamers for low rates and quick transit. And the present tonnage of the lakes is kept in an absorbing chase of distances by the enormous traffic turned over to the vessels by the railroads at deep water terminals like Chicago, Buffalo, and Superior.

In the mad rush of invention upon the land, marine architecture was allowed for a quarter of a century in this country to suffer somewhat. Land transportation absorbed all the powers of men's invention. But it was only a slumber for a season. Cheap transportation between the East and West became so important a factor that human nature could not resist the pressure, and so it happens that from the deep water's end in the middle of this continent, where land and water have their final junction, so to speak, from the head of Lake Superior, within dinner call of the farmers of Minnesota and Nebraska comes the latest and most wonderful innovation on marine architecture that has met the waters since Fulton's steamboat was put afloat. Alex. McDougall, of Superior, Wis., an old lake vessel master and agent, is the inventor, and is now at the head of the practical operations of a ship yard at that place which has keel blocks for the simultaneous construction of ten steel vessels, and from which the American Steel Barge Company, the owner of the plant and patents, expects soon to turn out 52 vessels per year, or one each week.

These vessels are built both as tow barges and as steam propellers. The first boat of the fleet (there are now eleven afloat), the tow barge "101," a small craft of 437 tons registry and 1,400 tons carrying capacity, excited unlimited ridicule and amazement among lake vessel builders, but her cost was only $45,000, and in two seasons she has netted her owners over $70,000, in the face of active competition, so that the laugh is now differently located. This boat was built in the summer of 1888, and was immediately denominated "the pig" by vessel men—a name that clings to all of her kind.

The first steam propeller, the Colgate Hoyt (named after the president of the American Steel Barge Company), was built in the winter of 1889-90, and has been in successful commission during the season of 1890 in the ore, grain and coal carrying trade between Superior and Lake Erie ports. She carries 2,800 tons of iron ore on a 15 foot draught, and readily makes 12 miles an hour with a tow barge in charge carrying 2,400 tons.

The Joseph L. Colby, launched November 15, is a somewhat smaller vessel than the Colgate Hoyt, being designed for passage through the Welland Canal and St. Lawrence River to Montreal. Her dimensions are as follows: Length over all 265 feet, width of beam 36 feet, depth of hold 22 feet. All subsequent steamers of this pattern will be built 38 feet beam and 24 feet depth of hold.

The tow barges 102 and 103 are of 1,132 tons registry and 3,000 tons carrying capacity; the tow barges 104, 105, 107, and 109 are each of 1,216 tons registry and 3,300 tons carrying capacity.

The Colgate Hoyt is registered at 1,008 tons, and 3,000 tons carrying capacity, with a speed of 15 knots per hour on 800 horse power. This statement will be understood when it is said that the fine steamers on the lakes of 1,800 tons registry, 15 knots speed and 3,000 tons carrying capacity, require 1,600 horse power for their work.

The "whalebacks" are all built upon the same pattern. They are round decked, flat bottomed, and ended up like the pointed end of a cigar. The wheel house on the tow barges is in a mere turret, and the men's quarters (it takes five to man one of them) are under the wheel house. On the steamers, the cabin and wheel house are set up on three turrets. These are the peculiarities that make of these boats a complete revolution in ship building. There is no ponderous bulk above the water to catch and fight the sea in a storm. The water washes over them, not against them. The round deck may make of them the most formidable naval vessel ever built. The flat bottom may make of them famous river boats.

The ship yard at Superior has six "slips" and ten piers or ways for keel blocks, so that ten of these boats can be under construction at one and the same time. And Manager McDougall speculates with some enthusiasm upon the fleet of "steam pigs" which he will send to the St. Lawrence in the fall of 1891 to engage in the Atlantic coasting trade for the winter season.

There is at present a whaleback tow barge lying on a dry dock in New York City, that was constructed at the Erie Basin for the coast and river trade, while two McDougall propellers are expected here in a short time, one of which is to be sent across to Liverpool and one to Puget Sound, on the Pacific coast.

CONTRACT has been let for the construction of a railroad from San Diego to San Quentin, Lower California, a distance of 162 miles. The road is to be built as soon as the Mexican government approves the survey. A cargo of supplies for the road is now on the way from England. The company is to receive $8,000 per mile subsidy from the Mexican government.

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NEW YORK, SATURDAY, JULY 4, 1891.

Contents.

(Illustrated articles are marked with an asterisk.)

TABLE OF CONTENTS OF

SCIENTIFIC AMERICAN SUPPLEMENT

No. 809.

For the Week Ending July 4, 1891.

Price 10 cents. For sale by all newsdealers.

THE CASINO AND PIER AT THE EXHIBITION.

One of the novel buildings at the Exposition will be the Casino and pier. The Casino, which will stand out in the lake 1,000 feet from the shore, is intended to reproduce Venice on a small scale in Lake Michigan. Burling & Whitehouse, of Chicago, have completed the design for this structure, and the architecture is of course of Venetian order.

The Casino will be built on piles and connected with the shore by a pier 80 feet wide. The base dimensions of the Casino will be 180 by 400 feet. The building will consist of nine p vilions, two stories in height, and, with the exception of the central one, 80 feet above the surface of the water. The center pavilion will be 1 0 feet high. There will be communication between the nine p vilions both by gondolas and bridges. Completely surrounded by water, this structure, with its fleet of boats and numerous waterways, is expected to have a decidedly Venetian flavor. Surrounding the central pavilion will run a gallery fifty-six feet wide. The pier connecting the Casino with the shore will form a broad promenade. At the west end of the pier will stand the thirteen columns designed by Sculptor St. Gaudens to represent the thirteen original States. In front of the Casino will be a harbor for small pleasure craft. At night this harbor will be lighted by incandescent lamps sunk beneath the surface of the water on floats. The material of the Casino will be of wood and the walls will be covered with staff. A striking combination of high colorings will be effected. The contract for the construction of the pier and Casino has been let.

FAST BOATS FOR THE NAVY.

We have repeatedly urged upon Congress the importance of high speed for some of our war vessels. Some progress has been made, but our neighbors still excel us. As yet we have nothing that can compare in speed with the best English and German mail steamers regularly employed between New York and Europe. Some of these ships have maintained a speed of over 20 knots per hour throughout the Atlantic voyage. The regular speed rate of several of them is 19½ knots at sea. They are specially built for naval service whenever the need for them occurs. No United States ship could compete with them at sea in point of celerity.

The advantage of high speed is conspicuous in the naval warfare now going on in Chile. At the outset of the war the insurgents had a great advantage in holding possession of the principal vessels belonging to the navy. There remained, however, to the government a few boats, among them two gun boats, not very large it is true, but they are among the fastest in the world, the Almirante Lynch and the Almirante Condell. In consequence of their high sea speed and rapidity of motion they steam with great celerity from port to port and threaten the enemy. They have become the terror of the insurgent fleet, which comprises ironclads such as the Huascar, Esmeralda, and Cochrane. The two gunboats in question lately torpedoed and sank the rebel ironclad Blanco Encalada, which was the strongest and proudest ship they had. This was a dreadful blow to the rebels.

An eminently successful trial of a torpedo boat just completed by Messrs. Thornycroft & Co., for the government of the United States of Brazil, took place in the estuary of the Thames on the 2d of June. The new vessel is 150 feet long by 14 feet 6 inches beam, there being four torpedo guns suited for the 14 inch Whitehead torpedo. Two of these torpedo tubes are mounted on racers on deck and two under deck in the bows, arranged not in the ordinary way, but with gear enabling them to be protruded through doors in the skin of the boat. The machinery consists of two sets of triple compound engines, supplied with steam by two Thornycroft water tube boilers. The trial consisted of two parts—first, a series of six runs on the measured mile, with a load of nineteen tons on board, during which a speed of twenty-five knots was guaranteed by the builders; and, secondly, a continuous run of two hours' duration, during which a speed of twenty-four knots was guaranteed. The results of the six runs were as follows:

	Knots.	Mean revolutions per knot.
First run, with tide	27·629	1,065·5
Second run, against tide	23·529	1,289
Third run, with tide	28·346	1,034
Fourth run, against tide	23·377	1,200·5
Fifth run, with tide	28·346	1,032·3
Sixth run, against tide	23·829	1,282·5

The mean of these speeds computed by the Admiralty method being 25·858 knots, Messrs. Thornycroft's guarantee was more than fulfilled. The mean number of revolutions required to do a knot was found to be 1,165·4. At 1:18 P. M. the vessel was put upon her two hours' run, and at 3:18 it was found that the mean number of revolutions of the screws amounted to 59,174, which, being divided by 1,165·4, the number required to complete a knot in still water, gives a distance of 50·775 nautical miles, or 58·4 statute miles, covered in the two hours. This

showed an average speed of 25·387 knots, which, it is claimed, is the greatest distance ever run and highest speed maintained by any vessel in the time. During the run steam was blowing off from both boilers and the pressure of 210 pounds per square inch was maintained with ease, there being an air pressure in the stokehold of only one and one-half inches of water.

It is encouraging to think that our own navy is likely to have one little fast torpedo boat in the course of a year, although it will not be equal to the Brazilian vessel.

Secretary Tracy has issued an advertisement inviting proposals for the construction of a steel twin-screw torpedo boat. The proposals are to be opened on Aug. 18. The boat will be about 120 tons displacement, and must be completed within twelve months after signature of the contract. The proposals may be under the department's designs or in accordance with the bidder's designs. The minimum speed is twenty-four knots per hour, and provision is made for a bonus ranging from $2,500 to $3,500 for every quarter knot speed above twenty-four knots and for deductions of $2,500 for every quarter knot deficiency. The vessel may be accepted if she makes twenty-two knots per hour.

The six torpedo boats lately built by Yarrow for the Argentine government had a speed of 24½ knots, on a displacement of 76 tons. They are 130 ft. long, 13½ ft. beam.

American Saltpeter Caves.

BY H. C. HOVEY.

The uses of saltpeter, or the nitrate of potash, are well known, in the curing of meats, glass making, metallurgy, pharmacy, pyrotechnics, and especially in manufacturing gunpowder. It contains 54 parts of nitric acid to 46 parts of potash; and one volume of it is said to hold as much oxygen as 3,000 volumes of ordinary atmospheric air. Hence it has been called "a magazine of oxygen in a solidified form." The result of suddenly liberating such an amount of imprisoned gas, by ignition with charcoal and sulphur, is the familiar explosion that gives gunpowder its terrific force.

The chief source of native saltpeter, from the remotest antiquity down to modern times, has been the great valley of the Ganges, in India, where it occurs as an efflorescence of the soil, having only to be purified by crystallization to fit it for the market. The business was formerly a monopoly of the East India Company, but it gradually passed in the hands of various private firms that annually export from Calcutta about 500,000 cwt., fully one-half of which goes to Great Britain. "Nitraries" are artificially made in Sweden and other parts of Europe. Quantities of the nitrate of soda are also imported from Chili, Bolivia, and Peru, from which saltpeter is obtained by double decomposition.

The manufacture of saltpeter in the United States has curiously ebbed and flowed with our military exigences. In times of peace we have had better ways of investing capital and labor than in producing what can be more cheaply imported from India or Chili. But in times of war, while the supply has been cut off, the demand has inevitably increased. When an embargo was laid on our commerce duing the war of the revolution, our fathers were thrown on their own resources in all respects; and thus, at the very time when gunpowder was most needed, it was most difficult to be had. Thomas Jefferson, who first drew public attention to the natural wealth of the Old Dominion, is our authority for the statement that at the crisis named more than 10,000 pounds of the nitrate of potash were extracted from the soil found in the caverns of the Kanawha, Greenbrier, and Cumberland valleys. The Madison Cave, in the Shenandoah Valley, enjoyed the unique distinction, according to its present owners, of having been worked for nitrate during three wars, namely, those of the revolution, of 1812, and of the secession. It is probable that the Confederate powder mills were altogether dependent on local supplies, from this and other caves in Virginia and Tennessee, especially the extensive works still visible in the famous Nicojack Cave, that begins in Tennessee and runs down into Georgia, and which I had an opportunity to examine last March.

My inquiries have been more especially directed, however, to the saltpeter works of the Ohio Valley, where at one time the speculative excitement ran very high, being, on a small scale, analogous to the subsequent gold fever of California. The pioneers who followed in the wake of Daniel Boone were in daily peril from wild beasts and more savage Indians; and yet they found the importation of ammunition almost impracticable on account of its expense and difficulty. They applied to the executive council of Virginia for 500 pounds of powder, and were curtly told in reply that the State "could only *lend* it to them, as to friends in distress, but could not *give* it to them, as to fellow citizens." This sort of aid was promptly rejected, and a project was immediately set on foot to create the independent State of Kentucky. This threat led to concessions whereby the region was made a county, instead of a State, and on the other hand the powder was given outright, instead of being merely lent; and on that fact hung the connection between Virginia and her splendid western domain. This was in 1776, and serves to show the scarcity of ammunition when most needed.

The lesson was not lost. The Kentuckians at once sent forth such strolling chemists as happened to be among them, to hunt for niter beds. These were found in the "rock houses" at the heads of ravines, in crevices amid the cliffs, and the sandstone itself was sometimes found to be rich in niter, whence may have come the term saltpeter, or literally "stone salt." But the main deposits were found in the great limestone caverns of the region. Solid masses of the coveted mineral were occasionally met with, weighing from 100 to 1,600 pounds each; and the workmen hunted for such lumps as others might have sought nuggets of gold. Yet, as is usually the case, the more systematic work paid the best in the long run. As many as twenty-eight saltpeter caves were worked in Kentucky before the year 1800, from which, up to that time, more than 100,000 pounds of niter had been extracted, with more than 2,000,000 pounds in sight and awaiting the hand of the miner.

In 1806 Dr. Samuel Brown, of Lexington, Ky., made a journey of a thousand miles on horseback in order to lay the facts as to this novel form of industry before the American Philosophical Society, of Philadelphia. His lengthy report is at hand as I write. He described what was being done in various localities, in both limestone and sandstone caves; but dwelt particularly on the works in the Great Cave on Crooked Creek, in Madison County. This latter cave had two mouths, 646 yards apart, on opposite sides of a mountain, with a level floor running completely through, like a public highway, beside which flowed a living stream. Some seventy men were employed, with ox carts. The oxen were trained to traverse their subterranean road in perfect darkness and without a driver. Brown advanced the curious theory that "potash, soda, lime, and magnesia are nothing more than varied forms and proportions of the same constituent ingredients." But however crude the notions, imperfect the tools, and rough the hands that wielded them, the historic fact remains to the credit of the pioneers, too often forgotten by the historian, that our national life was saved, during the war of 1812, by the salt that was found in the caverns of Kentucky, Indiana, and Virginia. And this was to a considerable degree likewise due to the prompt response made by men of learning and enterprise on hearing Dr. Brown's appeal to them to prove their "concern for the glory and defense of our country" by investigating as to "this salt, so valuable in time of peace, and so indispensable in time of war." Among influential men whose attention was thus directed to the subject were Mr. Gratz, of Philadelphia, and Mr. Wilkins, of Lexington, who formed a partnership for developing the novel industry.

These gentlemen shortly became joint owners of the Mammoth Cave, in Edmondson County, Kentucky, employing Mr. Archibald Miller as their agent. The latter, after due examination, reported with enthusiasm that there was in this one cavern "a sufficient quantity of saltpeter to supply the whole population of the globe." He set a large number of negro miners to work, who collected the nitrous earth from the various rooms where it had been deposited by nature, in many cases digging down from ten to thirty feet and finding the earth still impregnated with the salts. On an average every bushel of earth yielded at least two pounds of niter. The "peter dirt," as the miners called it, was carried by means of ox carts along underground roads, themselves monuments of industry, to hoppers of simple construction, each with a capacity of from 50 to 100 bushels. Cold water, conveyed by wooden pipes from the cascade at the cave's mouth, was poured on each charge. In a day or two a solution of the salts would run into the great vats below the hoppers, whence it was pumped into a second set of pipes so tilted as to let the liquor flow out of the cave. After boiling a while in the open air it was run through hoppers containing wood ashes; the result being, if skill had been used in mixing materials, a clear solution of the nitrate of potash, which was left in the troughs for cooling. In about 24 hours the crystals were ready for transportation. To make 100 pounds of saltpeter, 18 bushels of oak ashes were necessary, or 10 of elm ashes, or 2 of the ashes made by burning the dry wood in hollow trees. The superiority of this latter kind of ashes explains why the interiors of so many hollow forest trees have been burned out and the trees themselves left standing. The process as described above was the same that was adopted at the Wyandot Cave, in Indiana, and elsewhere through the limestone regions of the Ohio Valley. As a curious relic of those days, there is a law in some of the Western States requiring the owners of saltpeter caves to fence them in, to prevent the cattle from killing themselves by licking the casks and troughs, even a small portion of the salts being fatal to them. As an indication of the immense industry in the line of manufacture under consideration it is stated that the contract for the supply of the fixed alkali for Mammoth Cave alone, for the year 1814, was to the amount of $20,000.

All this was long before the days of railroads. Wagon roads, even, were few and ill constructed. Communication between the settlements was mainly by bridle paths "blazed" by cuts in the trees to guide the traveler. The primitive pack saddle was in use here for a century after it had been superseded in the old world, and it was by this means that hardy mules carried the dry saltpeter from the Western caverns over the mountains to the Eastern powder mills. It is stated that at a somewhat later day gunpowder was largely manufactured within the limits of Kentucky itself. But however that may be, the demand for native saltpeter fell off to such a degree, shortly after the treaty of Ghent, that the works were abandoned, and the caverns where they had been located were deserted, or else valued only as places of exhibition on account of their natural curiosities.

No thoughtful visitor can fail to be impressed by the relics yet remaining at the Mammoth Cave, and elsewhere, of these primitive saltpeter works. In Dixon's Cave, which is really a part of the Mammoth Cave, the rocky fragments piled transversely across the floor, like successive stony billows, 25 feet high and 40 feet in diameter, in a vast hall 75 feet wide and 125 feet high and 1,500 feet long, are what was left after the "peter dirt" had been carted out to the hoppers. The subterranean cart roads in Mammoth Cave are well marked, even to the ruts and hoof prints. Cribs are to be seen where the oxen were fed. The huge vats, long pipes, and tall pump frames are, for the most part, in excellent preservation. The mountains of lixiviated earth heaped along the road for hundreds of yards tell the magnitude of the business that long ago expired. The rocky chapel also remains, far below the surface, where the rude pioneers held their Sunday services by lamplight. Now and then rusty lamps are found in crevices where they were lost to the sorrow of their owners, who could not replace them short of a trip to Lexington. The legends told by the guides as to the strange adventures of the swarthy miners as they strolled through haunted halls unearthing now and then a gigantic skeleton, or finding some regally clad mummy, have a delightful flavor of antiquity, and also, in general, a certain substratum of truth. And yet, with all its interest and vital importance in connection with our great American struggles from first to last, what is here recorded is a chapter of history almost forgotten by the general public, and rarely hinted at except in local annals and guide books.

Population of British Cities.

The populations of some of the principal English towns, 1881 and 1891, are given below. The rates of increase between the two periods in the several towns are also given. It will be noticed that in Liverpool only is there a decrease since 1881:

	1881.	1891.	Increase per cent.
London	3,815,544	4,211,056	10·4
Liverpool	552,508	518,000	*6·2
Manchester	462,303	505,300	9·3
Birmingham	400,774	429,200	7·1
Leeds	309,119	367,500	18·9
Sheffield	284,508	324,200	14·0
Bristol	206,874	221,700	7·2
Bradford	194,495	216,300	11·2
Nottingham	186,575	212,000	13·6
Salford	176,235	198,800	12·4
Newcastle	145,359	186,300	28·2
Hull	165,690	183,800	10·9
Portsmouth	127,989	159,200	24·4
Leicester	122,376	242,100	16·1
Oldham	111,343	131,500	18·1
Sunderland	116,542	130,000	12·3
Cardiff	82,761	128,900	55·7
Blackburn	104,014	120,100	15·4
Brighton	107,546	115,400	7·3
Bolton	105,414	115,000	9·1
Preston	96,537	107,600	11·4
Norwich	87,842	100,900	14·9
Birkenhead	84,006	99,200	18·1
Huddersfield	86,502	95,400	10·3
Derby	81,168	94,100	16·0
Plymouth	73,794	84,200	14·1
Halifax	73,630	82,900	12·5
Wolverhampton	75,766	82,600	9·0

* Decrease.

A Flight of Eagles.

A Russian lettter says: A curious and unusual sight has just been witnessed by the inhabitants of Bjelgorod in the south of Russia. A few days ago an enormous flight of eagles were seen to fly past the town and settle in an adjacent forest. The woodmen who were in the forest at the time fled in dismay from the place. It is well they did, for when these unwelcome visitors had taken their departure, it was found that they had devoured ten horses, several sheep, and a vast number of smaller animals. The ground where they alighted was strewn with feathers, and all the birds of the neighborhood have been so terrified that they have flown away. Only one of the eagles was caught—a bird of immense size and belonging to a Siberian species. The eagles, which were several hundreds in number, flew away in a southwesterly direction. The peasants who saw this remarkable sight state that there were so many of them that for the space of several seconds their wings hid the sun from their sight.

Compressed Tea.

Tablet tea is manufactured at Hankow in factories belonging to Russian firms there. It is made of the finest tea dust procurable. The selection of the dust is the work of skilled experts; the cost of the dust varies from 10d. a pound upward. This dust is manufactured into tablets by steam machinery. About two ounces and a half of dust are poured into a steel mould on a steel cylinder. The dust is poured in dry without steaming, and the pressure brought to bear is two tons per tablet. Great care is required in the manufacture and packing of tablet tea, and the cost is comparatively high. The tablets are wrapped first in tinfoil, then in expensive and attractive paper wrappers, and finally packed in tin-lined cases for export to Russia. The tea, it is stated, loses none of its flavor by being pressed into tablets, and, as tablet tea is only one-sixth of the bulk of leaf tea, it is most convenient for travelers, and also for importing into the remoter regions of Russia. The increase in the export of tea dust from Hankow to 726,729 lb. in 1890, from 140,933 lb. in 1889, is due to the fact that while Indian and Ceylon teas are ousting China tea from the British market, many consumers, being accustomed to the flavor of China tea, wish for it. To meet this demand grocers use China tea dust to flavor the Indian tea. All the tea dust exported goes to Great Britain. Lately a new commodity has come on the Hankow market, to which the customs give the name of log tea. It is an inferior tea with stalks packed in the shape of logs, which weigh from 8 lb. to 80 lb. each log. The tea is wrapped in the leaves of the *Bambusa latifolia*, and then reduced in bulk by binding round the log with lengths of split bamboo.

Heat from the Moon.

Mr. C. Vernon Boys has been making measurements of the heat of the moon by means of his very delicate radiomicrometer. His method was to focus the rays of the moon on the face of the radiomicrometer by a reflecting telescope of 16 inches aperture. In the case of a new moon, he found that the heat coming from its disk diminished as you passed from the convex to the concave edge, and that from the dark surface was so slight as not to affect the apparatus. The maximum radiation of heat came from points of the disk itself, not from its limbs. At full moon the maximum point was at the center of the disk. The side of the moon which had been exposed to the sun for fourteen days was not warmer than that which had been exposed for seven days. No sensible heat was observed to come from the stars.

Electricity in the Printing Office.

No discovery has yet been made and no contrivance has been introduced that will *absolutely* dissipate or nullify the disturbing effects of electricity in paper, either latent or generated by the revolutions of the press. Many employers have paid out considerable money to electrical experts and others who claimed to have discovered or to be in possession of infallible remedies for this trouble; but not one of them has squarely fulfilled the terms of his contract. We have studied the effect of wires connected with batteries and of wires connected with gas or other pipes leading to the ground; the latter on the principle of the lightning rod. While these do to a certain extent help to modify the action of electricity or the generation of it, they fall far short of doing it effectively and completely, and for that reason do not justify the outlay of much money upon them. Again, many printeries throughout the country are beyond the reach of those who could help them with the appliances described; are at an expense which, as we have just said, the modicum of benefit that would be derived would not justify. It is for this reason that we recommend to all who have trouble with electricity in paper the adoption of the simple and inexpensive but surprisingly effective remedy we now present.

In nearly every printery a bottle of glycerine is kept for one purpose or another. Take this bottle and a clean rag or other cloth, wet the cloth with water and wring it out well until it is only damp, then pour a little glycerine upon the damp cloth, and wipe the surface of the tympan sheet with it, only on that part of the sheet where the impression is, as it is there that reaction is effected—at the point of pressure. Do not put on too much glycerine, as it will wrinkle the sheet too much. Simply go over it as you would in oiling the sheet to prevent off-set, but do not saturate it. If you find that one application or wiping will not stop the trouble, go over the impression parts again in the same manner. Some kinds of stock are more susceptible than others, and call for an additional application.

This is the simplest and cheapest of all the remedies, and as good as any hitherto known.—*American Art Printer.*

GUILEY'S ELECTRICAL BLOCK SYSTEM FOR RAILWAYS.

An invention which will tend to prevent railway collisions, by giving a timely alarm to an engineer on a moving locomotive when approaching a standing or moving locomotive on the same track, and which will give notice of an occupied grade crossing, an open switch, an open drawbridge, or a car projecting from a

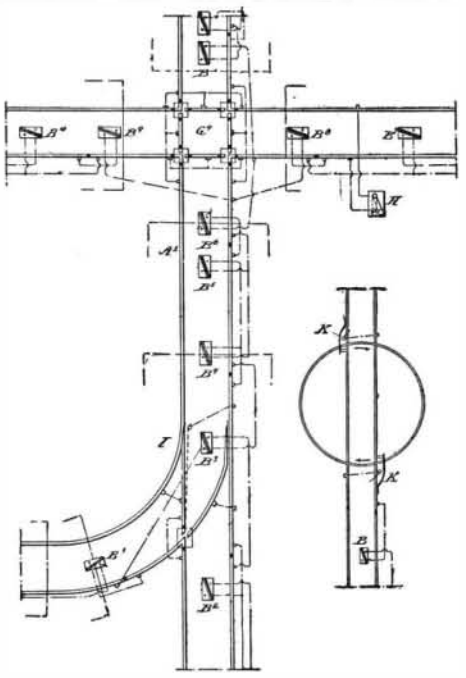
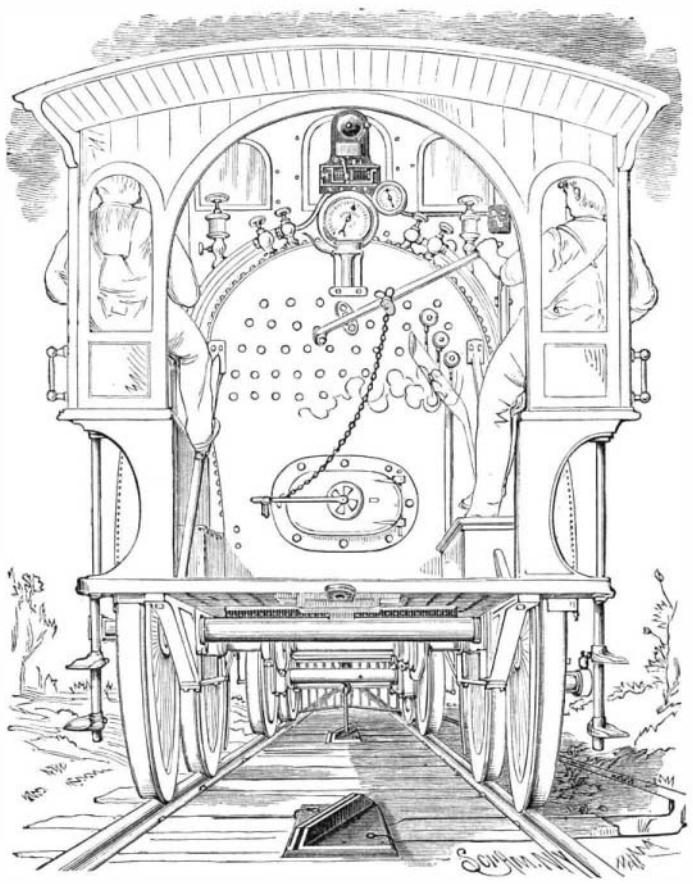


DIAGRAM OF GUILEY BLOCK SYSTEM.

side track over the main track, and which will afford a signal effective in daylight or darkness, on a straight or curved track, or in a tunnel, is one which would cover most of the causes of disaster on railways, and would prove a boon to travelers, and a paying investment for railways if generally adopted.

Such an invention has been made by Dr. A. H. R. Guiley, and has been patented in this and most other countries in the world.

According to this invention, which is illustrated in the annexed engraving, one of the rails is made a continuous conductor by connecting the rails electrically at the joints, and the other rail is divided into sections or blocks, and provided with electrical connections which overlap from one block to the other. Between the rails at suitable intervals, preferably at opposite ends of the blocks, are placed electric contact pieces, each formed of two plates insulated from each other and provided with vertical ribs arranged diagonally. These ribs lie in the path of an armor "feeler" carried by the locomotive, and upon the locomotive is placed a battery and alarm mechanism.



NEW ELECTRICAL BLOCK SYSTEM FOR RAILWAYS.

The arrangement of the circuits is such that when a train is passing in one direction, the feeler strikes a set of contacts controlling the circuit arranged for trains passing in that direction. When the train passes in the opposite direction, the feeler strikes the opposite contact plate, securing opposite results. The feeler, which extends downwardly from the pilot of the locomotive, is capable of swinging laterally, and is protected so that it is not injured by the shock due to striking the contact plates, or other objects lying on the track.

In the cab of the locomotive is arranged an electrical alarm which is set off by the contact of the feeler with one of the plates, and continues to ring until the engineer readjusts it for another alarm. The inventor has devised an attachment to the feeler by means of which steam is taken through pipes and through the contact end of the feeler for thawing snow and ice that may accumulate upon the feeler or upon the contact plates.

This improved system applied to a railway furnishes a complete grade crossing protection, and a very efficient block signal, while at the same time, under certain conditions, it may be used as a train signal by which one train may signal to another.

In the annexed diagram, the contacts, B, B', etc., and the electrical connections, as arranged upon the main track, A', and branch track, and on opposite sides of the crossing, as shown in the diagram, protect the grade crossing, G^4, and the switch, I.

The switch, H, is provided for the use of the track master and others for signaling a train in case of necessity. The detached view shows the application of the invention to a drawbridge, J, the contact springs, K, in this case serving to make or break the connections as the bridge is closed or opened.

Mr. E. B. Cornell, 922 N. 19th Street, Philadelphia, Pa., has the business management of this invention.

Determination of Resin Oil in Mineral Lubricants.

Ten to 15 grms. of the lubricant containing resin oil, but no fatty oils, is gently heated on the water bath in a small flask with 5 vols. alcohol at 96 p. c., shaken up, and let cool down to the temperature of the room. The alcohol is then placed in a small Erlenmeyer flask about 7 cm. in height; the mineral oil which remained in the first flask is rinsed round (not shaken) with a few c. c. of 90 per cent alcohol, the solution poured into the second flask and heated upon a water bath which is slightly simmering, inclosing it within a beaker with the bottom cut off, to avoid too rapid condensation on the sides of the vessel. The heat is continued until the residue in the flask is free from bubbles. It is weighed when cold, and the residue is covered with ten parts by weight of alcohol at 96 per cent. If the residue consists entirely of resin oil, this quantity of alcohol will suffice for its solution. The alcoholic solution is treated as above, and the residue contains small quantities of mineral oils.—*L. Storch, Chemiker Zeitung.*

How Tin Plates are Made.

Following is a summary of the Morewood process of tinning plates now in use at the works of the United States Iron and Tin Plate Company, Limited, at Demmler Station, Pa.:

The plates are rolled in the ordinary manner into black sheets, eight of these sheets being rolled at one time, and after being sheared to size are placed in the "black pickle" bath of sulphuric acid, where all oxidation is removed. They are placed in an annealing furnace for 36 hours and are next passed through the cold rolls, receiving a smoothly polished surface, after which they are annealed again and put into the "white pickle," where they are thoroughly cleansed from any oxidation and are ready for the tinning process. The mode of putting on the coating of tin is a very simple one, and is begun by submerging the plates in a bath of palm oil until all the water disappears, the oil forming a flux for the tin, the first coat of which is received in the tin pot, the plates next being dipped into the "wash pot," and when taken out the tin is spread over the surface with a brush by hand. The final act in the tin coating process is in passing the plates through rolls running in palm oil, whereby the tin is evenly distributed and a smooth surface is obtained. There are 5 of these rolls used, 3 running on top of 2, and the plates make two passes through them, first being let down through the first and second of the upper set, and by a cradle arrangement are returned through the second and third. This completes the tinning operation proper, and the polish is obtained by rapid movements of the plates through bran and middlings, respectively, and then polishing with sheepskin. The result obtained at the Demmler works is a very excellent article of bright tin plate.—*Iron Indus. Gazette.*

AT the great factory of the Singer Manufacturing Company, at Elizabethport, N. J., a half hour is allowed for the noon-day meal, and it is invariably taken in the shops, or in the immediate vicinity. The whistle sounds, and instantly 500 or more boys or young men appear on a run armed with tin pails, some carrying a dozen. They immediately repair to some adjoining saloons, where the pails are filled with beer, which shortly before has been drawn into tubs so as to allow of expeditious dipping. The beer is then carried to waiting comrades in the factories.