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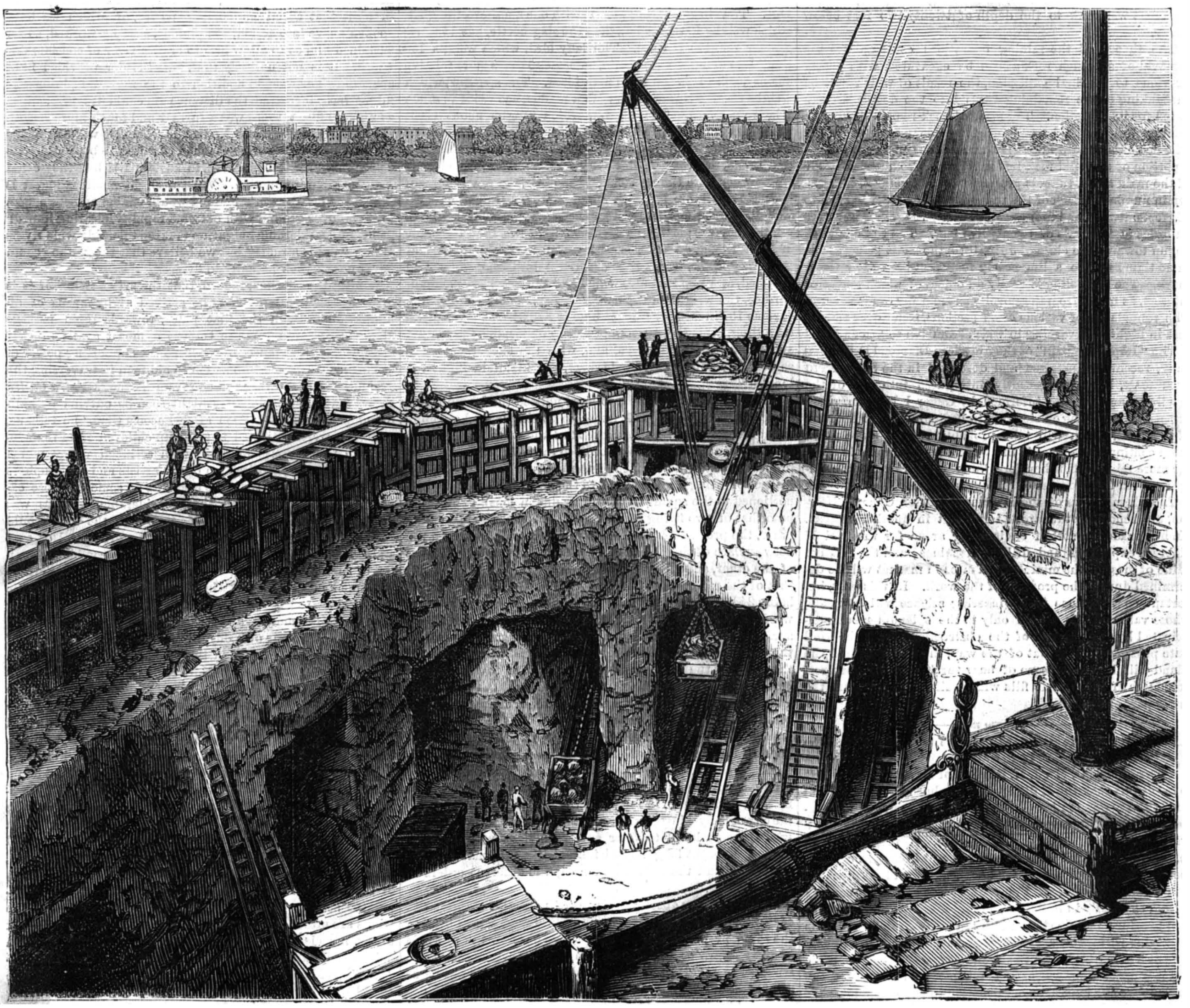


COFFER DAM, MAIN SHAFT, AND ENTRANCE TO HEADINGS, HELL GATE, EAST RIVER.

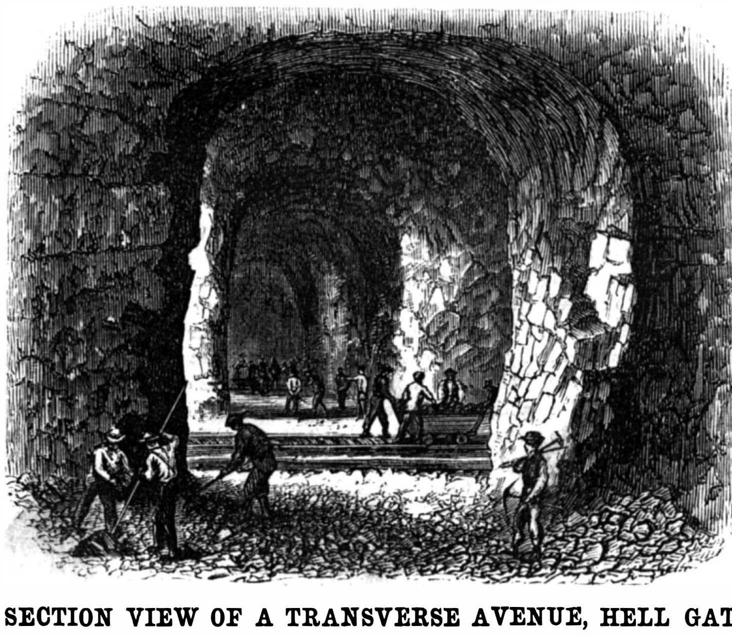
THE TUNNELING AND BLASTING OPERATIONS AT HELL GATE, EAST RIVER NEW YORK.

We give this week some engravings illustrating the operations now in progress for the removal of the obstructions at Hallett's Point, East River. Having often referred to this great work, our present notice will be rather historical and general than technical.

HISTORY OF THE WORK.

The following sketch of the origin and progress of the work is from the New York *Times:*

"Complete surveys of New York harbor have been made at different periods, as is well known, with the object of removing the obstructions to navigation, by Admirals Porter and Davis, Commodore Craven, and the present able and successful topographical engineer, General John Newton, of the United States army. In September, 1870, experimental blasts were made by General Newton, which proved to him beyond a doubt that the work he had undertaken, though a task of immense magnitude, could be accomplished, and at a comparatively trifling cost to the Government. Last May, General Newton commenced work with the steam drills on the dangerous rocks, in mid stream between Governor's Island and the Battery, known as Diamond Reef. After laboring assiduously for over five weeks, and making repeated blasts, between 700 and 800 yards square of the reef were blown away. Surveys were made of three blasts, which disclosed at the bottom of the river a mass of crushed rock, innumerable detached boulders, and huge hillocks of sand, lying around, and over which was once Diamond Reef. A contract was soon made to have the *débris* removed, a work which has almost been finished, and which has demonstrated the fact that no additional blasts will be required, and that the dreaded Diamond Reef is no more. Soon after the work of the drills upon Diamond Reef was concluded, the drill scows were securely moored over Coenties Reef, and immediately commenced operations. The number of cubic yards of rock to be removed at Coenties Reef is roughly estimated at over 3,000, and much of this has already been blasted out by General Newton's indefatigable workmen. Besides at Coenties Reef, General Newton's drills are now at work on the Shell Drake, Way's Reef, Hog's Back, Pot Rock, at the Hell Gate, or Horll Gatt as the old Dutch navigators termed it, and at Willett's Point. The operations at the Hell Gate are the most extensive, the most important, and decidedly the most interesting. The Hell Gate, as every New Yorker knows, is a narrow, rocky passage in the East River, and in the old Knickerbocker times its raging current was the terror of the Dutch skippers and their heavy and unwieldy craft. Of late years, many improvements have been effected by blasting away the surface rock, and the most salient points of the jagged ridges; but only since August, 1869, has the United States Government commenced to deal with the dangers of Hell Gate in a measure corresponding with their importance.



SECTION VIEW OF A TRANSVERSE AVENUE, HELL GATE.

The operations undertaken by General Newton at Hallett's Point, for the Hell Gate, involve the solution of an important problem of engineering as regards the most effective and economical process of submarine blasting. The *modus operandi* employed at Hallett's Point is entirely different from the manner in which the work of removing the obstructions has been accomplished at Diamond and Coenties Reefs, and is what is technically termed tunnel blasting. At Hallett's Point, in August, 1869, a coffer dam was commenced under the superintendence of General Newton, and was completed in October.

The dam is an irregular polygon in shape, having a circumference of 443 feet and a mean interior diameter of about 100 feet. The dam is built between low and high water marks. The excavation of the shaft immediately followed the construction of the dam, and during the spring of 1870 the shaft was sunk to the depth of twenty-two feet below water.

The theory of the mining operations contemplates the removal of as much rock as can be excavated with safety previous to the final explosion, the result of which will be the sinking of the remaining mass into the deep pit excavated for its reception. The mass of rock remaining for the final explosion will be supported by piers, each of which will be charged with nitro-glycerin. These piers are simply a portion of the solid rock left standing. From the bottom of the main shaft, tunnels proceed in all directions, and are ten in number. Each of the tunnels extends from 150 feet to 350 feet outward, and they are all connected together by cross-galleries at intervals of twenty-five feet. The tunnels were begun towards the close of July, 1870, the shaft being at the same time sunk to a line nearly forty feet below low water mark. The tunneling is really an object of a great deal of interest, as much from the novelty as from any other feature. The tunnels are of various cross sections, some over twenty feet in hight, and varying in width from ten to fifteen feet."

The "Improved Drill" of the American Diamond Drill Company, recently illustrated and described in the SCIENTIFIC AMERICAN, has been recently introduced into one of the headings, and, we are informed by General Newton, gives prospect of affording efficient aid in hastening the completion of the work, which will take probably two or three years more continuous labor. As the work advances, room is made for more miners, and therefore the rate of advance may increase with the progress of the excavation.

The liberal views of the Engineer in Chief, General Newton, are rendering this work important in another respect. He has made it a sort of engineering arena for the trial of different explosives and drilling machines; and the relative value of most of the mining appliances in market will be determined during the progress of the work. In this way, important contributions to engineering science will be made, whose value will be second only to the splendid results anticipated by the removal of the obstructions from the Hell Gate passage. These out of the way, the upper end of the island will become a scene of busy thrift, scarcely less prosperous than that which fills with unintermitting hum the lower part of the city.

The Holly System of Hydrants for Extinguishing Fires.

A correspondent, Mr. J. H. Balsley, of Dayton, Ohio, writes to inform us that the Holly system has been adopted in that city. Twenty-one miles of pipe have been laid, and the propelling power is a stationary engine, capable of producing a water pressure of 130 lbs. on the inch. A pressure of 80 lbs. on the inch will throw water 100 feet high, through 100 feet of hose, out of a one inch nozzle. With iron pipes to stand this pressure, all the connections must be equally strong, especially in buildings, as the bursting of a pipe under that pressure will flood a building in a few minutes. This apparatus will throw six or eight good fire streams when running at a safe speed. As the supply of water for domestic and manufacturing purposes is taken from these pipes, the engine must be kept always in motion to keep up a pressure sufficient for fire extinguishing purposes; in any other case, two sets of engines and pipes would be needed. The bursting of a four inch pipe will destroy the fire streams, and a large consumption for domestic or manufacturing purposes will have the same effect. The consumption of fuel in proportion to the water raised is considerable, and the expenses of the fire department, and the insurance premiums have not decreased in consequence of the introduction of this system.

THE ECLIPSE OF THE SUN.—In the number of our journal for October 21, of the present year, we informed our readers of the preparations being made, at home and abroad, for obtaining accurate and detailed accounts of the solar phenomena visible during the eclipse taking place on December 11; and we are glad to be able to report that the most favorable conditions existed during the critical period, and that perfect photographs of the corona were obtained. A party of astronomers, English, French, and Italian, journeyed to the East for the purpose of observing the eclipse, the most approved instruments having been forwarded in advance; and we hear, by telegraph *viâ* the Red Sea, that the desires of the party were fully satisfied, and that the settlement of several disputed facts as to the sun's composition, atmosphere, and luminosity may be looked for on the publication of the report. Mr. Norman Lockyer had charge of the expedition, Italy being represented by Signor Respighi, and France by M. Jannsen.

THE Russian Grand Duke, Prince Alexis, has contributed $5000 for distribution among the poor of New York city.

NOTES ON FLYING AND FLYING MACHINES.

[From the Cornhill Magazine.]

NUMBER II.

We owe to M. de Lucy, of Paris, the results of the first actual experiments carried out in this direction. The following account of his observations (made in the years 1868, 1869) is taken from a paper by Mr. Brearey, the Honorary Secretary to the Aëronaut cal Society. "M. de Lucy asserts," says Mr. Brearey, "that there is an unchangeable law to which he has never found any exception, amongst the considerable number of birds and insects whose weight and measurements he has taken—namely, that the smaller and lighter the winged animal is, the greater is the comparative extent of supporting surface. Thus in comparing insects with one another—the gnat, which weighs 460 times less than the stag beetle, has 14 times greater relative surface. The lady bird, which weighs 150 times less than the stag beetle, possesses 5 times more relative surface, etc. It is the same with birds. The sparrow, which weighs about ten times less than a pigeon, has twice as much relative surface. The pigeon, which weighs about eight times less than the stork, has twice as much relative surface. The sparrow, which weighs 339 times less than the Australian crane, possesses 7 times more relative surface, etc. If we now compare the insects and the birds, the gradation will become even more striking. The gnat, for example, which weighs 97,000 times less than the pigeon, has 40 times more relative surface; it weighs 3,000,000 times less than the crane of Australia, and possesses relatively 140 times more surface than this latter, which is the heaviest bird M. de Lucy had weighed, and was that also which had the smallest amount of surface, the weight being nearly 21 lbs., and the supporting surface 137 inches per kilogramme (2 lbs. 3¼ oz.). Yet of all travelling birds the Australian cranes undertake the longest and most remote journeys, and, with the exception of the eagles, elevate themselves highest, and maintain flight the longest."

M. de Lucy does not seem to have noticed the law to which these numbers point. It is exceedingly simple, and amounts in fact merely to this, that instead of the wing surface of a flying creature being proportioned to the weight, it should be proportioned to the surface of the body (or technically, that instead of being proportioned to the cube, it should be proportioned to the square of the linear dimensions). Thus, suppose that of two flying creatures one is 7 times as tall as the other, the proportions of their bodies being similar, then the body surface of the larger will be 49 times (or 7 times 7) that of the other, and the weight 343 times (or 7 times 7 times 7) that of the other. But instead of the extent of wing surface being 343 times as great, it is but 49 times as great. In other words, relatively to its weight, the smaller will have a wing surface 7 times greater than that of the larger. How closely this agrees with what is observed in nature will be seen by the case of the sparrow as compared with the Australian crane; for M. de Lucy's experiments show that the sparrow weighs 339 times less than the Australian crane, but has a relative wing surface 7 times greater.

It follows, in fact, from M. de Lucy's experiments that, as we see in nature, birds of similar shape should have wings similarly proportioned, and not wings corresponding to the relative weight of the birds. The same remark applies to insects; and we see, in fact, that the bee, the bluebottle, and the common fly—insects not unlike in their proportions—have wings proportioned to their surface dimensions; the same holding amongst long bodied insects, like the gnat and the dragon fly, and the same also among the different orders of flying beetles.

So that, setting apart differences of muscular capacity and adaptation, a man, in order to fly, would need wings bearing the same proportion to his body as we observe in the wings of the sparrow or the pigeon. In fact, the wings commonly assigned to angels by sculptors and painters would not be so disproportioned to the requirements of flight as has been commonly supposed, if only the muscular power of the human frame were well adapted to act upon wings so placed and shaped, and there were no actual inferiority in the power of human muscles (cross section for cross section) as compared with those birds.

So far as the practicability of actual flight on man's part is concerned, these two points are, indeed, among the most important that we have to consider. It was to Borelli's remarks on these points, in his famous treatise, *De Motu Animalium*, that the opinion so long entertained respecting the impracticability of flight must be referred. He compared the relative dimensions of the breast muscles of birds with those of corresponding muscles in man, and thence argued that man's frame is altogether unadapted to the use of wings. He compared also the relative muscular energy of birds and men, that is, the power of muscles of equal size in the bird and the man; and was yet further confirmed in the opinion that man can never be a flying animal.

But although the reasoning of Borelli suffices perfectly well to show that man can never fly by attaching pinions to his arms, and flapping these in imitation (however close) of a bird's action in flying, it by no means follows that man must be unable to fly when the most powerful muscles of his body are called into action to move suitably devised pinions. M. Besnier made a step in this direction (towards the close of the last century) when he employed, in his attempts to fly, those powerful muscles of the arm which are used in supporting a weight over the shoulder (as when a bricklayer carries a hod, or when a countryman carries a load of hay with a pitchfork). But the way in which he employed the muscles of the leg was less satisfactory. In his method, a long rod passed over each shoulder, folding pinions being attached to both ends of each rod. When either end of a rod was drawn down, the descending pinion opened, the ascending pinion at the other end closing; and the two rods were worked by alternate downward pulls with the arms and legs. The downward pull with the arms was exceedingly effective; but the downward pull with the legs was altogether feeble. For the body lying horizontally, the muscles used in the downward pull with the legs were those by which the leg is carried forward in walking, and these muscles have very little strength, as any one will see who, standing upright on one leg, tries, without bending the knee of the other, to push forward any considerable weight with the front of his leg.

Yet even with this imperfect contrivance Besnier achieved a partial success. His pinions did not, indeed, serve to raise him in the air; but when, by a sharp run forward, he had brought that aërial supporting power, of which we have spoken above into action, the pinions, sharply worked, so far sustained him as to allow him to cross a river of considerable width. It is not unlikely that, had Besnier provided fixed sustaining surfaces, in addition to the movable pinions, he might have increased the distance he could traverse. But, as regards flight, there was a further and much more serious defect in his apparatus. No means whatever were provided for propulsion. The wings tended to raise the body (this tendency only availing, however, to sustain it); but they could give no forward motion. With a slight modification, it is probable that Besnier's method would enable an active man to travel over ground with extreme rapidity, clearing impediments of considerable height, and taking tolerably wide rivers almost "in his stride;" but we believe that the method could never enable men actually to fly.

It may be remarked, indeed, that the art of flying, if it is ever attained, will probably be arrived at by means of attempts directed, in the first place, towards rapid passage along *terra firma*. As the trapeze gymnast avails himself of the supporting power of ropes, so the supporting power of the air may be called into action to aid men in traversing the ground. The following passage from Turnor's *Astra Castra* shows that our velocipedists might soon be outvied by half-flying pedestrians:—"Soon after Bacon's time," he tells us, "projects were instituted to train up children from their infancy in the exercise of flying with artificial wings, which seemed to be the favorite plan of the artists and philosophers of that day. If we credit the accounts of some of these experiments, it would seem that considerable progress was made that way. The individuals who used the wings could skim over the surface of the earth with a great deal of ease and celerity. This was accomplished by the combined faculties of running and flying. It is stated that, by an alternate continued motion of the wings against the air, and of the feet against the ground, they were enabled to move along with a striding motion, and with incredible speed."

A gymnast of our own day, Mr. Charles Spencer ("one of the best teachers of gymnastics in this country," says Mr. Brearey), has met with even more marked success, for he has been able to raise himself by the action of wings attached to his arms. The material of which these wings were made was too fragile for actual flight; and Mr. Spencer was prevented from making strong efforts because the wicker work, to which the apparatus was attached, fitting tightly round his body, caused pain, and obstructed his movements. Yet he tells us that, running down a small incline in the open air, and jumping from the ground, he has been able, by the action of the wings, to sustain flight for a distance of 150 feet; and when the apparatus was suspended in the transept of the Crystal Palace (in the spring of 1868), he was able, as we have said, to raise himself, though only to a slight extent, by the action of the wings. It should be remarked, however, that his apparatus seems very little adapted for its purpose, since the wings are attached to the arms in such sort that the weak breast muscles are chiefly called into play. Borelli's main objection applies in full to such a contrivance; and the wonder is that Mr. Spencer met with even a partial success. One would have expected rather that the prediction of a writer in the *Times* (calling himself Apteryx, or the Wingless) would have been fulfilled, and that "the aëronaut, if he flapped at all, would come to grief, like the sage in *Rasselas* and all others who have tried flying with artificial wing."

The objection founded on the relative weakness of the muscles of man as compared with those of birds (without reference to the question of adaptation), seems at first sight more serious. Although there can be little question that the superior strength of the muscles of birds has been in general enormously exaggerated, yet such a superiority undoubtedly exists to some degree. This gives the bird a clear advantage over man, insomuch that man can never hope by his unaided exertions to rival the bird in its own element. It by no means follows, however, that because man may never be able to rival the flight of the eagle or the condor, of the pigeon or the swallow, he must therefore needs be unable to fly at all.

It should be remembered, also, that men can avail themselves of contrivances by which a considerable velocity may be acquired at starting; and that when the aëronaut is once launched with adequate velocity, a comparatively moderate exertion of force may probably enable him to maintain that velocity, or even to increase it. In this case, a moderate exertion of force would also suffice to enable him to rise to a higher level. To show that this is so, we need only return to the illustration drawn from the kite. If a weight be attached to a kite's tail, the kite, which will maintain a certain hight when the wind is blowing with a certain degree of force, will rise to a greater hight when the force of the wind is but slightly increased.

Kites afford, indeed, the most striking evidence of the elevating power resulting from the swift motion of an inclined plane through the air, the fact being remembered always that, whatever supporting and elevating power is obtained when air moves horizontally with a certain velocity against an inclined plane, precisely the same supporting and elevating power will be obtained when the inclined plane is drawn or propelled horizontally with equal velocity through still air. Now the following passages from the *History of the Charvolant*, or kite carriage, bear significantly on the subject we are now upon. The kite employed in the first experiments (made early in the present century) had a surface of fifty-five square feet. "Nor was less progress made in the experimental department when large weights were required to be raised or transposed. While on this subject, we must not omit to observe that the first person who soared aloft in the air by this invention was a lady, whose courage would not be denied this test of its strength. An arm chair was brought on the ground, then, lowering the cordage of the kite by slackening the lower brace, the chair was firmly lashed to the main line, and the lady took her seat. The main brace being hauled taut, the huge buoyant sail rose aloft with its fair burden, continuing to ascend to the hight of a hundred yards. On descending, she expressed herself much pleased with the easy motion of the kite and the delightful prospect she had enjoyed. Soon after this, another experiment of a similar nature took place, when the inventor's son successfully carried out a design not less safe than bold—that of scaling, by this powerful aërial machine, the brow of a cliff two hundred feet in perpendicular hight. Here, after safely landing, he again took his seat in a chair expressly prepared for the purpose; and, detaching the swivel line which kept it at its elevation, glided gently down the cordage to the hand of the director. The buoyant sail employed on this occasion was thirty feet in hight, and had a proportionate spread of canvas. The rise of the machine was most majestic, and nothing could surpass the steadiness with which it was manœuvred, the certainty with which it answered the action of the braces, and the ease with which its power was lessened or increased. . . . Subsequently to this, an experiment of a very bold and novel character was made upon an extensive down, where a wagon with a considerable load was drawn along, while this huge machine at the same time carried an observer aloft in the air, realizing almost the romance of flying."

We have here abundant evidence of the supporting and elevating power of the air. This power is, however, in a sense, dormant. It requires to be called into action by suitaple contrivances. In the kite, advantage is taken of the motion of the air. In flight, advantage must be taken of motion athwart the air, this motion being, in the first place, communicated while the aëronaut or flying machine is on the ground. Given a sufficient extent of supporting surface and an adequate velocity, any body, however heavy, may be made to rise from the ground; and there can be no question that mechanicians can devise the means of obtaining at least a sufficient velocity of motion to raise either a man or a flying machine, provided with no greater extent of supporting surface than would be manageable in either case. It is not the difficulty of obtaining from the air *at starting* the requisite supporting power that need deter the aëronaut. The real difficulties are those which follow. The velocity of motion must be maintained, and should admit of being increased. There must be the means of increasing the elevation, however slowly. There must be the means of guiding the aeronaut's flight. And, lastly, the aëronaut or the flying machine must fly with well preserved balance—the supporting power of the air depending entirely on the steadiness with which the supporting surfaces traverse it.

We believe that these difficulties are not insuperable; and not only so, but that none of the failures recorded during the long history of aëronautical experiments need discourage us from trusting in eventual success. Nearly all those failures have resulted from the neglect of conditions which have now been shown to be essential to the solution of the problem. Nothing but failure could be looked for from the attempts hitherto made; and indeed, the only wonder is that failure has not been always as disastrous as in the case of Cocking's ill judged descent. If a man who has made no previous experiments will insist on jumping from the summit of a steeple, with untried wings attached to his arms, it cannot greatly be wondered at that he falls to the ground and breaks his limbs, as Allard and others have done. If, notwithstanding the well known weakness of the human breast muscles, the aëronaut tries to rise, by flapping wings like a bird's, we cannot be surprised that he should fail in his purpose. Nor again can we wonder if attempts to direct balloons from the car should fail, when we know that the car could not even be drawn with ropes against a steady breeze without injury to the supporting balloon. And we need look no further, for the cause of the repeated failures of all the flying machines yet constructed, than to the fact that no adequate provision has yet been made to balance such machines so that they may travel steadily through the air. It seems to have been supposed that if propelling and elevating power were supplied, the flying machine would balance itself; and accordingly, if we examine the proposed constructions, we find that in nine cases out of ten (if not in all) the machine would be as likely to travel bottom upwards as on an even keel. The common parachute (which, however, is not a flying machine) is the only instance we can think of in which a non-buoyant machine for aërial locomotion has possessed what is called a "position of rest."

Perhaps the gravest mistake of all is that of supposing that, on a first trial, a man could balance himself in the air by means of wings. Placed for the first time in deep water, man is utterly unable to swim, and if left to himself will inevitably drown; although a very slight and very easily acquired knowledge of the requisite motions will enable him to preserve his balance. And yet it seems to have been conceived by most of those who have attempted flight, that, when first left to himself in open air, with a more or less ingeniously contrived apparatus attached to him, a man can, not only balance himself in that unstable medium, but resist the down drawing action of gravity (which scarcely acts at all on the swimmer), and wing his way through the air by a series of new and untried movements!

It encourages confidence in the attempts now being made to solve the problem of aërial locomotion, that they are tentative—founded on observation and experiment, and not on vague notions respecting the manner in which birds fly. Fresh experiments are to be made, more particularly on the supporting power of the air, upon bodies of different form moving with different degrees of velocity. These experiments are under the charge of Messrs. Browning and Wenham, of the Aëronautical Society, whose skill in experimental research, and more particularly in inquiries depending on mechanical considerations, will give a high value to their deductions. The question of securing the equipoise of flying machines has also received attention; and it is probable that the principle of the instrument called the gyroscope will be call into action to secure steadiness of motion, at least in the experimental flights. What this principle is, need not here be scientifically discussed. But it may be described as the tendency of a rotating body to preserve unchanged the direction of the axis about which the body is rotating. The spinning top and the quoit (well thrown), afford illustrations of this principle. The peculiar flight of a flat missile, already referred to, depends on the same principle: for the flight only exhibits the peculiarities mentioned when the missile is caused to whirl in its own plane. But the most striking evidence, yet given of the steadying property of rotation, is that afforded by the experiments of Professor Piazzi Smyth, the Astronomer Royal for Scotland. During the voyage to Teneriffe (where, it will be remembered, his well known Astronomer's Experiment was carried out), he tested the power of the gyroscope in giving steadiness by causing a telescope to be so mounted, that the stand could not shift in position without changing the axial pose of a heavy rotating disk. The disk was set in rapid rotation by the sailors, and then the Professor directed the telescope towards a ship on the horizon. A fresh wind was blowing, so that everything on deck was swayed in lively sort by the tossing vessel; nor did the telescope *seem* a whit steadier—the motion of objects round it giving to the instrument an appearance of equal instability. But the officers were invited to look through the tube, and to their amazement, the distant ship was seen as steady in the middle of the telescopic field as though, instead of being set up on a tossing and rolling ship, the telescope had been mounted in an observatory on *terra firma*. The principle of the gyroscope has also been used for the purpose of so steadying the stand of a photographic camera placed in the car of a balloon, that photographs might be taken despite the tendency of the balloon to rotate. As applied to flying machines, the gyroscope would to be so modified in form that its weight would not prove an overload for the machine. This is practicable, because a flat horizontal disk, rotating rapidly, will support itself in the air if travelling horizontally forward with adequate swiftness. In other words, since travelling machines *must* travel swiftly, the gyroscopic portion of the machine may be made to support itself.

It is this property of enforced rapidity of motion which renders the probable results of the mastery of our problem so important. It has been well remarked that two problems will be solved at once, when the first really successful flying machine has been made—not only the problem of flight, but the problem of travelling more swiftly than by any contrivances yet devised. In the motion of a flying machine, as distinguished from the flight of man by his own exertions, the swiftness of the bird's flight may be more than matched. It is a mere mechanical problem which has to be solved; and few mechanicians will deny that when once the true principles of flight have been recognized, the ingenuity of man is capable of constructing machines in which these principles shall be carried out. Iron and steam have given man the power of surpassing the speed of the swiftest of fourfooted creatures—the horse, the grayhound, and the antelope. We have full confidence that the same useful servants place it in man's power to outvie in like manner the swiftest of winged creatures—the swallow, the pigeon, and the hawk.

The Pigeon's Wonderful Flight.

In September last a certain pigeon was heralded forth as having been let off the deck of a vessel near Cape Hatteras, and bearing to its birth nest, at Montclair, a message from Harry C. Bleecker. The distance and speed said to have been made by the bird, were so great as to create the gravest doubts as to whether they had really been done, but lately the distrust culminated in downright unbelief when a second bird was made to perform 1,004 statute miles at an average rate of over 196 miles an hour, and still a third, a distance of 1,596 statute miles at an average of 202 miles an hour; the last bird, appropriately named "Typhoon," exhausting itself by the effort and blowing out his last gasp as he reached his nest.

These birds all came from Harry C. Bleecker and to Montclair, and at once a rush was made to Montclair to find the consignee pigeon man. It got to be quite the thing for the depot hackmen to be asked to drive strangers to Harry C. Bleecker's, and one hackman is reported to have driven a stranger all day, and to the tune of $25, looking for the mythical H. C. B. But alas! he was found not. At the Post Office, the official was fain to confess he knew no such man, and to add that he wished he did, for letters were accumulating for him, and the box accommodations for stray letters were getting overcrowded. At last in Montclair forbearance ceased to be a virtue, and the man who whispered pigeon or H. C. B. to a citizen of that town did it at the risk of his life. But when celebrated pigeon fanciers, men of science, and others of the believing and unbelieving stock, pretty equally mixed, began to call at the *Daily Advertiser*, and ask for further facts, pointing to the columns of that paper from which they had gained their first information, it became time for a representative of this paper to plunge into the pigeon war.

Not at Montclair, but near Whippany, a small village some five miles north of Morristown, Harry C. Bleecker was found at last, and proved to be a bright faced intelligent lad of 14, the son of a farmer. Both Mr. Bleecker and his son willingly gave all the information in their power, and laughed heartily at being told of the excitement caused by H. C. B. and his pigeons.

Mr. Bleecker having determined to send Harry on a sea voyage, arranged for him with Capt. William Bacon of the brigantine George W. Chase; and, on the 8th of September last, that vessel sailed from pier 17, East River, New York, with Harry on board and bound for Galveston. With Harry was a small coop, in which were three slate colored pigeons, perfect models of symmetry and beauty. These were brought to the vessel by a friend of Harry's father, a resident of Montclair, who instructed the lad to let off a pigeon on accomplishing each 500 miles of his journey. Poor Harry was a landsman and got very sick, but on September 10, the vessel being then beyond Cape Hatteras, he scribbled a note to his father, fastened it to his youngest pigeon, and amid the sneers and jeers of the ship's crew, placed the bird Tempest on the deck of the vessel. In an instant it arose perpendicularly, and, when at an immense elevation, took a direct homeward course. The captain would not countenance such folly as letting a fine bird be lost at sea, and did not see it start, but entered the fact in the log to please the lad. This bird was but six months old, was a male, and had never had any practicing flights whatever. During its two day's sea voyage it had been sea sick, had eaten little and was thought to be too weak to fly. Yet it accomplished its journey with ease, and reached its dove cot in the quick time given.

On the 15th, the vessel being off Key West, the female bird Tornado was let loose, and also made a direct course, first upward and then homeward. This bird was two years old and had made short journeys around its neighborhood, having also flown from Troy and Syracuse. Like the first bird, it had been sick and refused to eat, and again captain and crew laughed at the plucky lad who was so wilfully slaughtering his pets. Yet the ship's log bears the entry, giving latitude and longitude, with the hour of the start. This bird flew the 1,004 statute miles at an average speed of 196 miles per hour, and was in perfect condition on reaching home, eating and drinking freely.

On the 21st, the vessel being then in the middle of the Gulf of Mexico, and 1,596 miles from home by the captain's reckoning, the veteran bird Typhoon was let loose. This male bird was three years of age, and had made several trips flying last year from Chicago. It had not been sick at all but had eaten greedily, all the voyage, pieces of meat and wheat, with bread crumbs and anything the men fed to it. The crew had become attached to it, and it was with the greatest trouble that Bleecker persuaded them to let him release it. They were positive no bird could reach land, but the lad determined to obey orders and let it go at all hazards, although in consequence of a gale blowing off the shore, he had thought it best not to let the bird go when the vessel was at 1,500 miles distance. Again the entry was made in the log, the Captain still protesting against such foolishness. The noble bird safely accomplished its fearful voyage, but, after alighting at his coop, refused food and soon died of exhaustion, experts saping that he had been over fed and was too fat. His average speed was 202 miles per hour.

As to the question: Were these flights accomplished? they may now be safely believed, the testimony of the captain and his log all going to prove this. As a further proof, however, young Bleecker is soon to start on a much longer journey, and is to be provided with a large coop of birds. Among these are to be Tempest and Tornado, the latter of which is to be let loose at five hundred miles distance, and its owner is prepared to bet heavily on its flying the same in under two hours. Tempest is to fly at 1,000, and other birds at 1,500, 2,000, 2,500, and even 3,000. Experts have denied *in toto* that a bird can sustain itself in continuous flight over 1,500 miles. Typhoon has done it, and more too, and his owner is confident that he has others, of the same breed, who will still further outdo him.—*Newark Daily Advertiser*.

Fireproof Roofs.

A wash, composed of lime, salt, and fine sand or wood ashes, put on in the ordinary way of whitewash, is said to render shingles fifty fold more safe against taking fire from falling cinders, or otherwise, in case of fire in the vicinity It pays the expenses a hundred fold in its preserving influence against the effect of the weather. The older and more weather beaten the shingles, the more benefit derived. Such shingles are generally more or less warped, rough, and cracked. The application of wash, by wetting the upper surface, restores them to their original or first form, thereby closing the spaces between the shingles; and the lime and sand, by filling up the cracks, prevents the warping.—*Fireman's Journal*.

THE mind, as well as the body, needs its gymnasium. Each faculty should be developed to its appropriate power, and the whole molded into symmetry.

MANUFACTURE OF ARTIFICIAL STONE FOR THE CARTHAGENA BREAKWATER.

One of the marks of Spanish revival is the attention paid to its commerce and the improvement of its harbors.

After the harbor improvements successfully carried out at Gijon, it was resolved to carry out a similar work in the port of Carthagena, in the hope of restoring its ancient importance. The main works were to be two breakwaters, called Curra and Navidad—one 800, the other 180 meters in length —a pier for loading and unloading, 700 metres wide, and a general dredging of the port to secure a uniform depth sufficient for vessels of any size.

The work was begun March 29, 1870, by Angoitia & Co., under the direction of Don José Rodriguez Acerete, a skillful engineer, and was to cost thirty-two millions of reals.

The base was to be of rough stone, on which rose two walls of artificial stone; but after the foundation was laid up to the surface of the water, it was found that the weight was too much for the ground below, and a gradual sinking took place.

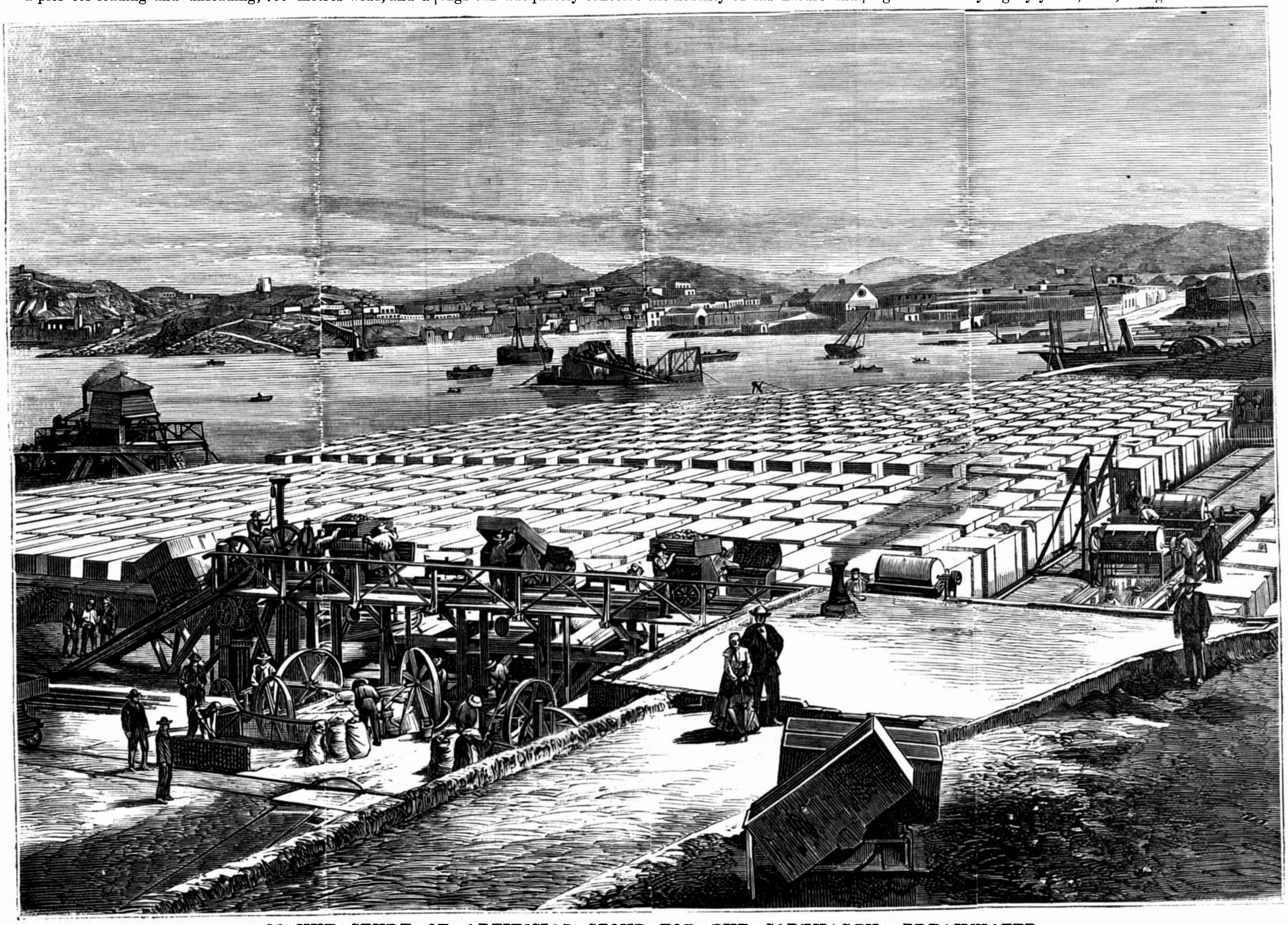
The engineer was thus compelled to adopt something different from an upright wall, and decided on the plan shown in our illustration. One tier of blocks of artificial stone is set vertically, and then others inclining at an angle of 45 degrees.

The weight is thus divided, and the sea, instead of dashing against a dead wall, requiring great strength and power of resistance, is met by a series of angles which break up its impetus with very little shock to the structure. A central wall of artificial stone runs through the length of the breakwater.

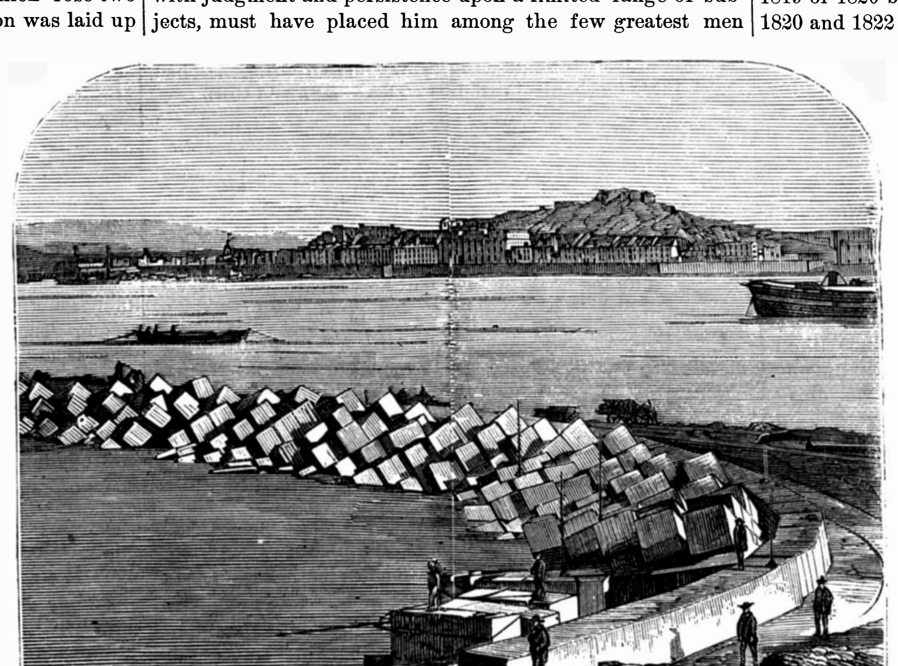
Our other illustration shows the operation of manufacturing the blocks of artificial stone, which are four meters, or about four yards long, by one and a half meters thick, and as many high.

The cement, composed of hydraulic lime and sand, is mixed by steam, which drives large wheels in the receptacle containing the mortar. This, when ready, drops into cars, running on a track, as do others with crushed stone, to cylinders in which the whole, revolving by steam, are thoroughly and densely worked together. These, in turn, run on another track to the molds, where the blocks receive their final shape. The blocks are then allowed to dry for ninety days, by which time they have all the character of real stone, and are slung on chains in the same way, for transportation to the portion of the works where they are required.

Spaniards now hope to make Carthagena the center of the hort route from Paris to Algiers.



MANUFACTURE OF ARTIFICIAL STONE FOR THE CARTHAGENA BREAKWATER.



BREAKWATER AT CARTHAGENA.

CHARLES BABBAGE.

The following interesting sketch of the life of this extraordinary man is condensed from *Nature :*

There is no fear that the worth of the late Charles Babbage will be over estimated by this or any generation. To the majority of people he was little known except as an irritable and eccentric person, possessed by a strange idea of a calculating machine, which he failed to carry to completion. Only those who have carefully studied a number of his writings can adequately conceive the nobility of his nature and the depth of his genius. To deny that there were deficiencies in his character, which much diminished the value of his labors, would be useless, for they were readily apparent in every part of his life.

The powers of mind possessed by Mr. Babbage, if used with judgment and persistence upon a limited range of subjects, must have placed him among the few greatest men who can create new methods or reform whole branches of knowledge. Unfortunately the works of Babbage are strangely fragmentary. It has been stated in the daily press that he wrote eighty volumes; but most of the eighty publications are short papers, often only a few pages in length, published in the transactions of learned societies. Those to which we can apply the name of books, such as "The Ninth Bridgewater Treatise," "The Reflections on the Decline of Science," or "The Account of the Exposition of 1851," are generally incomplete sketches, on which but little care could have been expended. We have, in fact, mere samples of what he could do. He was essentially one who began and did not complete. He sowed ideas, the fruit of which has been reaped by men less able but of more thrifty mental habits.

It was not time that was wanting to him. Born as long ago as the 26th of December, 1792, he has enjoyed a work ing life of nearly eighty years; and, though within the last few years his memory for immediate events and persons was rapidly decaying, the other intellectual powers seemed as strong as ever.

As early as 1812 or 1813 he entertained the notion of calculating mathematical tables by mechanical means, and in 1819 or 1820 began to reduce his ideas to practice. Between 1820 and 1822 he completed a small model, and in 1823 commenced a more perfect engine with the assistance of public money. It would be needless as well as impossible to pursue in detail the history of this undertaking, fully stated as it is in several of Mr. Babbage's volumes. Suffice it to say that, commencing with £1,500, the cost of the difference engine grew and grew until £17,000 of public money had been expended. Mr. Babbage then most unfortunately put forward a new scheme for an analytical engine, which should indefinitely surpass in power the previously designed engine. To trace out the intricacies of negotiation and misunderstanding which followed would be superfluous and painful. The result was that the Government withdrew all further assistance, the practical engineer threw up his work and tools, and Mr. Babbage, relinquishing all notions of completing the difference machine, bestowed all his energies upon the designs of the wonderful analytical engine. This great object of his aspirations was to be little less than the mind of a mathematician embodied in metallic wheels and levers. It was to be capable of any analytical operation, for instance, solving equations and tabulating the most complicated formulæ. Nothing but a careful study of the published accounts can give an adequate notion of the vast mechanical ingenuity lavished by Mr. Babbage upon this fascinating design. Although we are often without detailed explanations of the means, there can be little doubt that everything which Mr. Babbage asserted to be possible would have been theoretically possible. The engine was to possess a kind of power of prevision, and was to be constructed that intentional disturbance of all the loose parts would give no error in the final result

Although for many years Mr. Babbage entertained the intention of constructing this machine, and made many preparations, we can hardly suppose it capable of practical realization. Before 1851 he appears to have despaired of its completion, but his workshops were never wholly closed. It was his pleasure to lead any friend or visitor through these rooms and explain their contents. No more strange or melancholy sight could well be seen. Around these rooms in Dorset street were the ruins of a lifetime of the most severe and ingenious mental labors perhaps ever exerted by man. The drawings of the machine were alone a wonderful result of skill and industry; cabinets full of tools, pieces of mechanism and various contrivances for facilitating exact workmanship were on every side, now lying useless.

Mr. Babbage's inquiries were not at all restricted to mathematical and mechanical subjects. His work on the "Economy of Manufacturers and Machinery," first published in 1832, is in reality a fragment of a treatise on political economy. Its popularity at the time was great, and, besides reprints in America, translations were published in four Continental languages. The book teems with original and true suggestions, among which we find the system of industrial partnerships, now coming into practice. It is, in fact, impossible to overpraise the work, which, so far as it goes, is incomparably excellent. Having assisted in founding the Statistical Society of London in 1834, Mr. Babbage contributed to their transactions a single paper, but as usual it was a model research, containing a complete analysis of the operations of the Clearing House during 1839. It was probably the earliest in which complicated statistical fluctuations were carefully analysed, and it is only within the last few years that bankers have been persuaded by Sir John Lubbock to recognize the value of such statistics, and no longer to destroy them in secret. In this as in other cases, many years passed before people generally had any notion of the value of Mr. Babbage's inquiries; and there can be little doubt that, had he devoted his lofty powers to economic studies, the science of political economy would have stood by this time in something very different from its present pseudo-scientific form.

Of all Mr. Babbage's detached papers and volumes, it may be asserted that they will be found, when carefully studied, to be models of perfect logical thought and accurate expression. There is, probably, not a sentence ever penned by him in which lurked the least obscurity, confusion, or contradiction of thought. His language was clear and lucid beyond comparison, and yet it was ever elegant, and rose at times into the most unaffected and true eloquence. We may entertain some fear that the style of scientific writing in the present day is becoming bald, careless and even defective in philosophic accuracy. If so, the study of Mr. Babbage's writings would be the best antidote.

Let it be granted that in his life there was much to cause disappointment, and that the results of his labors, however, great, are below his powers. Can we withhold our tribute of admiration to one who throughout his long life inflexibly devoted his exertions to the most lofty subjects? Some will cultivate science as an amusement, others as a source of pecuniary profit, or the means of gaining popularity. Mr. Babbage was one of those whose genius urged them against everything conducive to their immediate interests. He nobly upheld the character of a discoverer and inventor, despising any less reward than to carry out the highest conception which his mind brought forth. His very failures arose from no want of industry or ability, but from excess of resolution that his aims should be at the very highest. In these money making days, can we forget that he expended almost a fortune on his task? If, as people think, wealth and luxury are corrupting society, should they omit to honor one of whom it may be truly said, in the words of Merlin, that the single wish of his heart was "to give them greater minds?"

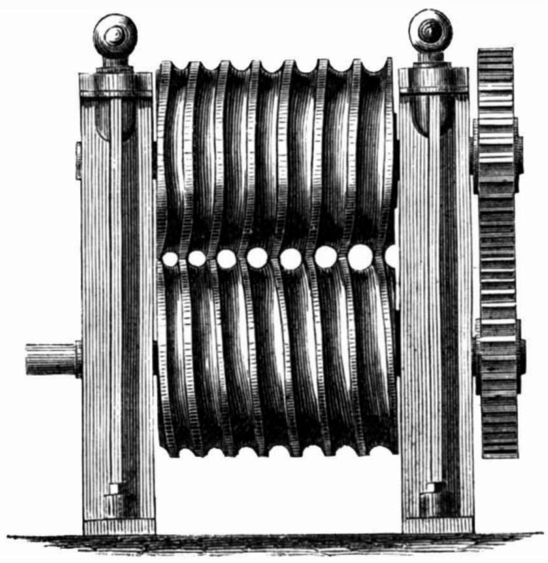
FEED AND TREATMENT OF HORSES.—Hay and oats make the best feed for horses that are obliged to work hard and regularly. If the hay is cut fine and the oats bruised or ground, the whole mixed and moistened, the horse will eat his rations quicker, digest them sooner, and thus have more time for resting and renewing his power for labor. Farmers' horses that work little during the winter time may be kept cheaper by cutting and mixing bright straw and hay in equal quantities, and adding a ration of steamed potatoes or raw carrots. Colts should be fed liberally on good hay—bright clover is best—and bruised oats; give them a roomy box stall in stormy weather and during nights. Litter freely, and do not let the manure accumulate under them. Sawdust or spent tan makes good and convenient bedding; in cities and villages they are often cheaper than straw. Groom horses well and let them have exercise every day; a run in the yard is excellent. See that stable floors over basements are sound and strong. Arrange the feeding racks so that dust and hay seed will not fall into the horses' manes or eyes; some horsemen build their mangers too high, thus forcing the animal to take an unnatural and painful position when eating. Farm horses that are not worked should have their shoes taken off, and those that are driven on the road should be kept well shod.—*Stock Journal.*

M. DEVERGIE, a French chemist, finds that water containing only one four thousandth of its weight of carbolic acid sufficed for the disinfection of the Morgue in Paris during the hottest weather, when it contained six or seven bodies.

TRUTHFULNESS is a corner stone in character; and if it be not firmly laid in youth, there will always be a weak spot in the character.

MACHINE FOR ROLLING TAPERED BARS.

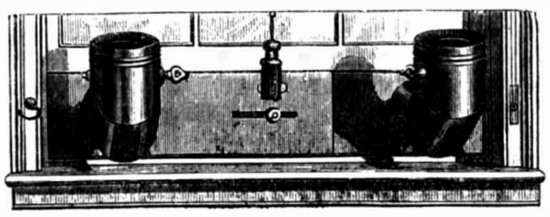
Mr. Henry Kesterton, of Birmingham, Eng., has patented an ingenious arrangement of rolls for rolling taper tubes or rods. According to his plan, there is employed a pair of rolls, each roll having a spiral groove of variable depth, and of half round section, turned on it. The groove in one roll is a right handed, and that in the other, a left handed spiral, as shown in the engraving, and when the rolls are placed together and geared, so as to revolve in union, the grooves form a series of eyes, which, as the rolls revolve, appear to move laterally, and gradually decrease in size. Thus, if a bar or tapered strip of iron, bent so as to approximately form a tube, be introduced between the rolls at that end where the grooves are largest and deepest, it will be gradually shifted towards the other end of the rolls as it passes between the latter, and will thus be rolled tapered.



MAINE'S PORTABLE WINDOW VENTILATOR.

We have been using the above ventilator (an engraving of which is annexed) in our office, with much satisfaction, for some time. By its means we find the condition of the air in the apartment much improved.

The principle of the invention is the deflection of the inflowing current directly up toward the ceiling, where it becomes diffused, and gradually falls without creating sharp currents.



Short sheet metal elbowed tubes are fixed in pieces of board, which overlap and are held together by a bolt which passes through a slot in one of them, so that they can be adjusted to fit windows of different widths. These boards are placed with their outer ends flush to the window casing, and the lower sash is raised to rest upon the upper edge of the apparatus. The joints are made tight with suitable packing. Each elbow tube has a damper to regulate the admission of air.

The apparatus is cheap and simple. It can be applied anywhere; and, if others are as well pleased with its working as we have been, it will gain a wide-spread popularity.

Patented March 1, 1870. Underhill & Co., 95 Duane street, New York, will give further information on application to them.

THE APPLICATION OF MECHANICS AND MECHANICAL PRINCIPLES IN AGRICULTURAL OPERATIONS.

We copy from the *Ohio Convention Reporter*, published at Columbus, Ohio, some extracts from the introductory address by Hon. L. F. Ward, delivered before the Ohio State Agricultural Convention at its last meeting. We would also state that from the *Reporter* we learn that another meeting of the convention will be held on the 3d and 4th of January 1872, at Columbus. We hope it will be well attended. Such associations do a vast amount of good in the dissemination of practical knowledge among the agricultural producers of a State, and we are glad to see that a growing interest is manifest among the farmers throughout the country to enlighten themselves on subjects so important to their prosperity. The speaker thus accords to the mechanic and inventor, due credit for the great advances made in the agricultural field:

"We may rejoice that we live in a period of mechanical triumph. The dreams of past ages are already *more* than realized. The "alchemy" of invention has learned the world more than the transmutation of baser metals into gold. By machinery, crude iron ore, in the hands of scientific manipulators, is wrought into delicate hair springs and tiny watch screws, worth far more than so much gold; and so is it in a thousand places. There is something truly wonderful to stand among the machines, and see what is accomplished by the mechanic arts of the age.

By the electric telegraph we have almost distanced time, and by steam locomotion we have nearly destroyed the idea of terrestrial distance.

This rapid advance of the world announces the dawning of "millennial morning," when wearied fingers can give place to those of steel; when exhausted muscles rest and let sinews of iron endurance do the hard work; when, indeed, emancipated humanity may rest, and the mind preside over mechanical agencies doing his work; when we may have leisure for cultivation of intellect and such development of both mind and matter as will elevate our race.

There is something impressive in contemplating the triumphs of mechanical skill exhibited in this nineteenth century. These triumphs come so rapidly, are being developed everywhere, that we scarcely note the wonders before they are displaced by others. Every department of industry has its new machinery and new modes of accomplishing wonderful results. New fields of enterprise are being constantly developed, while inventors are handing out new devices and improved machines to accomplish new work, and are teaching the world how to do things better and more surely.

I need hardly say that agricultural pursuits are entirely different and surrounded by a different kind of machinery than when we were boys on the farm. Do any of you remember the thump, thump, of the winter's flail, and the long weeks of hard threshing? These have given place to the thresher and separator, and the work of the winter is done in a day. We can some us remember the old flax brake, the "scutching" board, the old spinning wheels and hand looms, and the months it took our mothers and sisters to produce the wearing apparel of the family. These are all gone, and steam has been harnessed on to automatic machinery, and a thousand spindles hum and power looms "weave away the web" to warm and adorn us. You can remember the long weeks of back aching hand mowing. Since then the mowing machine, in a hundred forms, has been wheeled in, and with his team the farmer does in a few days and easily what was a tedious and long "haying." All departments of farm labor have improved tools and machinery, and new modes of accomplishing the work that used to make farm labor so wearying.

DEMAND FOR THE PRACTICAL APPLICATION OF SCIENCE.

A competent amount of knowledge of the fitness of machinery and its auxiliaries is a valuable attainment for him who would make agricultural work a success. The honest farmer, who had learned a part when he had learned that the axles of his wagon needed lubricating, and so kept his tar bucket filled and at hand, showed that he had not matured his mechanical knowledge when he applied tar to the cogs and pivots of his Yankee clock, and was, himself, much surprised when he found it would not run!

The use of machinery on the farm implies the want of mechanical principle, and the farmer would hardly use his steel plow for a stump machine, or his reaper for clearing brushwood, or his mower for trimming his hedges; yet as absurd things as these have been done. We do not expect the enlightened farmer will insist on putting his corn in one end of his sack, and a stone in the other, to balance it, even on going to mill on horseback; but we do often see the laborer working away at the wrong end of the lever, doing his work wrong end first, and in the hardest way. A little clear headed thought, that weaves in mechanical ideas, wonderfully helps on even herculean tasks.

AS AN IMPROVER OF FARM IMPLEMENTS.

The farmer ought to be the best judge of farm implements and farm machinery; and, if properly instructed in mechanical principles, could not only (as he now does) discover the defects of tools and machinery, but could at once cure and perfect them. He should indeed, select an easier and more rapid accomplishment of many agricultural employments now involving hard muscular labor.

It is the mission of applied mechanics to emancipate the agricultural laborer from that exhaustion that holds both soul and body in the slavery of a mere animal drudgery. Why may not a great deal that is now done by muscular exertion be accomplished by improved mechanical adaptations? Why not harness up the unmeasured power of steam to do some of his work? And what objection can there be to letting the idle winds pump water, for his stock or for irrigating his lands in time of drought? With a little mechanical and engineering skill, a whole farm could be well watered at a comparatively trifling expense. Can you see any reason why in the future, steam may not do our plowing—and indeed a great deal of our farm work?

Thought and mechanical science will enable any to judge as to how power should be applied—whether with rapid or slow motion, or whether great power is to be attained by reducing motion. I have no doubt that this single fact will account for the difference we find in the ease with which some accomplish much with little effort, while others do everything by the hardest. The farmer should know so much, of the strength and nature of the material and construction of the machinery he uses, that he may form an accurate judgment of its capability and durability. He is the only proper judge of his own machines.

THE FARM SHOP.

The farm should have a good shop, well furnished with material and tools, where, in stormy weather, tools and implements can be repaired, and new labor-saving machinery constructed; and if half the time lounged away by many in bar-rooms and saloons were used in this shop, it would make the farmer so much a mechanic that he could repair much of his machinery in a great deal less time than is now spent in hunting for and being disappointed by mechanics."

After referring to the proposed new agricultural college of Ohio, and recommending the Professor to insist upon the pupil *doing* the science as well as reciting from text books, Mr. Ward closes with a word in behalf of

THE MECHANIC AND INVENTOR.

"The world has been in the habit of giving these producers a very unenviable place, and speaking of them as the "greasy mechanic" and "poor inventor," and has assigned to them a subordinate place in the social scale. "Yet by their works ye shall know them," and rank them too.

The mechanics and inventors of the nineteenth century are the "royal family" of the world—the true "aristocracy," before whom, if any, we should uncover. Inventors' and mechanics' skill have developed and opened this whole nation as it could not have been done without this agency. Without these (as the world was two hundred years since) it would have taken a thousand years to do what has been done in the United States in the last fifty years with steam and the fruit of invention. How magical the facts that meet us! How like enchantment the wonderful results attained! See the magnificent palaces flying along our railroad lines, at the rate of thirty or forty miles an hour, and ourselves talking with the wings of lightning across continents and through oceans! Ingenuity and mechanical skill, guided by science, have attained this glory. To the scientific mechanic and inventor is the chief honor due. Capital has aided and sustained this enterprise, but it has been repaid, principal and interest, and the chief pœan should be given to these active manipulators. Let us grasp the honest hand of skillful industry, and honor them as we ought."

Correspondence.

The Editors are not responsible for the opinions expressed by their Correspondents.

Traction Engines--Steam Plowing.

To the Editor of the Scientific American:

The combined efforts of inventors, to surmount the difficulties attending the practical use and introduction of steam road wagons and plows, may make a few words upon this hackneyed theme of some interest, especially to your many readers who are directly connected with agricultural pursuits.

The Williamson road steamer and plow, New York, the Parvin steam plow, Philadelphia, the Redmond steam plow, Rochester, N. Y., the New Albany, Ind. road wagon and plow, the Porter & Aveling heavy road locomotive, and a number of others which are now being perfected, make the list quite respectable.

The steamers enumerated above, in their efforts to get traction or hold to exert power upon the road, may be divided into three classes. The first class is by the resistance of the main bearing wheels at each contact, and embraces the Williamson, the Parvin, the Porter & Aveling, and most of the other heretofore unsuccessful machines. The second class consists in thrusting, through the tire, at earth contact, a pointed instrument; this includes, besides the Redmond, two or three more machines not now fully perfected. The third class consists of the use of shoving legs, hanging at an angle of 45° to 39°, which includes the New Albany machine.

The Williamson steamer is one of the most perfected forms of the first class of steamers. Yet when it is at its greatest strain, the machine will not exert a dead lift of more than one half its own weight, and to do that it requires 56·53 inches piston surface at one hundred pounds, compounded in the gearing 16 to 1. The weight of the machine, with wood and water, will be probably 16,006 lbs. Why 56 53×100 lbs. pressure×16 to 1 gearing(=90,480), should not produce better results, is incomprehensible to me.

The operations of devices of the second class (the Redmond) are much better; with only one half of the weight of machine of the Williamson, it can exert as much of a lifting power, or pulling force, in open field plowing; but the machine is not adapted to road service, as upon hard surfaces the thrusting points do not act; hence, as a road wagon it should be placed in the first class. Inventors are forced to make a machine equally efficient as a road wagon, portable power, or steam plow.

We witnessed a few days since the operation of the New Albany machine; weight 2,000 lbs., cylinders 2 inches diameter and 4 inch stroke, ten in number; steam 50 lbs. The cylinders were evidently too small, yet the movements were novel, and seemed to be suggestive of a principle that will yield better results than either the first or second class of machines mentioned. In this machine a toothed yoke, worked on the main engine shaft, operated backward and forward four horizontal slides; to each of these slides were suspended two straight pushing legs, with a hoof on each, resembling a horse's hoof. At the first trial these legs were suspended at an angle of 33°, and would slip occasionally, in soft ground. In the second trial they were shortened to 39°, and there was found no disposition to slip. At 45° angle of leg this machine would pull its own weight of lifting force; at 39°, one and one half times its weight, and at 33°, twice its own weight.

The inventor claims he is only using the mechanical movements of a horse, which can very readily, when required to do so, lift its own weight. Upon the machine was an eight horse power boiler, 50 gallon water tank, coal bunkers, etc. My attention was particularly directed to the boiler, it being a vertical sectional safety boiler, entirely surrounded by an outside exhaust case, where the feed water was heated and condensed, and waste water saved to use again. With engines in proportion to boiler, I look for good practice in this machine.

The urgent demand, all over the country, for the devices mentioned, makes any information in regard to them watched with more than ordinary interest. The writer is a farmer, not well versed in mechanism, but feels very much like purchasing some one of the implements mentioned above as soon as he can intelligently do so. I believe there are many farmers just like myself; hence the importance of scientific men expressing their opinions, that parties about purchasing may profit by their views.

Greenville, Ind. ADVOCATE OF STEAM FARMING.

An Underground Railroad in New York.

To the Editor of the Scientific American:

On reading your article on the "Progress of the Underground Railway System" (SCIENTIFIC AMERICAN of December 2d.), I cannot help calling attention to some points in the history of this important question, which now requires only a little public spirit, on the part of the inhabitants of New York city, to be finally set at rest in the manner most consistent with the economy and convenience of the business community. In view of the simplicity and cheapness of construction, the avoiding interference with structures and streets, and the safety in traveling, all of which are secured by the tunnel system, it may be fairly taken for granted that the superiority of this mode of construction is demonstrated. Especially is it so when the locality under consideration is a crowded city, of which every square foot of the surface is covered with costly buildings, and every street filled with daily increasing traffic. Leaving, then, this part of the subject, I propose to consider its special adaptation to the wants of New York.

The length and narrowness of this city necessitate a rapid means of transit from one end to the other; and the stream of traffic, as well as the already expressed public opinion, point out Broadway as the road under which the tunnel should be made. Another recommendation of this course is its termination at the Battery, the only situation at the southern extremity of the city where a depot, sufficiently large to accomodate the traffic could be constructed. Thus the route of Broadway will certainly be the best for the lower and business portion of New York; and it may be left an open question, for the present, as to whether the railroad should, at some point up town, diverge into one of the avenues, or continue up Broadway to the end, thus terminating on the west side of the city. It would probably be necessary, in the latter case, to make a bifurcation about halfway up the island, so that a branch might diverge to the east side and Harlem. If this plan were adopted, the branch should, if the non-interference of house property be kept in view, leave the main line at the junction of Fifty-ninth street and Eighth avenue, and pass under the Central Park. But it would be less expense, and it would afford accommodation to all parts impartially, to let the railroad quit Broadway at Union Square and then follow the course of Fourth avenue to Harlem.

Public needs would demand depots, not farther apart than half a mile, in the lower portion of the city. Starting from the Battery, these depots would be situated as follows: at Wall street, Worth street, Spring street, Washington Place, and Union Square. Beyond this point, the depots need not be in such close proximity to each other.

Trains stopping at all stations would reach Union Square from the Battery in nine or ten minutes. To effect this, locomotive engines specially designed to accomplish a high velocity as soon as possible after starting would have to be constructed. This has been done on the Metropolitan Railway of London, on which trains frequently attain a speed of twenty-five miles an hour between stations that are not more than half a mile apart. To free this traffic from perils of persons crowding on to trains that have started, a lesson from European management would have to be learned. No person under any pretence whatever should be admitted to the platforms after a train is in sight. If such a rule be rigidly enforced, a hundred passengers can safely mount a train in one minute, and so the detention would be as short as possible.

Under these regulations, trains at three minute intervals can be run with perfect safety. By never permitting a train to leave a station till the previous one has quitted the station in advance, trains can travel with complete immunity from disaster; an end which has not yet been reached on lines, with trains an hour or two apart, worked on the old happy-go lucky system(?) of signaling.

There are many other suggestions I could give you, such as the construction of cars with several side entrances to facilitate rapid ingress and egress, but I forbear for the present. The chief point for the public consideration is how to get rid of the Ring and the viaduct thereof. This seems in a fair way to be accomplished; and when the course is clear, the Underground Railway will only require impartial consideration on its merits, and then we can go ahead and make it.

New York city. D. B.

Testing Kerosene Oil.

To the Editor of the Scientific American:

I obtained some kerosene which had been inspected by the Government inspector, and passed as standing the test of 110° Fah. before throwing off vapor, or the flashing point, as commonly called; and I placed the same in a long test tube, in which was placed a delicate thermometer. I then inverted the tube, full of oil, in a vessel containing water, so that the vacuum in the tube was complete. I then applied heat to the water, and watched carefully the thermometer; and, at 86° Fah., the vapor began to rise in bubbles and collect in the top. At 142° large bubbles rose rapidly, and at 190° about 33⅓ per cent of the oil was in vapor. I then allowed it to cool, when the bubble disappeared from the top by condensation. I then took some of the same oil which had not been heated, and passed ozonized air through it, then subjected it to the same test as the previous; and I found the thermometer stood at 174° Fah. when the first bubble of vapor rose to the surface, and at 190° Fah. only about 2 per cent of vapor was thrown off.

I think the apparatus for testing the flashing points of kerosene and petroleum oils, as at present used, are very ineffective and inadequate for the purpose, and oils are passed, as standing 110° fire test, which vaporize at much lower temperatures.

I believe an apparatus made like that described by me would be more simple and certain.

New York city. C. F. DUNDERDALE.

Equilibrium of Water in a "Nest" of Steam Boilers.

To the Editor of the Scientific American:

In last week's issue of your journal, H. P. S. of Kansas city, Mo., tells us of a "Curious Freak of Twin Steam Boilers" and asks the "decision of older engineers." Probably an explanation of the "mysterious working" would be acceptable from a young engineer.

A host of engineers have encountered and are still encountering the same difficulty. The cause in nine cases out of ten is malconstruction, which is the trouble in the case of H. P. S. The steam connections are entirely too small, and they must be enlarged to prevent the difficulty. When the production of steam in the boilers is equal, there will be no such trouble.

It is only when the production of steam in the different boilers is disproportionate that this difficulty developes itself. The water is depressed in the boiler producing the most steam. It is caused by the resistance the steam encounters in adjusting the pressure in the different boilers. A greater quantity of steam crowding through one stand pipe than the other, a greater resistance will be encountered and a depression of water in that boiler is the result.

There is a corresponding increase in the pressure of steam in the same boiler. This difference in pressure may be measured by the difference in the hight of water. If the difference in hight of water is two inches, the difference in pressure will be nearly one ounce; four inches, nearly two ounces, six inches nearly three ounces; or the difference in pressure will be the difference in weight of the column of water in each boiler. The pressure of steam may be 90 or 100 lbs to the square inch, speak of the difference only.

It is simply impossible to fire two or more boilers so evenly that the amount of steam produced in the different boilers will be equal. Then what is the remedy? It is to make the steam connections and stand pipes on top of the boilers large enough to allow the pressure of steam to adjust itself in the different boilers without disturbing the equilibrium of the water. The smaller these connections are, the more trouble it will be to maintain the same water level in the different boilers.

The pressure of steam and water in a "nest" of boilers may be compared to a huge balance suspended with equal weights, the equilibrium of which can be disturbed by the slightest cause.

In the case of H. P. S., he should have larger connections between the boilers—say a four inch pipe connecting the two boilers either above or below the water line, so as to allow a freer passage between the boilers, and he will have no further trouble; or, what is still better, he should compel the builders to place (at their own expense) larger and proper steam connections on the boilers.

It shows gross ignorance in the management of steam on the part of builders to set up two steam boilers "sixteen feet long and forty inches in diameter," with only "two inch" steam connections; with such imperfect connections boilers are positively dangerous.

Zanesville, O. W. A. C.

Making Flour without Millstones.

To the Editor of the Scientific American:

In regard to your article, page 353, current volume, on the manufacture of flour, I would like to answer a few questions and ask a few others.

I am constantly using a machine, such as you speak of, that will grind wheat, or, in fact, almost anything, without the use of stones, and will run for years without repairs. But your article says there is no heat. That is not so; the heat produced in the winter is about 60 or 70 degrees, and in summer about 100; and, as you say, it is done by extreme velocity and requires no skilled labor. But what I wish to ask is, will it make better flour, and what would be the difference in the price of labor now used, and the price of labor with one of these machines? I have had considerable experience with this machine, and have ground, in ten hours, 15,000 to 18,000 lbs. of a substance similar to flour.

Brooklyn, N. Y. G. T. GRANGER.

The Existence of an Open Sea at the Poles of the Earth proved by Magnetism.

To the Editor of the Scientific American:

As a general rule, fresh water from wells and brooks freezes at 30° Fahr., sea water at 28½° Fahr., regulated, however, by the amount of salt and saline matter it contains.

Rain water freezes generally at 30½° Fahr., and distilled water at 31° Fahr. Fresh and sea water ice melts at 32° As sea water gives out its salt, etc., in the act of freezing, therefore the ice of both melts at the same degree of heat. These facts being understood, the following experiments were performed on November 28, 29, 30, and December 1, 1871. During the four days of those experiments, the thermometer in the shade ranged from 17° Fahr., to 24° Fahr., between 7 A. M. and 4 P. M. The wind blew hard from the north west.

Everything being ready, we commenced at 10 A. M, in the shade, and the experiments were continued until 12 noon, and the experiments on each day were made at the same time of day.

The experiments in detail are as follow; We took two wooden bowls, highly coated with shellac varnish, being 8 and 18 inches in diameter respectively. The smaller one was intended to represent the open polar sea, and the larger one, to represent the belt of ice which surrounds that sea. In the large bowl, we put 4 inches of water, and the same depth in the small one. The large vessel was placed upon a pine table insulated by a plate of glass beneath it and the table, and the small bowl was placed in the center of the large one, with another plate of glass under it.

The water, when first put into the two vessels, was of the same degree, that is, 34° Fahr. It was brought from the kitchen for this purpose.

Having the electromagnetic machine and the battery ready we made the circuit at 10 A. M.. At 11 A. M., there was thin scum of ice in the outer vessel but none in the inner one. The thermometer in the outside one at this time indicate $23\frac{1}{2}$° Fahr., the same as the one in the shade in the open air but the one in the small vessel was $28\frac{3}{4}$° Fah., being $\frac{3}{4}$ of degree above the general freezing point of sea water. Fifteen minutes after the circuit was broken (12 noon), there were signs of ice in the inside vessel, and, at $2\frac{1}{2}$ P. M., there was a thin sheet of ice covering the whole surface. The thermometers in both vessels and the one in the open air, now stood at $23\frac{1}{2}$ Fahr. The battery was supplied with crystals of the sulphate of iron during the operation, so as to keep up a strong and uniform current.

During the experiments, the water in the inside vessel was continually examined with a microscope, and we observed a vibration of the water and also a rotary motion around a common center, until the circuit was broken.

Now, as a slight agitation of water retards its freezing, will not such have a similar effect at the poles, to preserve the water from freezing?

We have long entertained the idea that electric and magnetic currents pass and counterpass over the surface of the earth, and are concentrated at the poles, where the intensity is the greatest.

For as heat, light, and electricity are nearly the same in principle, and as decomposition in nature, friction, concussion, and chemical combinations in the earth, all tend to develope them, we can readily conceive that, whenever they are in an active state, that heat and motion must be there also.

Therefore, if such a theory be true, the convergence of the electric and magnetic currents to the poles of the earth, will continually produce heat and motion, which will prevent the water from freezing; and, consequently, an open sea will be the result.

New York city. JAMES QUARTERMAN.

[For the Scientific American.]

SUBTERRANEAN EXPLORATIONS.

One of Nature's geological freaks during the ages past resulted in the formation of a large cave near where the city of Hannibal, Missouri, now stands. It is not a new or recent discovery, having been known for at least half a century.

Though not to be compared with the Mammoth Cave or Niagara Falls, it is still deserving of more attention than it has heretofore received, from the travelling and scientific world.

The entrance to the cave is one quarter of a mile from the west bank of the Mississippi river, and about thirty feet above the bed of a small stream that joins the Mississippi at this point. The bluffs are limestone, and from 200 to 300 feet high. Passing within the portals of the entrance, the explorer finds there three passages diverging as the radii of a circle; following either of these he will soon find himself entangled in a perfect labyrinth of avenues and passages, passing into, through, above and below one another, at every conceivable angle. Instead of the one passage, with which he started, there may be twenty or more, running in all possible directions. This is the general arrangement of the whole cave—a vast network of subterranean channels, a "mighty maze" and quite "without a plan."

In some places the cave is four stories deep; that is, there are that many distinct systems of galleries, one above another; at other places these may be all merged into one. The above will afford one some idea of the intricate and complicated structure of this wonderful underground city.

To get lost is one of the easiest things imaginable. The explorer needs to take every possible precaution, if he would prevent such a result. The truth of this statement has been proven on more than one occasion; but never, I believe, with any fatal or serious results. Two boys were once lost in the cave for a week, and had to subsist on *raw bats* during that time. On another occasion, a man, who had been lost for several days, came out at a point two or three miles from where he went in, and thus discovered a new entrance.

The extent of the cave is not known, with any certainty. One avenue, which has been named "Grand Hall," is quite straight for nearly a mile in length. Judging from its direction and length, it must pass under the Mississippi river, as also do many of the other passages. So that the cave is at once subterranean and sub-fluvial (if I may be allowed to coin a word).

There is but little water in the portion of the cave visited by your correspondent, and the atmosphere is comparatively dry.

The temperature, of course, is always the same, and that is near 60° Fahrenheit. Summer heat and winter cold have never penetrated to these subterranean vaults. The absence of water, or some other cause, has prevented the formation of those beautiful stalactites and stalagmites which are usually found in limestone caverns.

The rock is the mountain limestone of the sub-carboniferous age; and it is a fact worth noting, that all the great caverns of this country, if not of the whole world, are found in this formation.

The walls of the cave are studded with water worn crystals of calc spar-carbonate of calcium; a light blow with the hammer reveals the beautiful interiors of these rusty looking nodules.

The origin of the cave is plainly and indelibly written on the walls of every passage and chamber; the characters are horizontal water marks and ledges, such as would be produced by a running stream of water. They are so plain and distinct as to preclude the possibility of its having been produced by any other cause than a subterranean river.

There is considerable niter—nitrate of potassium—in the clay or silt found in many parts of the cave. Tradition says that, during the war of 1812, a man and his sons manufactured saltpeter here. At any rate, there are still to be seen remains of old leaches, which were used for the lixiviation of the nitrous earth.

Bats seem to be the sole representatives of the animal kingdom; these melancholy creatures are found here in large numbers. They love the dark and shun the light; does it follow that their deeds are evil?

There are, in this part of Missouri, a great many caves, large and small, in some of which are found most beautiful stalactitic formations. But there are none as large or intricate as the one above described. R. O. C.

[For the Scientific American.]

LATENT HEAT OF LIQUIDS.

BY P. H. VANDER WEYDE.

The adoption of the unit of heat has not only given rise to discoveries of a purely speculative scientific nature (of which an example was given on page 389 of the last number of this journal), but it has also led to important practical results, of which the application of the knowledge of specific heat is an instance. A much more important result, however, was the knowledge obtained concerning that class of phenomena where heat actually disappears and reappears; this kind of heat has been called "latent heat," it is *the heat of form;* that means, this apparently disappearing heat is the cause of the fluid and gaseous conditions of matter; solids have no latent heat, fluids a certain amount, and gases a very large amount. Latent heat, therefore, must not be confounded with specific heat, as it gives rise to an entirely different class of phenomena.

Before the acceptance of the unit of heat, the phenomena referred to were totally misunderstood. It was, for instance, supposed that when water was cooled below 32° Fah., it all suddenly congealed by the abstraction of a single degree of heat; and, inversely, that ice of 32° had only to be heated a single degree above that point to convert it all into water. If this in reality were the case, the freezing of rivers in winter would be most inconveniently rapid, and the melting of ice, on the fields and mountain slopes, most disastrously sudden; so that it would produce the most fearful inundations every day that the temperature rose above 32°.

Fortunately this is not the case. When we attempt to raise the temperature of a very cold mass of ice, say of 10° Fah., by supplying it with heat from any source whatever, we find that its temperature will increase gradually till we reach 32°; when this point is attained the increase in temperature will suddenly be arrested, notwithstanding that we continue our supply of heat; and it appears that this further supply is all consumed in the operation of changing this solid condition of the substance gradually into the liquid. We see, further, that a very considerable amount of heat is, as it were, absorbed into the resulting water, and that this water will remain at the same temperature of 32° till all the ice is melted. If we try to find how much heat is absorbed in this way, we shall obtain as result 142 units, that means, that to convert one pound of ice of 32° into water of 32° will require as much heat as would suffice to heat a pound of water from 32° to 174°. This is 142°, which, if applied to one pound of water, is, of course, 142 units. It is evident that, in this case, the thermometer can be no guide, since the ice, just before and just after the melting, remains at 32°, notwithstanding the absorption or consumption of 142 units.

The heat thus disappearing is also called "heat of fusion," and any solid substance, when melted or converted into the liquid condition, will absorb heat in exactly the same way. The amount of heat thus rendered latent varies for different substances, of which the following table contains a few:

Name of substance.	Melting points.	Latent heat.
Ice	32° Fah.	142 units.
Spermaceti	130° "	144 "
Beeswax	149° "	171 "
Sulphur	230° "	142 "
Tin	430° "	490 "
Bismuth	500° "	550 "
Lead	617° "	160 "
Zinc	700° "	480 "

It will be noticed that the units of heat, absorbed by melting, have no relation to the melting point; so the latent heat of ice and sulphur do not differ, while their melting points differ considerably. The melting points of lead and bismuth differ not a great deal, while the latent heat of the latter is three times as great as that of the former. No doubt that the crystalline tendency of the solidifying bismuth, which is absent in the lead, has something to do with the peculiarity that the body with the higher melting point has the less latent heat.

It may be well to explain some of the methods of determining the amount of heat absorbed by fusion, as this will, at the same time, give a clearer conception of the doctrine of latent heat. One method is to expose the solid substance, during melting, to a constant source of heat; for instance, a Bunsen burner, of which it has previously been determined how many units of heat it will produce per minute, or how many degrees it will raise a pound of water in that time. Suppose such a burner were arranged so as to raise the temperature of one pound of water two degrees per minute; every half minute would then be equivalent to a unit of heat; and, with such a flame, it would then be found that one pound of ice of 32° would require 71 minutes to be converted into water of 32°; or that one pound of solid beeswax of 149° would require 85 minutes to be entirely changed into the liquid condition. This method, however, is not adapted for correct estimates, especially in experimenting with the metals at high temperatures, by reason of the great loss of heat by radiation in such cases.

A more correct method is that of mixing, similarly to the method described on page 189, for finding the specific heat One pound of boiling water of 212°, poured in one pound of water of 32° will produce two pounds of water of the mean temperature of 133°; but when the pound of boiling water is poured upon one pound of ice, it will commence with losing 142°, which will be consumed to melt the ice and change it into water of 32°; we shall then have one pound of water of 212°—144°, or 68°, and one pound of water (the melted ice) of 32°; the mean of 68° and 32° is 50°, and this will be the temperature of the mixture. Or suppose we put, into the pound of water of 212°, one pound of spermaceti, previously heated to 129° or 130°, near its melting point. We shall then find that the water will soon be cooled down to 140°, and will have melted half the spermaceti, 72 units having been abstracted by the melting of half a pound of this substance. A pound requires 2×72 or 144 units of heat, or, in other words, the temperature of the boiling water exceeding that of the melting spermaceti, 212°—130° or 82°, and the latent heat of the spermaceti being 144 units, it would require $144\div82$, or nearly $7\div4$ lbs. boiling water, to melt the whole of the spermaceti.

A third and most reliable method is the measuring of the amount of ice melted by the solidification of the substance under investigation, which previously has been melted and cooled to near its point of congelation or solidification. Knowing that every pound of ice melted represents 142 units of heat abstracted, in that every 142d part of a pound of melted ice represents one unit, we have only to weigh the water obtained from the inside of a block of ice, into which the melted substance has been introduced, and which has been melted by the cooling and solidification of that substance. Take, for an illustration, a pound of melted tin, showing a temperature of 430° Fah., its melting point, and introduce it, in a proper vessel, in the inside of a previously hollowed large block of ice; the opening in the top is covered with another block of ice, and all is placed in a properly constructed box of non-conducting material so as to have no unnecessary melting on the outside. If we wait till the tin has solidified, but still has a temperature of 430°, we shall find that three and a half pounds of ice have been melted, as we may pour so much water out of the hole from which we remove the tin, and as every pound of ice melted represents 142 units of heat, we have $3\frac{1}{2}\times142=497$ units of heat for the latent heat given off by the melted tin during its solidification, without change of temperature. Or, if we wait till the tin has cooled to 32°, the temperature of the ice, we shall find that, in all, $6\frac{1}{4}$ pounds of ice have been melted; of this $2\frac{3}{4}$ is 400 units, the descent of solid tin of 430° to 32°; the balance represents the latent heat.

Electricity--Lecture by Professor Doremus.

Professor Doremus, in the last of his course of scientific lectures before the Young Men's Christian Association, New York, discoursed on electricity and its applications. In opening, he said that Oersted, of Copenhagen, was the first to make known the fact that electric currents have a marked influence upon the magnetic needle. This discovery led to a multitude of other discoveries, chief among which is the telegraph. The Professor here explained the minute details of operating the telegraph, and, in speaking of the rapidity with which the electric current moves, stated that recently a message was sent from Cambridge, Mass., to San Francisco and back in less than three quarters of a minute, excepting the time necessary to repeat it at the various stations. A prince visits us, and almost the very moment he lands on our soil, his family are acquainted with the fact by electricity. Another prince lies on his deathbed, and day by day, hour by hour, the whole civilized world is informed of his condition, and made to sympathize as one common family. It has been claimed recently that electricity will one day supersede the steam engine, but he could not think so, as it seems thus far to be utterly impossible to move anything but comparatively delicate instruments or machinery by its method. Professor Doremus next explained the various applications of electricity to heat for purposes of exploding torpedoes, blasts and mines, and even for assisting in surgical operations by heating the platinum knife, which, when used, of course cauterizes the wound; also the application of the galvanic battery to the human system in cases of paralysis and poison. The Professor had seen a person, whose arm was rendered utterly useless by the disease just mentioned, perfectly cured in from five to six weeks by the use of the battery. In conclusion, the speaker remarked that the greatest, most glorious field for this agency—its application to the human system to restore life, or, in other words, as a resuscitator—was as yet wholly unexplored; but he trusted that we should, before many years, find a solution of this problem.

A CONNECTICUT paper says that a lawyer hung out his shingle in the town of Bethel, in that State, but left after a year, having had only one case, and that was of inflammatory rheumatism. Hard on the lawyer, but creditable to the Bethelists.

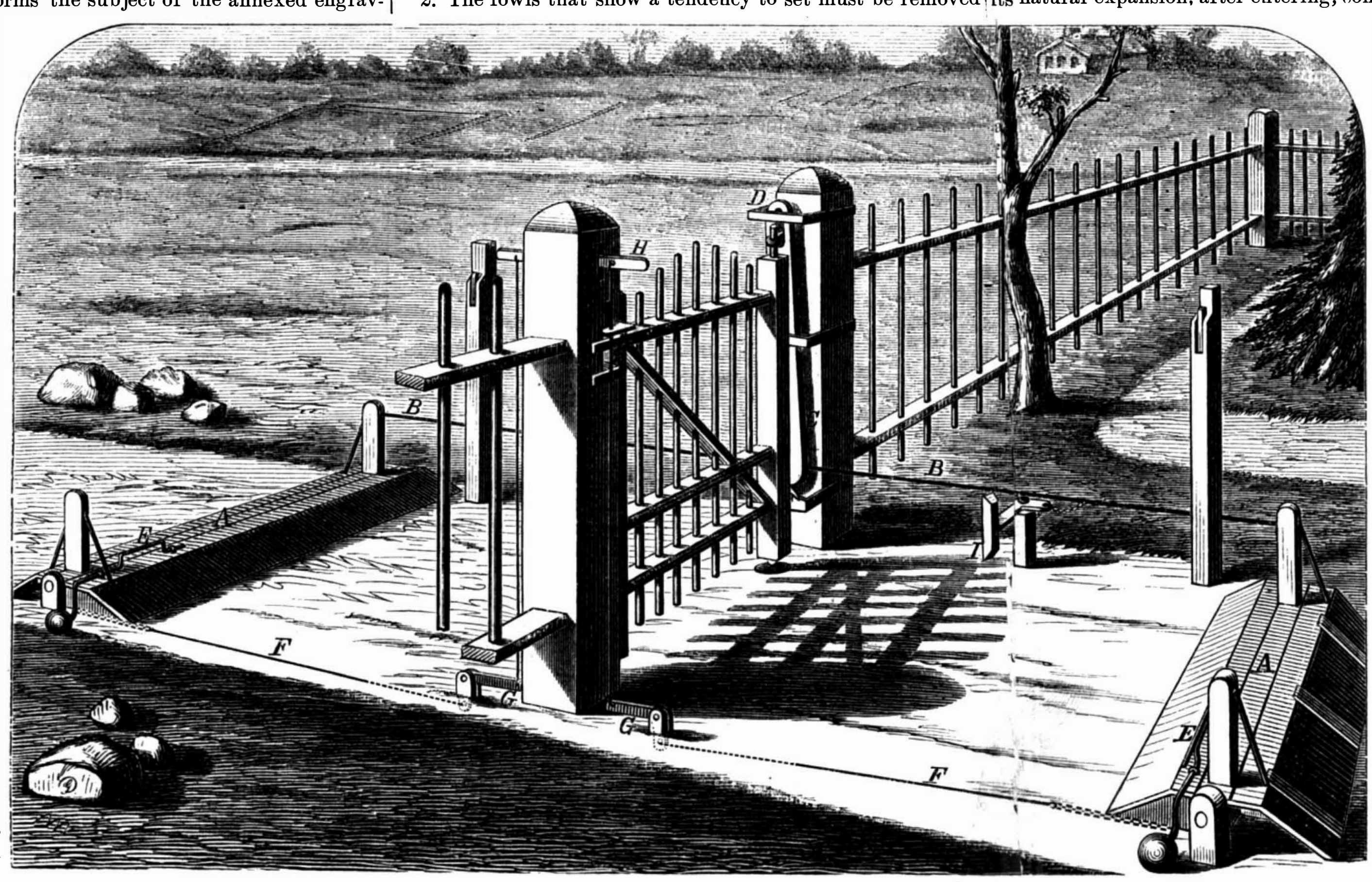
Automatically Acting or Rocking Gate.

Only when the points of support in a swinging door or gate are in the same perpendicular line, will it remain in any position in the arc of its oscillation on its hinges. If the top hinge be placed to one side of the perpendicular line which passes through the lower hinge, the gate will swing toward that side of the perpendicular. If the top hinge be made movable from side to side of the perpendicular line described, it is obvious that the gate may be made to swing, by its own gravity, either one way or the other, as the hinge is thrust to one side or the other.

The gate which forms the subject of the annexed engraving is thus constructed, and is also made to latch and unlatch itself automatically on the approach of vehicles, opening in the direction of the advancing carriage, and closing automatically after the vehicle has passed.

This is accomplished by very simple means. The carriage, as it approaches the gate, passes over a rocking bridge, A. From a perpendicular rock-bar, attached to A, passes a cord, rod, or chain, B, to a lever (not shown) behind a tilting bar, C, pivoted to the hinge post of the gate, which tilting bar carries the pintles which support the gate and on which it swings.

The top part of the tilting bar, C, slides back and forth in a metal guide, D, as it is tilted from side to side by the action of the bridges, of which there are two, as shown.



AUTOMATICALLY ACTING OR ROCKING GATE.

In swinging together, the gate latches itself. It is unlatched by the wheel of the carriage which, in passing over the bridge, depresses a weighted crank lever, E, which acts to raise the latch through the rod, cord, or chain, F, the bell crank lever, G, and rods which operate the latch.

The gate, as it swings open, strikes against wind guards, I. These are pivoted to the tops of the short posts which support them, and are attached by short chains to the connecting rods, B, as shown; by which means they act to give the gate a start in closing, this being necessary when the action of strong winds opposes the movement of the gate.

It is evident that when, in passing over either bridge, the tilting bar is inclined to swing the gate open, the rocking of the bridge on the other side of the gate will tilt the bar in the other direction, so that the gate will close. It is also evident that no animal can open the gate, nor can it be left open by accident, so long as the working parts are in order. A rider on horseback opens the gate by lifting with his hand the lever, H, which is connected with the latch. When droves of stock are passing through, the gate is held open by a hook on the wind guards.

The gate is easily made, by ordinary workmen, from materials generally at hand; and any ordinary swinging gate is easily altered into one of these rocking gates.

The invention was patented July 12, 1870, and February 7, 1871. For further particulars and descriptive catalogues, address J. Madison Cutts, attorney and counsellor at law, corner of 7th and E street, Washington, D. C.

Preserving Eggs.

The subject of the preservation of eggs, says the *Boston Journal of Chemistry*, has recently attracted a great deal of attention, and many methods of effecting it have been published; though none are altogether perfect, for the simple reason that the true cause of the spoiling of the eggs is either unknown by those who have attempted to furnish us with directions, or has been lost sight of by them. There are two efficient causes for the spoiling of eggs, and unless one or both of these are avoided, we cannot hope for success. The first is exposure to a high temperature, and the other is access of air. It may be safely affirmed that at temperatures below 32° Fahr. nearly all change ceases in organic bodies, while very few organic substances will bear continual exposure to a temperature above 90°. The freezing point is rather too low for the preservation of eggs in good condition, as freezing affects the flavor unfavorably; but, if we desire to preserve eggs in the best manner, we must keep them cool—say at a temperature below 50°, if possible, a temperature which is frequently maintained in good cellars. But it will be of no use to place the eggs in a cool cellar if they have been previously exposed for hours to a temperature of over 90°.

The collection of the eggs must, therefore, in the first place, engage our attention. Those who raise poultry, and especially those who keep fowls for the sake of their eggs, commit a great error when they fail to remove from their yards those birds that are inclined to set, and which consequently take every opportunity of warming the eggs in the nests. If any one will attempt to preserve eggs that have been subjected to the hatching process for one or two days, he will discover the force of this statement. Kohler, of Germany, who owns an extensive poultry raising establishment, and who every winter preserves thousands of eggs without ever losing one, has recently published an account of his method of proceeding, and has given the following rules for securing favorable results:

1. The nest must be placed in a cool position.

2. The fowls that show a tendency to set must be removed at once, and placed in separate inclosures until this propensity has left them.

3. If many hens be confined in the same inclosure, or use the same nests for laying their eggs, the eggs ought to be removed from the nests several times a day.

4. The eggs ought to be assorted according to age, and preserved in boxes with the covers always partially open. These boxes must be kept in a cool, airy, and perfectly dry place.

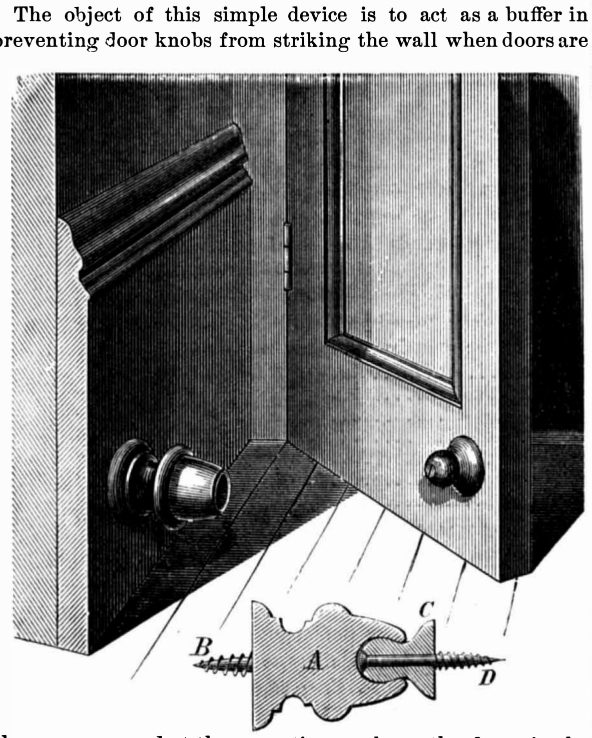
5. At the commencement of winter, the store of eggs is placed in some room that is not heated by fire, but that is, at the same time, thoroughly protected from frost.

6. The packages should be so arranged that the oldest may be used first.

Eggs treated according to these rules do not acquire the peculiar taste which is generally the result of the recipes in vogue for preserving eggs.

WENDELL'S COMBINED DOOR BUFFER AND DOOR FASTENER.

The object of this simple device is to act as a buffer in preventing door knobs from striking the wall when doors are thrown open, and at the same time to keep the doors in the open position when so desired. The objection to devices now in use, for overcoming the concussion in throwing the door against the washboard pedestal, is the rebound they give the door, throwing it away from the position designed for it. To obviate this, several devices have been brought out, consisting of springs, ratchets, catches, etc., most of which have been proved too intricate and expensive for the purpose.



The door buffer and fastener in the annexed illustration has the combined merits of simplicity, durability, effectiveness, and cheapness, as will be seen from the following description and an inspection of the engraving in which a section of the stop is shown.

A represents the pedestal to be attached to the washboard by the screw, B. This pedestal can be made from wood, brass iron, or porcelain, in plain or ornamental forms, the gimlet pointed wood screw, B, being permanently attached. The rubber cushion, C, is to be attached to the door by a screw, D. It will be seen that the contraction of this rubber cushion when entering the cup-shaped cavity in the end of the pedestal, and its natural expansion, after entering, constitutes the catching device. It requires but little direct pushing to fasten the door, and but little to unfasten it, yet it is held firm against wind or draft.

The striking of the face of the pedestal against the base of the rubber cushion lessens the concussion. The simplicity, cheapness, and usefulness of this invention recommend it to builders, carpenters, and families, the cost above the ordinary pedestals now in common use being merely nominal. It requires no skill or special tools for application. In a word, it is one of that class of little things by which the public is benefitted cheaply, and from which the manufacturer generally reaps a substantial pecuniary reward.

Patented June 27 1871. For further information address Wendell & Francis, 436 Walnut street, Philadelphia, Pa.

Recent Progress in Chemistry.

I wonder what Sir Humphry Davy would have said to any one who talked about stellar chemistry. That great man, in ridiculing the idea of lighting London with gas, triumphantly asked the fanatics who proposed such a wild scheme, whether the dome of St. Paul's was to be the gasometer? Yet we cannot imagine Regent street illuminated, or rather darkened, with dips again, and to us stellar chemistry has a real meaning. Who will venture to bound a science which reaches far away through space, and with unerring accuracy tells us the composition of distant worlds and distant suns? What can be more humiliating to our small intelligences than the reflection that a distant star will photograph its spectrum on a sensitive surface with the ray of light that left it when the oldest man in this room was a boy? What would the great father of British chemistry have said, had he stood in the lecture room of the Royal Institution, where his great discoveries were made, and seen the burning hydrogen extracted by our great countryman Graham, from a meteorite, the heat and light of another world: or could he look with Lockyer on the burning flames of hydrogen, which dart up from the sun to a hight of 50,000 miles, or could he read the flashing telegrams which run so rapidly round our world, that all our notions of time are completely upset, and we actually receive intelligence today which was sent tomorrow? (Excuse the apparent absurdity; it only shows how powerless language is to keep up with human progress.) Had he lived with us, he would have seen a large city dependent entirely for its communication with the outer world by a marvellous kind of photography, so minute that it enabled a pigeon to carry a proof sheet of the *Times* under its wing.—*E. C. C. Stanford.*

THE increasing use of bromide of potassium, another of chemistry's contributions, would have been impossible, were it not for the extraordinary discovery of an apparently evaporated sea water bed in Germany. The amount of bromide consumed in medicine is now enormous, and most of it is derived from this source. The same mines have also completely changed our sources of potash; they produce far more than all the other sources of England and France put together, and have so reduced the price that carbonate of potash is now largely made in this country at a price which competes most favorably with American pearlash, and will ultimately drive it out of the market. Bromide of potassium is an instance of a substance long used in medicine before its valuable properties were discovered.—*E. C. C. Stanford.*

IT is stated that a little girl in Philadelphia died a few days ago from hydrophobia taken by biting off a thread after mending a rent in her dress which her dog had torn with his teeth in play. She had the disease in its most frightful and distressing form. This is probably a case of idiopathic tetanus or lock jaw, the symptoms of which often simulate to some extent those of hydrophobia.

Scientific American.

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VOL. XXV., NO. 26 . . [NEW SERIES.] . . *Twenty-sixth Year.*

NEW YORK, SATURDAY, DECEMBER 23, 1871.

Contents:

(Illustrated articles are marked with an asterisk.)

CLOSE OF THE TWENTY-SIXTH YEAR OF THE SCIENTIFIC AMERICAN.

Our readers will pardon us if we display in this article the natural gratification we feel in the continual and increasing prosperity of the SCIENTIFIC AMERICAN. This number closes its twenty-sixth year of existence. So long a connection with the publication of a single paper as we have had almost identifies it with our daily existence. The pride we feel in it redounds to the good of our readers, for our ambition will never consent to see our journal deteriorate either in quantity or in quality of matter.

Our editorial labors during the past six months have been arduous. These months have not been prolific in discoveries or inventions of such a nature as to furnish fertile subjects for discussion or numerous items of interest. Yet, we have, we think, succeeded in rendering our paper even more interesting and profitable than in preceding volumes. We have full evidence of this in the steady healthy growth of our subscription list, in the encouragement constantly received from correspondents, and in the increasing patronage in every department of our business.

The conviction we feel that our paper exerts one of the most important educating influences in the world, and tha its record may be scrutinized in vain to find in it anything that has not been salutary to mental and moral progress, gives us courage to urge upon all to help us in widening its circle of readers. We are not content to have the largest circulation of any paper of the kind now published. We wish to reach others who have not as yet learned, by long perusal, the real value of such a publication.

You, OLD FRIEND, whose long acquaintance with its merits has deepened your respect and regard for the SCIENTIFIC AMERICAN, and who feel and write that you have been our patron for more than a quarter of a century and would not be without the paper if obliged to dispense with one meal a day, say those kind words not to us only, but tell the same thing to your neighbor and shop mate. Tell him to send for a copy if he wants one to see how he likes it, and induce him to try it for six months or a year. When the SCIENTIFIC AMERICAN visits a house for six months, it generally finds a permanent home there.

As will be seen by our prospectus, we offer special inducements to those who aid us in getting new subscribers.

We have no solicitude about the old patrons renewing; we simply ask that they will do so promptly that we may not miscalculate the quantity of paper to print at the commencing of the volume.

THE GREAT EXHIBITION AT VIENNA, 1873.

We published, on October 28th of the present year, the announcement of the appointment, by the Emperor of Austria, of a commission to arrange for holding an international exhibition at Vienna, in 1873; and on November 18th our readers were given some further information on the subject, and some suggestions, for organizing a proper representation of American genius and industry, based on our experience gathered in Paris, London, and elsewhere. The Austrian scheme is gradually getting into shape, the form and dimensions of the building having been decided upon. A building 3,000 feet in length and 660 in width is to be erected; this structure will be crowned with a cupola, about 330 feet in diameter. This will be finished by October 1, 1872. A separate building will be provided for exhibiting machinery in motion, and another for the works of art. The novel features in the arrangements have been submitted by us to public approval, and it now remains for the manufacturers, inventors, and scientists of the United States to decide upon their course of action.

Constructors and patentees who have introduced their inventions in European countries have suffered grievous ill-treatment at the hands of the Austrian authorities, whose regulations on the subject of patents are, to say the least, not formed for the protection and reward of foreign talent and ingenuity. One most vexatious rule is that which invalidates a patent unless the article be manufactured *in the realm*, within twelve months from the date of issue. Now as patents are, in a measure, characterized by the locality in which they take rise, and are generally most economically worked in the country in which they originate, it is almost equivalent to prohibition to enact that the locomotive engines of Great Britain, the telegraph instruments of the United States, and the printed muslins of France shall be manufactured on Austrian soil within a year from securing the patent, and is a preposterous requirement, which ill comports with our liberal system of granting patents to their subjects.

But worse remains to be told. An American gentleman, having a manufactory at Vienna, was enabled to comply with this obnoxious rule; but he recently had a taste of Austrian legal administration. He had obtained a patent and commenced the manufacture of the article almost simultaneously; and two trustworthy and credible witnesses were produced to prove this fact, but the officials deemed their affidavits insufficient, and the manufacturer has been summoned before a court of justice to prove the introduction. Such hindrance of the rights of foreigners gives rise to an uncomfortable suspicion that the value of Austrian patents, issued to Americans and other foreigners, can be easily escheated to the benefit of the Austrian public. The inventor in question even goes farther, and intimates that his production, being used by the Imperial government, was specially and purposely hindered from its proper protection, that the authorities might more readily convey it to their own use without reward to the patentee.

Under such laws, it would be well for the Austrians to consider whether their invitation to the nations is not likely to meet with a contumelious refusal. Here, as elsewhere, experience is valuable, and we remember that when we sent to Europe in 1851, 1855, 1862 and 1867, we took our inventions and processes to an open market. Neither in London nor in Paris was there any room for suspicion that our specimen machines and productions were there for Europeans to avail themselves of, the American being allowed a courteous protection of his invention while the exhibition lasted; but we do not learn that Austria proposes any such protection. The result of this most erroneous and destructive policy will easily be foreseen.

LYCEUM OF NATURAL HISTORY---DISCUSSION ON MILK AND DISINFECTANTS.

At the meeting of the chemical section of the Lyceum of Natural History, on Monday evening, December 11, two important papers were read, one on "Milk," by Dr. Schweitzer, Assistant Professor in the School of Mines of Columbia College, and the other on "Disinfectants," by Dr. Endemann, Assistant Chemist to the Board of Health.

Dr. Schweitzer has had occasion to analyse a very large number of specimens of milk, gathered by the sanitary inspectors of the Board of Health, and it was a satisfaction to hear him say that he had never found any other adulteration than water. The popular impression, that chalk, calves' brains, and similar unappetizing impurities are added by milk dealers, appears to be erroneous. The chief results obtained by Dr. Schweitzer were as follows: Normal milk has the specific gravity of 1·029, and contains from 12½ to 13 per cent solid constituents. Two, out of numerous analyses, afforded:

Water	87·81	87·23
Butter	3·23	3·81
Casein (cheese)	3·57	3·71
Sugar	4·69	4·46
Ash	0·70	0·79

The best specimens of condensed milk gave: water, 53·54; butter, 13·12; casein, 14·44; sugar, 16·30; ash, 2·60. In the preparation of the condensed milk, 430 quarts were condensed to 100, and the solid constituents increased from 12·55 to 46·46 per cent. These results appeared to warrant the suspicion that 378 quarts had been reduced to 100; but by making the correction, called for by the fact that the quart was a measure of volume while all the determinations were made by weight, the company were found to have actually started with 430 quarts to make 100 of the condensed article. The ashes of milk are rich in phosphates and alkalies.

Dr. Schweitzer has added largely to our knowledge of the composition of milk, and it is to be hoped that his valuable paper will be published in full, in some technical journal.

Dr. Endemann, at the request of numerous members of the Lyceum, gave a sketch of experiments tried with various disinfectants, under the direction of the Board of Health, taking them up in the following order:

1. Metropolitan disinfecting fluid. This famous disinfectant is composed of 90 per cent of a saturated solution of sesquichloride of iron, and 10 per cent of carbolic acid. If it be entirely neutral, its operation is quite effective; but the chief difficulty encountered with it was in its acid character, which destroyed articles brought in contact with it, and often liberated bad gases.

2. Girondin disinfecting fluid is composed of zinc and copper salts, and can only be obtained on a large scale in countries where these salts are the incidental products in extensive chemical manufactures.

3. Chloralum had been subjected to a thorough trial, and found wanting. It is essentially composed of the hydrated sesquioxide of aluminum, and in its action has the tendency to liberate sulphuretted hydrogen instead of fixing it.

4. Bromo-chloralum is the preceding with a little bromine added to it; but as this bromine is in combination with alkaline bases, it is of no effect; and the disinfectant was found to be no better than it should be. The fact was brought out that forty years ago, M. Gannal, in France, proposed chloride of aluminum for the embalming of bodies, but did not seem to find acceptance, and was forgotten until Mr. Gamgee recently revived it for the preservation of meat. It appears to have disappointed the expectations that were raised in reference to it; and also as a disinfectant and antiseptic its value has been overrated.

5. Egyptian powder was declared to be only a little less disgusting than the bad odor it was intended to disinfect. The remedy was worse than the disease. It appears to be essentially clay, mixed with a few per cent of the carbolic acid contained in refuse tarry liquids, and was said to have a decidedly disagreeable smell.

6. Dry earth and peat. Dr. Endemann gave us the result of his experience, that for the disinfecting of night soil, there was nothing so valuable as dry earth and peat. Other disinfectants poisoned the rich soil and destroyed vegetation, but the simple earth prevented the growth of germs, and thus stopped the spread of disease and added to the growth of plants. We cannot dispense with disinfectants and antiseptics on all occasions, but there are many instances where dry earth could be more effective, while it is cheaper and more easily handled.

Professor Joy confirmed the observations of Dr. Endemann, and stated that he had tried the earth closet system for two years, and was convinced that it was destined to supersede all other methods of getting rid of the fecal matters, both in the city and in the country. He believed that it was better to stop the cause of disease at the outset, rather than to scatter it broadcast through our water closets and open privies, and then to try to prevent its further spread by the use of costly chemicals. The open country privy and the city water closet were declared to be the very hot bed for the germination of the worst forms of disease; and the sooner both are abolished the better for the welfare of the community. The ashes of hard coal, which the scavengers carry in enormous quantities from every house in the city, can be used as a substitute for dry earth. It is only necessary to run this through a tolerably fine seive, and to use it in the commode, and after use, to pass it into the garbage barrel, to be carried away in the carts.

All that any family requires is a hopper shaped reservoir for holding the sifted ashes, a galvanized iron hod, and a pull up similar to that which is provided in water closets. It is easy enough to try the experiment, as commodes of different patterns are now kept on sale. Such a use of fine coal cinders would be very valuable; and the material thus obtained from private houses would be highly prized by farmers. If the Board of Health would go to work energetically in this matter, they could do good work in introducing a much needed reform. We cannot expect to go on forever contaminating the rivers and bays with the contents of our sewers. A stop must be put to it some time, and the sooner the better. Who will put the earth closet system into such a practical shape as to drive water closets out of our city houses and banish the unsightly temples from country houses? We trust that the time is not far distant when this result will be accomplished.

THE MYSTERIES OF FLIGHT.

Perhaps in the whole range of animated nature there is no greater mechanical mystery than the flight of birds. We publish in this issue a well authenticated account of a most remarkable flight of some carrier pigeons, one flying at a rate of 196 miles per hour through a distance of 1,004 miles and another, 202 miles an hour for a distance of 1,596 miles. The article referred to gives accounts of other remarkable flights which, as we do not deem them well attested, we shall not further refer to at this time.

The power necessary to propel a pigeon 200 miles per hour proves, upon computation, to be something astonishing. The shape of one of these birds is almost perfectly adapted to reduce cross-section resistance to a minimum; but we think we shall be considered as entirely within bounds when we assume that such resistance would be as great as that exerted upon one half a square inch of flat surface. The pressure upon this surface moving through air of ordinary density at the rate of one mile per hour is, according to Smeaton, 0·000017 of one pound. Though the air, at the hight at which pigeons fly, has less than the ordinary density close to the earth's surface, its rarity tells as much against the action of wings as it lessens resistance to advance, and may, therefore, be neglected in the computation. At a velocity of 200 miles per hour the resistance of air upon one half a square inch of flat surface would be 40,000 times that at a speed of one mile per hour, or 0·68 of a pound. The bird to fly three and a third miles per minute would, therefore, be be obliged to overcome 11,968 foot pounds per minute, or to exert a force of over one third of a horse power.

It is impossible to believe this can have been the case with the pigeons in question. We are rather inclined to believe that they availed themselves of the aid afforded by air currents flowing in the direction of their flight. Though the wind might appear blowing against them when released, it is well known that at different altitudes currents of air may be rapidly flowing in opposite directions, and thus we have good ground for our supposition.

We last week commenced the publication of an article, which is concluded in our present number, entitled "Notes on Flying and Flying Machines," which contains much interesting information. Mention is made therein of many kinds of bird and insects; but we believe that the flight of sea gulls affords a more useful study than can be obtained from the movements of any other bird of equal strength of wing, on account of the fearlessness with which they approach the observer. We think no one can watch the evolutions of these birds without conceding that we are far from having solved the mystery of flight. Taking into account their weight, it is impossible to conceive their power, to float in air and to sail against a strong current of wind, as due to the slow and easy movements of their wings. We have watched these birds daily for months together, and we are wholly at a loss to account for their ability to sustain themselves with so small an effort as they appear to exert. The most rapid movement of their wings appears to be made when they poise themselves in air without advance or retreat. When sailing either with or against the wind, they seem to need but little power to propel them. This peculiarity may be noticed in all the birds which can sail slowly through the air, like the eagle, hawk, etc. The swallow, which skims like an arrow, moves its wings, which are large in proportion to its size, with great rapidity. The stroke of the pigeon is also swift and strong. The wings of the wild goose scarcely move more than one hundred and twenty times per minute, yet they are small in proportion to the weight of the bird, which is often from ten to thirteen pounds.

Standing with a glass on some high peak, one may see, in certain localities and seasons, flock after flock of wild geese traversing the sky from horizon to horizon with steady and uniform stroke, and probably passing thirty or forty miles from the time they are first discovered till they disappear in the distance. Now let the curious reader calculate the power necessary to sustain a body weighing ten pounds, by one hundred and twenty successive and uniform impulses per minute, without taking into account cross section resistance to advance, and he will begin to appreciate the mystery of flight.

It is because this mystery exists that the problem of human flight through the aid of machinery is still unsolved. As soon as we know the mechanical principles of flight, we shall have some ground for judging its possibility or impossibility to "birds without feathers."

SCIENCE RECORD FOR 1872.

We have in press, to be issued January 1st, a new and valuable book of 350 pages octavo, entitled as above, which, we think, will be read everywhere with interest. It will be a compendium of scientific progress of the present year, and is to be profusely illustrated with steel plate and wood engravings.

The following is a partial outline of the general contents of the *Science Record:*

Notices and descriptions of the leading discoveries and improvements invented or introduced during the present year, pertaining to Engineering, Mechanics, Chemistry, Philosophy, Natural History, Agriculture, Architecture, Domestic Economy, and the various Arts and Sciences, with many engravings.

Biographical notices of prominent men of science, with portraits.

Descriptions of the most important public works, began or completed during the year, with illustrations.

Notes of the progress and extension of railways, telegraphs, and other means of communication.

Descriptions of the new applications of steam, electricity, and other motive powers, with engravings.

Almanac for the year, and a chronological table of notable scientific events and phenomena.

Reports of Patent Office proceedings. Classification of inventions at the Patent Office, with the names of all examiners, officials and employees.

Portrait and biographical sketch of the Hon. M. D. Leggett, Commissioner of Patents.

Description of that great engineering work, the Mount Cenis Tunnel through the Alps, with engravings of the tunneling machinery, portraits of the chief engineers of the work, and other illustrations.

Description of the great Government works at Hell Gate, New York, with many illustrations, showing the wonderful galleries now being cut in the rocks under the bed of the East River, preparatory to removal of these obstructions by explosion, the drilling machinery, the electric apparatus, and other interesting objects.

Description of the great Suspension Bridge between New York and Brooklyn, now in process of erection, with interesting engravings.

Steel plate engravings of the celebrated Gatling Gun or Mitrailleur, showing its construction and use in various forms, upon wheels, horseback, camels, boats, etc.

Illustrations of recent improvements in cannon, fire arms, etc.

Recent applications of science to the construction of steam and sailing vessels, with illustrations.

Reports of the important law trials, and decisions pertaining to inventions and scientific matters.

Proceedings of scientific bodies, with notes of interesting papers.

Illustrations of late improvements in all the leading bepartments of mechanics and science.

Useful tables and practical recipes pertaining to the principal branches of industry.

The whole forming a convenient and popular SCIENCE RECORD of the present year, of permanent value and importance necessary for reference and interesting to everybody. It should have a place in every library.

350 pages octavo. Handsomely bound. Price $1.50. Extra binding, half calf, $2. Sent post free on receipt of the price. Published by Munn & Co., 37 Park Row, N. Y. Office of the SCIENTIFIC AMERICAN.

One copy of the SCIENTIFIC AMERICAN for one year and a copy of the Science Record, $4.

TO CITY SUBSCRIBERS.

The SCIENTIFIC AMERICAN will hereafter be served to our city subscribers, either at their residences or places of business, at $3·50 a year, through the post office by mail carriers. The newsdealers throughout this city, Brooklyn, Jersey City, and Hoboken keep the SCIENTIFIC AMERICAN on sale, and supply subscribers regularly. Many prefer to receive their papers of dealers in their neighborhood. We recommend persons to patronize the local dealers if they wish the SCIENTIFIC AMERICAN or any other paper or magazine.

TIMELY SUGGESTIONS.

Agents who receive their weekly supply of the SCIENTIFIC AMERICAN through news companies are urged to canvass their localities. By a little effort among intelligent mechanics and manufacturers, they can add largely to their lists. We will send specimen numbers, when desired, for that purpose.

What more valuable present can be made to young mechanics than a year's subscription to the SCIENTIFIC AMERICAN? Employers will be doing their employés a great service by acting on this hint, and we feel sure that at the end of the year they will consider the investment a good one.

Subscribers who wish to have their volumes bound can send them to this office. The charge for binding is $1.50 per volume. The amount should be remitted with the numbers, and the volumes will be sent as soon as they are bound.

Every Employer should present his workmen and apprentices with a subscription to the SCIENTIFIC AMERICAN for the coming year.

Every Mechanic and Artisan whose employer does not take the SCIENTIFIC AMERICAN should solicit him to subscribe for 1872.

Now is the Time for old subscribers, whose subscriptions expire with the year, to renew.

Now is the Time for new subscribers to send $3 and commence with the new year.

Now is the Time for forming clubs for the new year.

It will pay any one to invest $3 for himself, his sons, or his workmen, for one year's subscription to the SCIENTIFIC AMERICAN.

It is easy for any one to get ten subscribers at $2·50 each, and for his trouble obtain the splendid large steel plate engraving, worth $10.

It is easy for any old subscriber to get a new one to join in taking the paper. Those who do will receive a bound volume of the "Science Record" for 1872. See description of this work on page 353, SCIENTIFIC AMERICAN, issue of December 2d.

It is no more trouble to remit $6 for two subscribers than $3 for one.

If any mechanic whom you ask to subscribe says he cannot afford it, tell him he cannot afford not to.

If any one wishes specimens of the paper to examine before subscribing, tell him to write to the publishers and they will cheerfully mail them.

If any one wishes an illuminated Calendar for 1872, to hang in his office or shop, he can have it sent free on sending a request to this office.

If handsome illustrated posters and prospectuses are wanted to assist in obtaining subscribers, send to the publishers of this paper.

It is the intention of the publishers of the SCIENTIFIC AMERICAN to make the paper next year better and handsomer than any previous year during the last quarter century it has been published.

It is the intention of the publishers to illustrate, by superb engravings, all new and practical inventions and discoveries that may be developed during the year.

For Prospectus and terms to Clubs see last page.

APPLICATIONS FOR EXTENSION OF PATENTS.

FLOATING ANCHOR AND LIFE PRESERVER.—Joseph Humphries, Washington, D. C., has petitioned for an extension of the above patent. Day of hearing, February 28, 1872.

RAISING DOUGH.—James Perry, Brooklyn, N.Y., and Joseph C. Fuller Orange, N. J., executor of Elisha Fitzgerald, deceased, have petitioned for an extension of the above patent. Day of hearing, February 21, 1872.

Business and Personal.

The Charge for Insertion under this head is One Dollar a Line. If the Notices exceed Four Lines, One Dollar and a Half per Line will be charged.

Answers to Correspondents.

SPECIAL NOTE.—This column is designed for the general interest and instruction of our readers, not for gratuitous replies to questions of a purely business or personal nature. We will publish such inquiries, however when paid for as advertisements at 1·00 a line, under the head of "Business and Personal."

ALL reference to back numbers must be by volume and page.

T. B., of Pa.—We have not the address of manufacturers or dealers in white brass.

CARBON PLATES FOR BATTERY.—Gas carbon is rather a hard material to work. There are various ways of making plates for batteries of it. For an amateur, it has been recommended to cut it with a tenon saw. It will cost some elbow grease, but perseverance will give you success.

EXPANSION OF BELT.—I think, in the dispute between A and B, A is decidedly wrong in his opinion about belts being tighter in wet weather than in dry; and I can convince him that it is not so. At the late South Carolina State Fair, the belts that drove the cotton gins were run from two engines on the outside of the building, and I noticed that the belts were slacker on one day when it was raining, than they were on the other days that were clear. This, I think, is proof enough.—E. O. McC., of S. C.

CANKER IN MOUTH.—I notice that, in reply to F. S. C., a correspondent recommends the use of muriated tincture of iron as a mouth wash, for the above affection. If F. S. C. uses that remedy in that manner for a few months, he will ruin his teeth, and will injure them if he uses it for any time. He will find a solution of chlorate of potash—two drams to two ounces of water—a much more efficient remedy and perfectly harmless.—C. S. S.

TWIN BOILERS.—To H. P. S.: The trouble with your boilers is in the connections on top. From what you say you have no steam dome on either boiler, which is undoubtedly the cause of all your trouble. Put on a dome of fifteen or eighteen inches diameter, running to the center of each boiler; connect it by not less than a four inch pipe to each boiler. Then take your steam from the center of the dome, where you will connect your safety valve, and your trouble is over, if the mud drum is clear.—W. J. W.

GRAPE JUICE.—In answer to query 4, No. 23, I would say that if the grape juice be from cultivated varieties of grape, the way to make good wine out of it is to let it ferment without any admixture of any kind, and to draw it off clear in the spring, when it will be a pure and wholesome wine, ready for use or the market. If the juice be from wild grapes, and, as is usual in that case, very astringent and deficient in sugar, let M. T. M. add to it equal parts of water, and to each gallon of the mixture two or three pounds of white sugar. Both formulas make good wine, but the former pleases better the European and the latter the American taste.—D. L.

CURIOUS FREAK OF TWIN BOILERS.—Let me say that the trouble can all be got rid of by making the steam pipe, connecting the two boilers on top, 3½ or 4 inches inside diameter, and connecting the two at the water line with a 4 inch pipe. This allows the water to maintain its level regardless of unequal firing. The trouble is caused by the small connecting pipe; as two pounds pressure will raise water four feet high; by firing heavily under one boiler you can fill the other full to the safety valve. There is no trouble of this kind where large connections are used, even with four boilers connected together.—B., of O.

SUCTION PUMP.—In answer to M. W. Q., of Mo.: He is very much mistaken when he says "ten feet horizontal is equal to one foot perpendicular." I can show him a pump on the Chicago and Alton Railroad, at Shipman (now working and has been for seven years) that draws water 730 feet horizontally and 16 feet perpendicularly, and works well.—J. M.

Official List of Patents.

ISSUED BY THE U. S. PATENT OFFICE.

FOR THE WEEK ENDING DECEMBER 12, 1871.

Reported Officially for the Scientific American.

SCHEDULE OF PATENT FEES:

On each Caveat	$10
On each Trade-Mark	$25
On filing each application for a Patent, (seventeen years)	$15
On issuing each original Patent	$20
On appeal to Examiners-in-Chief	$10
On appeal to Commissioner of Patents	$20
On application for Reissue	$30
On application for Extension of Patent	$50
On granting the Extension	$50
On filing a Disclaimer	$10
On an application for Design (three and a half years)	$10
On an application for Design (seven years)	$15
On an application for Design (fourteen years)	$30

121,701.—SASH SUPPORTER.—W. H. Brown, Bangor, Me.
121,702.—TOY ENGINE.—A. Buckman, Brooklyn, N. Y.
121,703.—DOOR PLATE.—W. A. Caron, Springfield, Mass.
121,704.—HALTER.—J. Carpenter, Wilmington, O.
121,705.—MOWER.—D. H. Chamberlain, West Roxbury, Mass.
121,706.—BOX FOR WHEEL.—W. A. Clark, Westfield, Conn.
121,707.—AUGER.—W. A. Clark, Woodbridge, Conn.
121,708.—FLOUR BOLT.—J. C. Cookson, Lancaster, Pa.
121,709.—GUARD.—W. Darrah, J. Cutshall, Coshocton, O.
121,710.—SAFE.—J. Farrel, New York city.
121,711.—BOLT.—J. Farrel, J. Weimar, New York city.
121,712.—CANAL BOAT.—H. Fowler, Washington, D. C.
121,713.—CANAL BOAT.—H. Fowler, Washington, D. C.
121,714.—CANAL BOAT.—H. Fowler, Washington, D. C.
121,715.—BACKGROUND.—A. R. Gould, Carrollton, O.
121,716.—HYDRANT.—P. H. Griffin, Albany, N. Y.
121,717.—FIRE ALARM.—E. A. Hill, Chicago, Ill.
121,718.—BOTTLE WRAPPER.—W. A. Hinman, New York city.
121,719.—MIXING GASES.—T. C. Hopper, Philadelphia, Pa.
121,720.—PRESSING CLOTH.—P. Howe, Boston, Mass.
121,721.—LIFTING JACK.—I. D. Johnson, Kennett Square, Pa.
121,722.—DRYER.—G. A. Keene, Lynn, Mass.
121,723.—MATTRESS.—J. Maas, Westfield, Mass.
121,724.—LOCKING NUTS.—J. Maitland, Newburg, O.
121,725.—LINK.—J. H. McIntire, Crestline, O.
121,726.—FASTENING.—W. H. McPherson, Nashville, Tenn.
121,727.—PRESSING SKINS. N. D. Morey, Saratoga Springs, N. Y.
121,728.—BED BOTTOM.—E. P. Read, Chicago, Ill.
121,729.—BED BOTTOM.—E. P. Read, Chicago, Ill.
121,730.—STRIKING MECHANISM.—C. W. Roberts, Chicago, Ill.
121,731.—CATTLE PUMP.—G. B. Roe, Ogie Co., Ill.
121,732.—RAIL.—R. S. Sanborn, Rockford, Ill.
121,733.—GRATE.—W. Sanford, Brooklyn, N. Y.
121,734.—BEDSTEAD.—S. Springer, Chicago, Ill.
121,735.—HINGE JOINT.—N. Thompson, Brooklyn, N. Y.
121,736.—MOLD.—N. Thompson, Brooklyn, N. Y.
121,737.—DITCHER.—J. Valentine, Buffalo, N. Y.
121,738.—VESSEL.—E. Whitehead, Cincinnati, O.
121,739.—THRASHER.—R. S. Williams, Norristown, Pa.
121,740.—HORSE POWER.—A. Wissler, Brunersville, J. Gamber, Petersburg, Pa.
121,741.—STOVE.—H. Zahn, Philadelphia, Pa.
121,742.—BIRD CAGE PERCH.—E. Aldom, New York city.
121,743.—BOLT THREADER.—F. S. Allen, C. F. Ritchel, N. Y. city.
121,744.—OILER.—J. F. Allen, Mott Haven, N. Y.
121,745.—MOTIVE POWER.—H. S. Barnes, Augusta, Wis.
121,746.—DRYING SAND, ETC.—A. H. Bauman, Mapleton, Pa.
121,747.—KNIFE CLEANER.—W. S. Beebe, J. T. Baynes, A. King, West Troy, N. Y.
121,748.—STEAM HEATER.—J. H. Blessing, Albany, N. Y.
121,749.—CANAL BOAT.—T. J. Burke, Virginia, Ill.
121,750.—FLY BRUSH.—H. C. Chandler, Peru, Ind.
121,751.—REFRIGERATOR.—A. J. Chase, Boston, Mass.
121,752.—FENCE.—J. W. Cherry, Carthage, Ill.
121,753.—WASHER.—J. F. Chesebro, Trenton, N. J.
121,754.—DRAFT COCK.—W. P. Clark, Medford, Mass.
121,755.—CHURN.—J. Cochran, Jr., Auburn, Mo.
121,756.—BALE TIE.—M. N. Coe, Madison, La.
121,757.—SHOE FASTENING.—F. Coeller, New Haven, Conn.
121,758.—BASKET.—E. B. Cole, Huntington, Mass.
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121,760.—REST.—M. Craven, Dedham, Mass.
121,761.—WHIP COVER.—V. W. Crowson, Westfield, Mass.
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121,768.—KEY BOARD.—C. Fogelberg, Boston, Mass.
121,769.—LATCH, ETC.—V. Frazee, San Francisco, Cal.
121,770.—BOILER.—B. French, Rochester, N. Y.
121,771.—HYDRANT.—J. Fricker, Cincinnati, Ohio.
121,772.—BRAKE.—J. A. Gerhart, Easton, Pa.
121,773.—STONE SAW.—H. S. Gillette, New Preston, Conn.
121,774.—LIFTING JACK.—A. E. Goddard, Essex, Conn.
121,775.—CORDER.—H. C. Goodrich, Chicago, Ill.
121,776.—ROPE WAY.—A. S. Hallidie, San Francisco, Cal.
121,777.—HAY LOADER.—H. W. Hamilton, Brandon, Vt.
121,778.—KEYBOARD INSTRUMENT.—E. Hamlin, Winchester, Ms.
121,779.—LUBRICATOR.—J. Harper, New Haven, Conn.
121,780.—PULP ENGINE.—J. Hatch, South Windham, Conn.
121,781.—BELT FASTENER.—J. W. Hicks, Laurel, Md.
121,782.—TIME LOCK.—S. W. Hollen, Cincinnati, Ohio.
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121,794.—CULTIVATOR.—J. Mallon, H. Von Phul, Jr., Holly Wood, La.
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121,796.—FIRE ESCAPE.—G. D. McCullen, New Orleans, La.
121,797.—FENCE.—R. B. Meeker, Sandford's Corners, N. Y.
121,798.—SEPARATING METALS.—A. Monnier, Phila., Pa.
121,799.—TREATING SULPHATES.—A. Monnier, Phila., Pa.
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121,801.—PAINTER'S TRESTLE.—D. Moritz, New York city.
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121,803.—DIE.—F. B. Morse, Plantsville, Conn.
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121,829.—HAT SWEAT.—W. M. Waterbury, New York city.
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121,831.—WIRE NET MACHINE.—F. C. C. Weber, Brooklyn, N. Y.
121,832.—GLOVE.—W. W. Whitaker, Gloversville, N. Y.
121,833.—GLOVE.—W. W. Whitaker, Gloversville, N. Y.
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121,836.—RAILWAY CROSSING.—J. Wood, Red Bank, N. J.
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121,838.—SHUTTLE BOX.—J. Ashworth, North Andover, Mass.
121,839.—BAKING OVEN.—A. A. & J. A. Aull, Bellefontaine, Ohio.
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121,843.—PUMP.—H. E. Braunfeld, Phila., Pa.
121,844.—WASHER.—R. M. Bruce, Camp Point, Ill.
121,845.—ORNAMENT.—E. T. Bussell, Indianapolis, Ind.
121,846.—DITCHER.—E. T. Bussell, Indianapolis, Ind.
121,847.—DRYER, ETC.—L. S. & C. F. Chichester, Brooklyn, N. Y.
121,848.—BRIDGE.—T. C. Clarke, A. Bonzano, Phila., Pa.
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121,850.—DIVIDER.—A. A. Cook, Milford, Mass.
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121,853.—WINDMILL.—J. Cushman, Thomson, Ill.
121,854.—TRANSMITTING POWER, ETC.—T. Damon, Thompsonville, Conn.
121,855.—FENCE.—B. G. Devoe, Fredericktown, Ohio.
121,856.—SCROLL SAW.—W. H. Dobson, W. H. Doane, Cincinnati, Ohio.
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121,860.—PUTTING UP NEEDLES.—D. Evans, Studley, Eng.
121,861.—BELT SHIFTER.—A. Fox, Edinburg, Ind.
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121,864.—STEAM ENGINE.—G. Gärtner, C. Diebold, Lebanon, Pa.
121,865.—BARREL FASTENING.—E. T. Gilmore, New York city.
121,866.—ROCK DRILL.—Henry B. Gingrich, Bradford, Ohio.
121,867.—GRAIN CARRIER.—O. M. Gould, Montreal, Can.
121,868.—SUPPORTER.—H. Greentree, Baltimore, Md.
121,869.—TIN CAN.—S. E. Gunn, Chicago, Ill.
121,870.—SIGNAL HOUSE.—T. S. Hall, West Meriden, Conn.
121,871.—BRICK MACHINE.—D. Hess, Des Moines, Iowa.
121,872.—IRON, ETC.—T. C. Hinde, Fownhope, Eng.
121,873.—HANDLING BOXES.—C. Hoffman, New York city.
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121,875.—RAILWAY FROG.—S. M. Hudson, St. Louis, Mo.
121,876.—COOKING STOVE.—W. J. Keep, Troy, N. Y.
121,877.—STOVE PIPE DAMPER.—W. J. Keep, Troy, N. Y.
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121,884.—LIGHTNING ROD.—S. H. Miner, Winona, Minn.
121,885.—GLOSSING IRON, ETC.—C. W. Monroe, Chicago, Ill.
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121,887.—SKIVING MACHINE.—J. H. Mudgett, Lynn, Mass.
121,888.—ICE MACHINE.—A. Mühl, Waco, Tex.
121,889.—STEEL.—C. M. Nes, York, Pa.
121,890.—BOOM BAND.—G. Nevenger, Phila., Pa.
121,891.—STEAM ENGINE.—E. Nicholson, Cleveland, Ohio.
121,892.—GATE.—A. D. Northway, Kenosha, Wis.
121,893.—MOVEMENT.—T. H. Percival, Harper's Ferry, Va.
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121,895.—VISE.—R. Porter, Bristol, Conn.
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121,899.—REFRIGERATOR.—J. Rohrer, Lancaster, Pa.
121,900.—ADDRESSING MACHINE.—J. K. Rukenbrod, Salem, O.
121,901.—SIGNAL.—D. L. Schönberg, New York city.
121,902.—PRESERVING HOPS.—J. Seeger, J. Boyd, Baltimore, Md.
121,903.—SEPARATING FATS.—T. Sim, Baltimore, Md.
121,904.—MEDICAL COMPOUND.—C. A. Simmons, Waldo, Fla.
121,905.—VALVE.—C. B. Smith, Newark, N. J.
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121,907.—SHUTTLE BOX.—J. M. Stone, North Andover, Mass.
121,908.—IRONING MACHINE.—G. F. Taylor, New York city.
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121,911.—FIREPLACE.—R. P. Thomas, Sciotoville, Ohio.
121,912.—WEATHER STRIP.—J. Thompson, Aledo, Ill.
121,913.—DISINFECTANT.—H. A. Tilden, New Lebanon, N. Y.
121,914.—WATER GAGE, ETC.—T. W. Todd, Schenectady, N. Y.
121,915.—DRYER.—J. Turner, Chicago, Ill.
121,916.—TRUCK FRAME, ETC.—B. W. Tuthill, New York city.
121,917.—BROILER.—C. Walsh, Newark, N. J.
121,918.—PUMP.—Z. Waters, S. Bradley, Bloomington, Ill.
121,919.—RATTAN.—G. A. Watkins, Gardner, Mass.
121,920.—FARE BOX.—J. F. Winchell, Springfield, Ohio.
121,921.—SHAMPOOING.—M. L. Winn, New York city.
121,922.—CARRIAGE DOOR.—A. Wright, Wilmington, Del.
121,923.—ADVERTISING LANTERN.—T. L. Wright, N. Y. city.
121,924.—KNITTING MACHINE, ETC.—N. Clark, Malden, Mass.

REISSUES.

4,664.—COTTON GIN.—D. Pratt, Prattville, Ala.—Patent No. 17,806, dated July 14, 1857; extended seven years.
4,665.—CULTIVATOR.—F. J. Underwood, Rock Island, Ill.—Patent No. 85,412, dated December 29, 1868.
4,666.—LUBRICATING BOLSTER.—M. P. Wilmarth, North Providence, R. I.—Patent No. 39,190, dated July 7, 1863.
4,667.—ANIMAL POKE.—H. F. Chapin, Rochester, N. Y.—Patent No. 112,546, dated March 14, 1871.
4,668.—EXPANSIVE BIT.—W. A. Clark, Wellsville, Conn.—Patent No. 20,192, dated May 11, 1858; reissue No. 3,516, dated June 22, 1869; reissue No. 3,733, dated November 16, 1869.
4,669.—TREADLE ATTACHMENT.—W. Glover, Millbury, Mass.—Patent dated January 29, 1861.
4,670.—CAR SPRING.—A. Hebbard, Cambridge, Mass.—Patent No. 53,222, dated March 13, 1866; reissue No. 4,335, dated April 11, 1871.
4,671.—PREPARING GRASS, ETC.—G. E. Hopkins, W. B. Shedd, Boston, Mass.—Patent No. 110,237, dated December 20, 1870.
4,672.—Division A.—HARVESTER.—Ketchum Harvesting Machine Company.—Patent No. 8,724, dated February 10, 1852; reissue No. 259, dated February 28, 1854; reissue No. 466, dated June 2, 1857; extended seven years; reissue No. 3,033, dated July 14, 1868.
4,673.—Division B.—HARVESTER.—Ketchum Harvesting Machine Company.—Patent No. 8,724, dated February 10, 1852; reissue No. 259, dated February 28, 1854; reissue No. 466, dated June 2, 1857; extended seven years; reissue No. 3,034, dated July 14, 1868.
4,674.—LOCK.—L. F. Munger, Rochester, N. Y.—Patent No. 23,040, dated February 22, 1859.
4,675.—HAND STAMP.—T. J. W. Robertson, Washington, D. C.—Patent No. 18,249, dated September 22, 1857; extended seven years.
4,676.—DITCHER, ETC.—W. J. Wauchope, Brookfield, Ill.—Patent No. 62,171, dated February 19, 1867.

DESIGNS.

5,408.—GEOMETRICAL FORMS.—C. Baillairge, Quebec, Canada.
5,409 & 5,410.—CARPETS.—J. Wade, Palmer, Mass.
5,411.—THREE BOTTLE CASTER.—G. D. Dudley, Lowell, Mass.
5,412.—SHAWL.—H. Erbs and J. Barth, Philadelphia, Pa.
5,413.—SHOW CARD.—T. Hall, Jersey City, N. J.
5,414.—HARNESS BRACKET.—J. L. Jackson, New York city.
5,415 & 5,416.—HARNESS HOOKS.—J. L. Jackson, New York city.
5,417 to 5,422.—CARPETS.—A. McCallum, Halifax, England.
5,423.—RACK FOR ROBES.—M. Nuhn, New York city.

TRADE MARKS.

573.—CAST STEEL, ETC.—W. Butcher & Co., Lewiston, Pa.
574.—MEDICINE.—E. Chiles, Philadelphia, Pa.
575.—ALCOHOL.—C. H. Graves, Boston, Mass.
576 to 579.—CLOCKS.—E. Ingraham & Co., Bristol, Conn.
580.—BITTERS.—W. H. Knoepfel, New York city.
581.—CIGARS.—P. Pohalski & Co., New York city.
582.—RUBBER PAINT.—Rubber Paint Company, Cleveland, O.
583 & 584.—BOOTS AND SHOES.—The Ventilating Waterproof Shoe Company, Boston, Mass.
585.—CEMENT.—Wendt & Rammelsberg, New York city.

EXTENSIONS.

COTTON AND HAY PRESS.—W. Penniston, of North Vernon, Ind.—Letters Patent No. 18,766, dated December 1, 1857.

LONG TRUNKS FOR CLEANING COTTON.—I. HAYDEN, of Lawrence, Mass.—Letters Patent No. 18,742, dated December 1, 1857.

MOWING MACHINE.—E. Ball, of Canton, Ohio.—Letters Patent No. 18,788, dated December 1, 1857; reissue No. 831, dated September 27, 1859; reissue No. 1,007, dated July 17, 1860.

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BILLIARD TABLE CUSHION.—H. W. Collender, of New York city.—Letters Patent No. 18,805, dated December 8, 1857; reissue No. 799, dated August 23, 1859; reissue No. 2,510, dated March 19, 1867.

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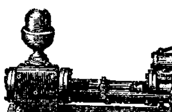

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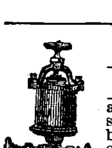

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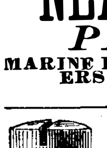

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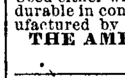

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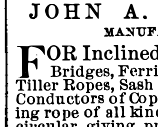

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