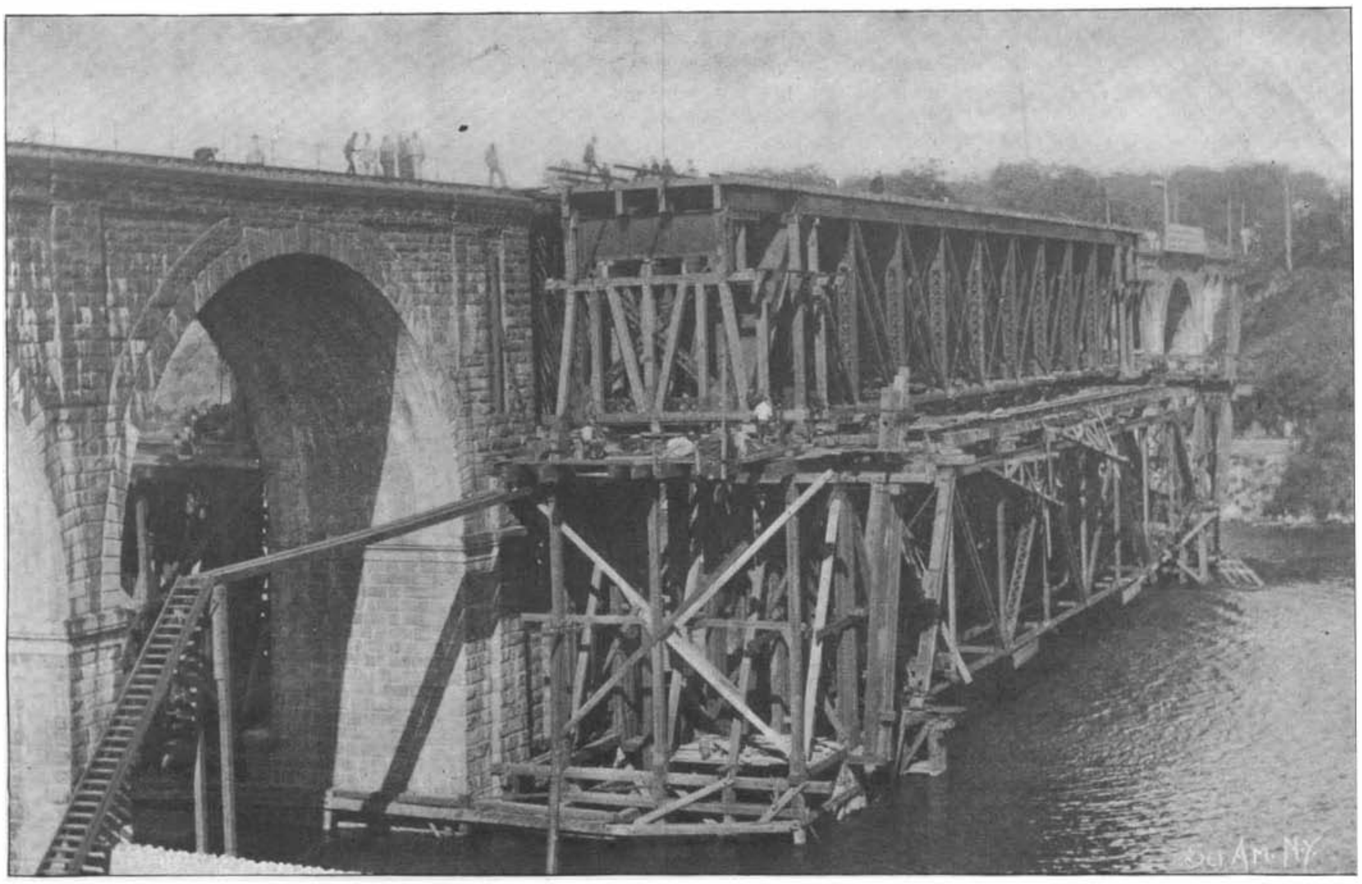
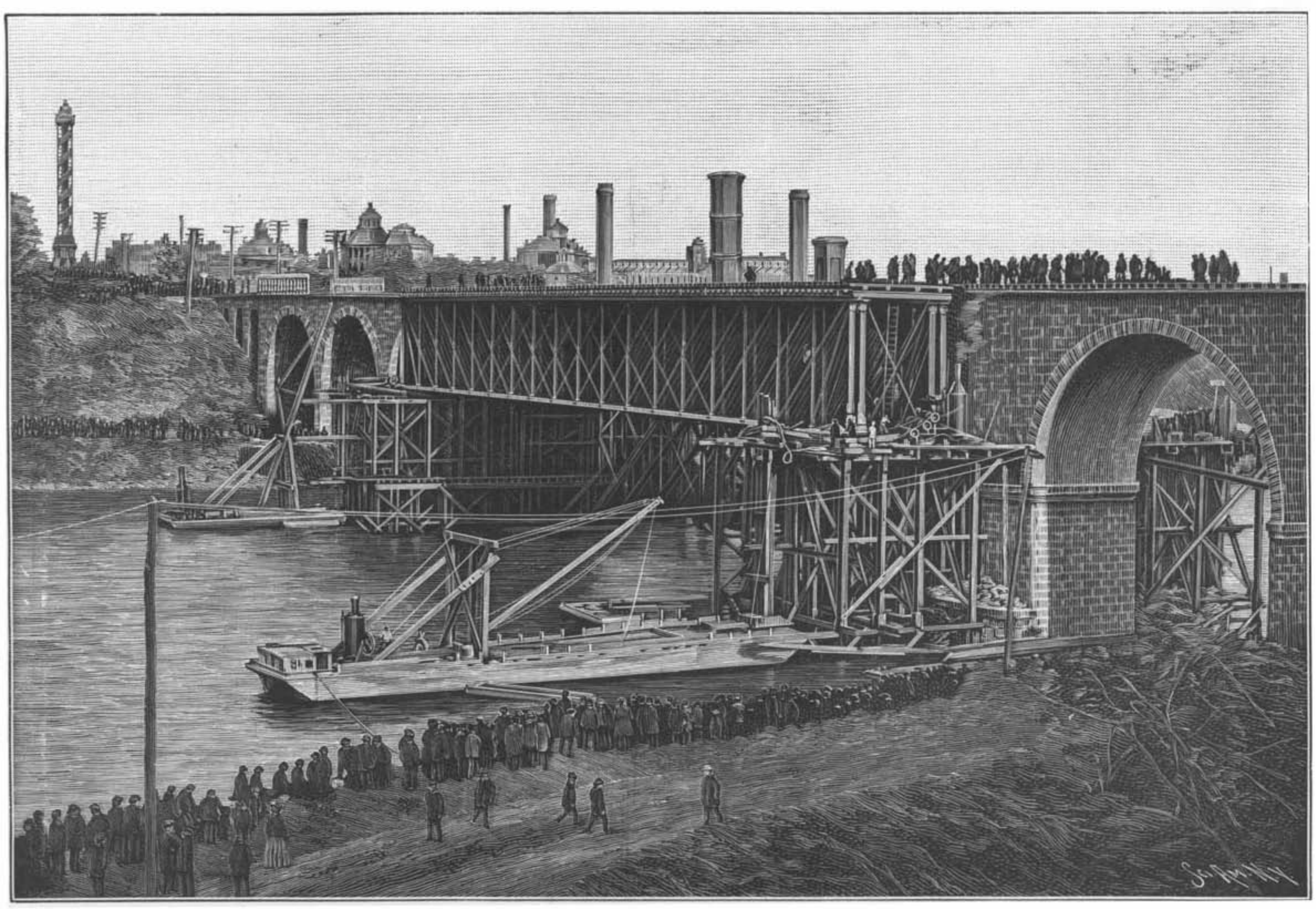


THE NEW STEEL SPAN READY FOR TRANSFERRING TO PLACE.

steel, and, after being carefully hardened, they are put in the chain limbering machine, Fig. 4, which consists of a series of large and small sprockets, over which they are run at a speed of 500 revolutions per minute under a tension of 50 pounds. After being tested under a pull of 1,000 pounds in the testing machine, the chain is ready to be put on to the bicycle.

Many of the Eclipse bicycles are fitted with the Morrow brake, which avoids the objectionable features of the ordinary plunger brake, and which gives the wheelman full command of his mount on the steepest hills. Moreover, it enables him to hold his pedals stationary for the purpose of coasting. The mechanism consists of a friction clutch on the rear hub, another clutch on the left crank, and a spoon brake controlled by the latter. In the normal position the rear sprocket clutch is locked and the crank clutch is free. If it is desired to coast, a slight back pressure on the pedals releases the sprocket clutch and allows the rear wheel to run independently of the chain and cranks. To set the brake all that is now necessary is a rather sudden application of back pressure to the pedals. This sets the crank clutch. The external ring of this clutch is provided with a projecting arm which is pivotally connected to an arm on the spoon brake. By pressing down on the pedals the ring is turned backward and the brake is set against the wheel with any pressure desired. It will thus be seen that the rider can coast or set the brake by varying the back pressure upon the pedals, and the leverage is so greatly in his favor that he can stop the rear wheel altogether in cases of emergency.



A RAPID BRIDGE RENEWAL—THE OLD SPAN REMOVED TO TEMPORARY FALSEWORK.

The sprocket clutch, Fig. 11, consists of a steel disk upon which the sprocket is free to rotate. Around the periphery of the disk are cut out half a dozen rectangular recesses whose bottom faces are not tangent to the periphery but slightly inclined. In each pocket or recess is a hardened steel pin whose diameter is less than the depth of the rear wall of the pocket but greater than the depth of the front wall. The pins are pressed into contact with both the disk and the sprocket by coiled springs. When the sprocket is pulled forward by the chain, the pins also roll forward and become tightly wedged, locking the sprocket to the wheel. On the other hand, when the pull of the chain is reversed, as in back pedaling, the pins are released and the wheel is free to rotate independently of the sprocket. The sprocket is kept in place by a couple of covering flanges, one of which is shown in the accompanying engraving.

The neat appearance and simple handle bar adjustment used on Eclipse bicycles is an attractive feature. The fork head is split and threaded. Upon this are screwed three threaded sleeves, the middle one of which carries a threaded stud. A loose sleeve is passed over the stud and bears upon the outer sleeves above mentioned in such a way that when the nut is tightened the outer sleeves are pressed against one side of the fork stem and the center sleeve against the opposite side, thus securing an even hold upon the handle bar. The device is very efficient and is marked by the neat appearance that distinguishes the various parts of this machine.

We close our notice of this machine and the admirable plant for its construction with a reference to the large number of special tools that are used in the manufacture of all parts, from the minutest to the largest. Before attempting to turn out any number of bicycles, a jig or form is specially made, and in this jig or form is placed whatever part of the bicycle work is being done. All pieces made in such forms will be absolutely alike and interchangeable. After the frames have been entirely completed, they are trued up in another jig or form, to insure that they shall be in perfect alignment.

One cannot go through an establishment such as the Eclipse Bicycle Company's and see the close work, rigid inspection of all parts, the vast number of labor saving machines, and not be impressed with the great skill and care, and the elaborate plant, required in the construction of the modern bicycle.

A RAPID BRIDGE RENEWAL.

A remarkable record for rapid bridge renewal was made by the engineers of the Pennsylvania Railroad Company on Sunday, October 10, when a large iron structure on the busiest part of that road was taken away and a new span put in its place in the remarkable time of nine minutes. This feat was performed on the bridge which crosses the Schuylkill River, carrying the tracks of the New York branch over that beautiful stream just above Girard Avenue, Philadelphia. The approaches of this structure are of the most substantial stone work, and a long metal span stretches across the river, connecting the arches on either side. The original span was placed in 1868, and as latterly it has not been considered strong enough to sustain the weight of the heavy traffic which is now sent over this line, it was decided to renew it. With this end in view a new span was built on a construction of false work which had been raised on the south side of the bridge. Another false work was also built to the north side. In the river, also to the north, two floats, with a dummy engine on each, were anchored and two other auxiliary engines were placed on the false work at either end of the span. Sunday afternoon was fixed as the most available time to make the exchange of spans, as the business is much lighter on that day. The Chestnut Hill train due at this point at 2:17 was not off the bridge yet when the work of dismantling was commenced at the other end. The track connections were quickly cut, and at a signal both the new and the old spans were raised simultaneously by hydraulic pressure. Another signal was then given for the engines to pull. In exactly two minutes and twenty-eight seconds the change was made and the new iron work slipped into its permanent resting place. It was only the task of a few minutes more to complete the track connection again, and in exactly nine minutes after the passage of the Chestnut Hill train the special car of Superintendent Brooks went smoothly over the bridge without a hitch. Then a couple of heavily ballasted freight trains were rolled back and forth over the bridge tracks as a test, and, having withstood this trial, the structure was declared ready for regular work.

The new span, which is constructed entirely of steel, is 240 feet long, 25 feet wide and 30 feet high. It is known as a Pratt truss or a single intersection quadrangular type of bridge. The old span was of the Linnville or double intersection type, and with its castings weighed 750 tons, while the new span is 200 tons heavier. The two were fastened together and moved at the same time, so that the entire load was 1,700 tons. The new span was built by the Edgemoor Iron Company, but the work of putting it into place was performed wholly by the men of the Pennsylvania Company.

The plans for accomplishing this great work were devised by Joseph T. Richards, the engineer of maintenance of way of the railroad company. They were executed under the supervision of Chief Engineer L. H. Barker and Assistant Chief Engineer L. W. Allibone, of the United Railways of New Jersey division; George Mershon, the veteran master carpenter and bridge builder of the same division, and his son, W. H. Mershon. Several weeks were consumed in the making of these preparations, as the greatest care had to be exercised and every possibility figured out to a nicety. A single mistake meant disaster and possibly serious interruption to the road's business. To avert any such trouble as this, each workman was given a particular duty to perform, and the success of the work attests the excellence with which the orders given were carried out.

Bridges have been moved before by the same methods, but heretofore the change has occurred on very small structures on the less frequented parts of the road. Never before has so massive a bridge been removed in so short a time.

Kite of the Weather Bureau.

The latest achievement of the Weather Bureau's scientists is the successful flying of a new cellular kite which presents a surface of about 70 square feet to the wind and balances itself at a height of one and a half miles. As in the other kites now used for upper air observations, the spruce framework is joined together with wires instead of nails, while the white muslin covering is as durable as the black silk used in the earlier forms of scientific kites, and much cheaper.

The big kite is rectangular in shape like the Hargrave flier, but the details of its construction are very different and it is altogether superior to the Australian kite.

Much time and labor have been expended in condensing the apparatus for recording atmospheric conditions to the minimum weight, which is but 2½ pounds. The anemometer is attached to a truss which projects forward from the topmost support of the front cell. The meteorograph is at present lashed to the lower side of the center truss, but as its being beneath the kite endangers its safety in descending, this delicate instrument is in future to be fastened where the framework will lessen the chances of injury.

Not having time to supervise personally the experiments made with kites, Mr. Potter long ago relegated that branch of the Weather Bureau's work to C. F. Marvin, Professor of Meteorology. The latter gentleman has said in relation to the flying of kites at the very greatest elevation: "If we could employ a string or wire having no weight, and so fine that the wind pressure upon it would be wholly inappreciable, then, as more and more of this wire is paid out to it, the kite would pass outward and upward along the same straight line, retaining always the same angular elevation. A kite could be flown to an unlimited height under such circumstances, provided the wind remained unchanged. Unfortunately, however, we cannot fly kites with wire having no weight and against which the wind will not press; and, in consequence, our actual kite behaves in a very different manner from that described above."

The necessity for using a string which, like the other materials in their respective elements, would combine the greatest strength with lightness, will be plainly seen from the foregoing quotation.

Very fine steel wire was selected because it was strong enough to prevent a kite breaking away, and weighed but five pounds to the mile. As three miles of wire are required for an elevation of one mile, the total weight sustained by a kite at that altitude, including the recording apparatus, would be about 17 pounds, or 25 pounds at a height of one and one-half miles, which is the limit of ascent as yet attained by a Weather Bureau kite.

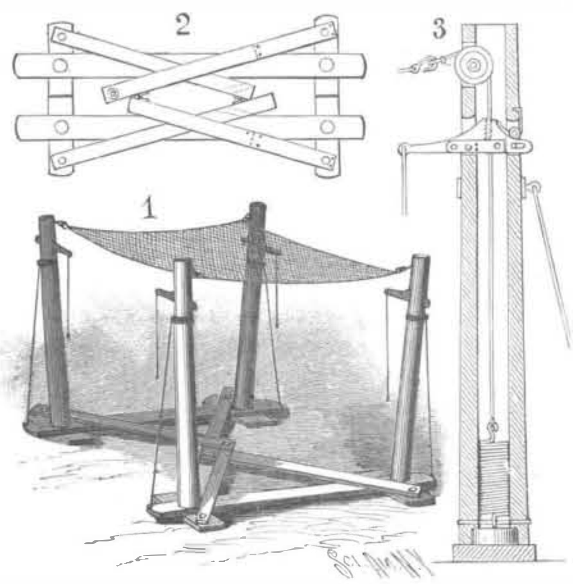
This wire is cut in lengths of 7,000 feet, and after each thousand is reeled out the flight is arrested until the inclination can be determined by focusing telescopes upon a scale marked in black ink upon the inner surface of the white muslin covering.

When a kite has risen above the treacherous undercurrents of air, it is out of danger until, in descending, it strikes the breakers again.

A number of kites are sent up from the flying grounds near Washington every windy day, a small engine being used for paying out the wire.

A NET HOLDER FOR USE AT FIRES.

The illustration represents a life saving device which may be folded to occupy but small space when not in use, but which may be quickly and conveniently set up, as shown in Fig. 1, to support a net, mattress, or bed in position to receive a person jumping or falling from a burning building. The construction is such



ALLING'S NET HOLDER FOR USE AT FIRES.

that the receiving surface yields under the weight of the falling body, the net or bed being thus forced downward, but there is no rebound, the net being afterward restored to its upper or normal position by those present. The improvement has been patented by Samuel A. Alling, of Homer, Minn. Fig. 2 shows the base of the device folded and Fig. 3 represents a vertical section through one of the posts. In the lower part of each post a spring is secured by means of a pin at its lower end, and from the upper end of the spring a cord extends up the hollow post and over a pulley to a hook or clip connection with a net or mattress. Near the upper end of each post are opposite openings, in one of which is fulcrumed a lever having on its inner end gripping teeth, while in the opposite opening is pivoted a spring-pressed gripping arm, the lever and gripping arm forming a clutch through which passes the cord from the spring to the net. This clutch permits the outward movement of the cord as the spring is extended by the force of the body falling on the net, the springs thus cushioning the fall, but the return movement of the cord, or rebound by the springs, is prevented by the action of the clutch in each post. After the body has been removed from the net, however, the clutch in each post is released from engagement with the cord by pulling upon a downwardly extending release cord attached to the outer end of the lever member of each clutch.

What Invention Has Done.

What is it that enables an operative to-day to produce so much more in a less number of hours than he could thirty or forty years ago? It is simply invention, as embodied in the improved machines, tools, processes and appliances that American inventors are constantly furnishing to American manufacturers.

Near Baltimore there was recently erected one of the largest plants in the world for the manufacture of Bessemer steel in all its forms; and, as recently stated by its superintendent, by means of the inventions and improved appliances they have adopted, they are enabled to produce a ton of steel with but one-third of the manual labor required at their other establishment, built twenty or twenty-five years before.

In 1866 steel rails cost $165 per ton. In 1884 they had dropped to $34, in 1893 they were $21 to $24 per ton, and in 1897 even less. See how that has expedited the building of railroads, which now cover the country like a network, and without which modern enterprise could not be carried on. And the same is true of steel in all its forms. So that to-day we build steel bridges, steel vessels, steel cannon, steel frames for our buildings and for farm implements, and use steel nails.

Inventions and improvements have so reduced the cost of steel rails that already, during the year 1897, the United States have sold 100,000 tons to Europe. —Engineering Magazine.

Ant Shelters.

BY GEORGE M. BROOKE.

One morning in early summer, several years ago, I was admiring from a distance a beautiful Virginia creeper, the young and graceful shoots of which, covered with fresh green leaves, adorned the weatherworn panels of an old board fence. A nearer view revealed the young shoots covered with brown aphides (plant lice), attended by busy ants. These were ants belonging to a common species, although I am ignorant of their scientific name. They were small, and dark brown in color, with short, sharp pointed bodies and short legs. The species, when excited or disturbed, has the peculiar habit of bending the abdomen upward to a vertical position; running hither and thither with it thus elevated, so long as disturbed. It is quite common to see these ants traveling on fences, in long lines; some moving in one direction, some in the opposite, passing each other, going and returning. Their nests are found in rotten timber, as in the decayed trunks and stumps of trees, in old fences, or in piles of refuse wood.

While watching the ants and aphides, my attention was arrested by some small gray structures sticking to the panels of the fence. Each was pierced by one or more small apertures. These structures, while not symmetrical, had all more or less the form of flattened domes, varying in width and length from one to one-fourth inch, with an average height of the eighth of an inch. Breaking one open, I discovered within it several ants of the species I saw milking the aphides. Soon I noticed numbers of them running in and out of the apertures of some of the little structures. I was at first declined to believe that these little gray houses were real ants' nests, but I knew from observation that these ants lived in holes and cavities in rotten timber. On close examination, no sacs were discovered, and none but worker ants were visible. All moved slowly and lazily, presenting a very different appearance from the busy little workers one sees running rapidly hither and thither in the proximity of the nest. I was mystified.

Most of the little houses—for houses they seemed to be—were sticking to the panels of the fence. Some were built over the shoots themselves on which the aphides were feeding, affording cover to aphides as well as ants. The appearance was that of a village in miniature. Some, however, were built upon free shoots, waving to and fro in the wind—breezy homes for the small dairymen. Some of the ants, I soon discovered, were engaged in tearing up wood fiber, of which the houses were made, and sticking the pieces together, to build new ones or repair old ones. During a shower or on a rainy day the houses were always quite full; but, when the sun dispelled the clouds and once more shone again, the little builders sallied forth to repair the damage done their frail houses by the passing rain or squall, or to milk the aphides in their pastures on the shoots.

The ants use these structures exclusively as shelters, and my continued observations failed to detect any other use or purpose in their construction. They were kept in constant repair and were used at night and in rainy weather; and even in the daytime served as retreats for those not occupied at the dairies. One broken open during the day seldom failed to reveal several of the inhabitants at home. As the shoots of the creeper grew with the advancing season, and the aphides were transferred gradually further from the shelters, the ants abandoned them and built themselves new ones, nearer the dairies. Those abandoned soon fell to pieces, being washed away by the showers.

The true nest and home of all the ants on the creeper was in a pile of boards, at some distance from the fence—probably some ten or fifteen feet away. I have seen shelters like these since, and on this fence; but never in such numbers as they appeared that season. I have seen them built by ants of this same species, while tending aphides on the tendrils of the grapevine and on the young shoots of the wild raspberry.

No mention of the foregoing facts has ever come to my notice. If they are on record as observed, I should like to be further informed with regard to this subject.—Popular Science News.