A School of Military Ballooning.

The School of Military Ballooning, under the charge of officers of the Royal Engineers at Aldershot, Eng., has done much to increase the practicability of balloon service in war, says the Army and Navy Journal. Steel tubes are used for carrying compressed hydrogen for inflation, and hydrogen of the purest quality is manufactured from zinc and sulphuric acid by electrolysis. These tubes are safe under a strain of 101 atmospheres. Three wagons are required to transport tubes carrying a charge of 11,000 cubic feet of gas, but new patterns, tubes and wagons have been adopted, which will reduce the transportation to two wagons. "Gold beater's skins" are used for the balloon, and they are so light that the balloon with 2,500 feet of surface and carrying 10,000 cubic feet of gas weighs only 170 pounds. The material is so strong that a closed balloon of large size has ascended 7,000 feet without bursting. The present material is not subject to the disadvantages of the varnished silk and cloth balloons of olden times, which were subject to cracks, became often overheated, were easily torn, and permitted the gas to leak away. The top valve of the balloon is now made very light and strong, of an aluminum alloy, and is perfectly gastight. The cords of the balloon are made of Italian hemp, a fine brass thread being woven into the cord for security in thunder storms. It weighs one pound to the hank, and will stand 500 pounds strain to the yard without breaking. The rings are of American hickory and the wickerwork of the car is excellent. Every balloon wagon has half a mile of wire rope attached to it which is available for holding the balloon captive. There is also a telephone conductor; and connection with the wagon is neatly made on a screw bar, so that in whatever direction the pull of the balloon may be the wire rope will never come into contact across the drum.

The London Standard, from which we obtain these particulars, says: "Some of the hand records taken in the free balloon excursions are extremely precise and full of serviceable details. The photographs, even those of small size, usually contain details of value. Soldiers within a range of two miles on each side of the line of flight can be detected with a hand lens. The coming trials of the capabilities of balloons for taking part in military engineering operations in warfare will be fraught with interest and novelty, whether they be successful or not. The first trials will probably be directed toward the application of captive and carrying balloons in assisting or preventing operations in trenches. The ditch forms the protection to the working sappers; and the artillery projectiles cut into the rear of the trench and drive the debris to the rear of the work. The object of a balloon attack, therefore, might be to plant, say, a 500 pound charge of high explosive in rear of the trench, so that when exploded it would blow the debris into it, overwhelming the men or exposing them to the enemy."

THE OPERATION OF THE SELF-BINDING HARVESTER.

BY E. J. PRINDLE.

It is marvelous how quickly the practical self-binding harvester has been produced. The young men of to-day can remember when the sickle was in common use for harvesting, at least on the smaller farms. The better equipped farmer had the cradle. Then came the form of harvester having a platform on which the grain fell as it was cut, and from which it was raked by an attendant when a proper quantity had accumulated. The harvester was followed by men who bound the bundles by hand. On some machines two men were carried who bound the bundles as they were formed. Improvements were steadily made until the first successful self-binders were produced, requiring four or six horses, and being unreliable to such an extent that it required the attention of several men to run them.

Fig 2.

And now we have harvesters cutting and binding automatically, easily managed by one man, and some of them so light that two ordinary horses can draw them. To the uninitiated they seem an unintelligible mass of intricate machinery. But like most machines, the principle is comparatively simple, even of that almost human contrivance the cord knotter. Fig. 1 is a transverse cross section of a self-binding harvester. The grain, as it falls from the sickle, is caught on the horizontal traveling belt, K, which carries it to the two inclined belts, L and M, between which it is elevated to the packer, B, which throws it against the cord. The cord runs from the twine box through the eye of the pivoted needle, or binder arm, D, and from thence past the knotter, U, to the holder, F, which clamps the end of the cord. The packer forces the grain into the bight of the cord until the trip arm, G, is forced back far enough to operate the clutch, which sets the cord knotter in motion. The needle is thrown up through the column of grain, carrying the cord by the knotter and into the holder. At the same time, the compressor arm, E, compacts the bundle between itself and the needle. There is now a loop of cord surrounding the bundle, and having its ends caught in the holder, the knotter being between the bundle and the holder.

To make the operation of the cord knotter clear, a series of photographs is reproduced, showing the same knot being tied by hand in the same manner. In Fig. 2 the general arrangement is shown. The twine runs from the ball through the holder, by the knotter, around the bundle and back to the holder, leaving a second strand passing the knotter, which is here replaced by two fingers of the hand. In tying the knot, the fingers sweep back, over the cord, Fig. 3, continue around in a nearly horizontal plane, Fig. 4, and separate so that one passes above and one below the strands of cord, Fig. 5. The fingers are then forced together, grasping the strands between them, after which they are drawn back, Fig. 6, carrying a loop of the two strands up through the circle formed by the previous motions of the fingers, Fig. 7. This completes the knot, as shown in Fig. 8.

The mechanical knotter, shown inverted in Fig. 9, consists of a fixed finger on a rotatable shaft, and a finger pivoted to the shaft and pressed against the fixed finger by a strong spring. The pivoted finger carries a friction roller, U'', on its rear end and is raised as the knotter rotates by the action of this roller on a cam fixed on the frame of the machine. The fixed finger has a purely rotary motion, and when the knot has reached the stage represented in Fig. 5, the knotter simply holds the strands of cord, and the expulsion of the bundle draws the circle of cord over the fingers, thus having the effect of drawing the strands through the loop.

The holder consists of a disk having notches which catch the cord and carry it between the disk and a spring-pressed lever which fits against the face of the disk, thus clamping the cord.

After the knot is tied the cord is cut between the knotter and the holder, leaving the new end of cord thus formed in the holder, the rotation of whose disk has caught the portion between the needle and the knot. A small piece of cord two or three inches long is

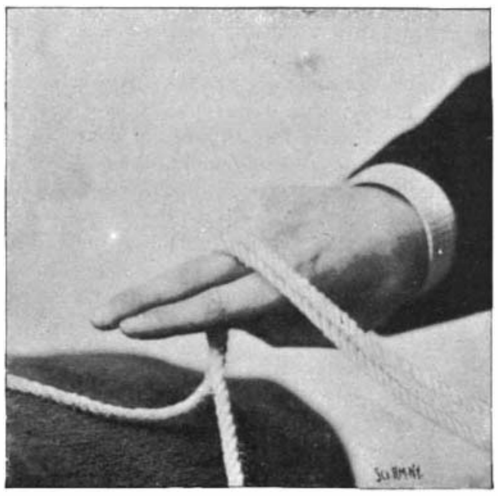


Fig. 3.

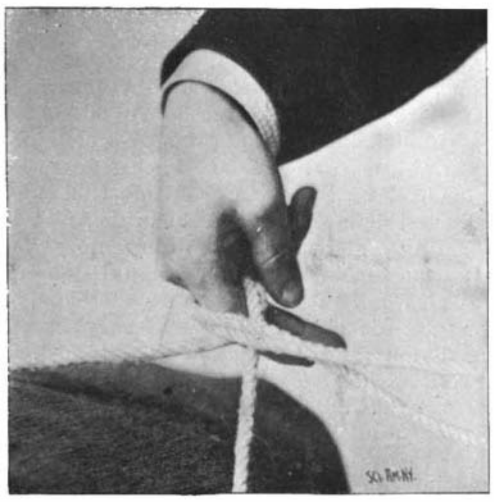


Fig. 4.

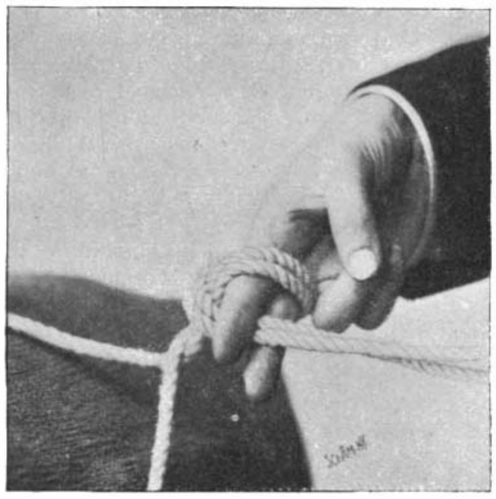


Fig. 5.

Fig. 6.

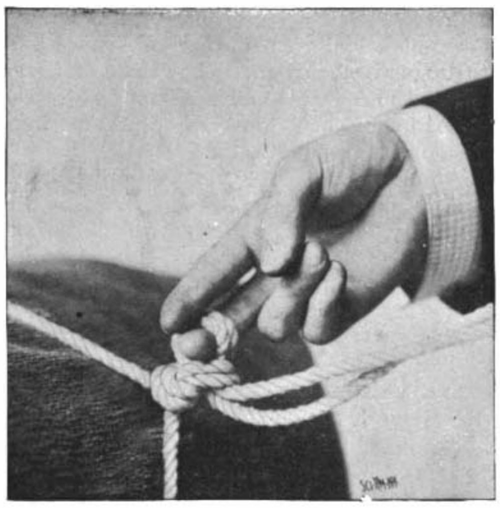


Fig. 7.

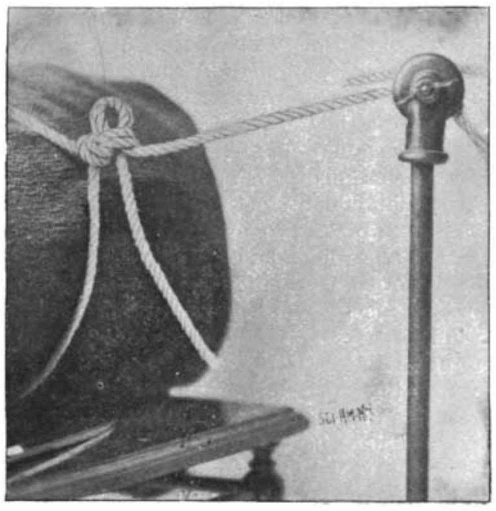


Fig 8.

left in the holder after each knot and drops out as the holder rotates. There are several types of knotters. The one described is the form in most general use.

While a large number of parts are used to operate the essential parts described, it will be seen that the principle of the self-binding harvester, like that of most machines, is comparatively simple.

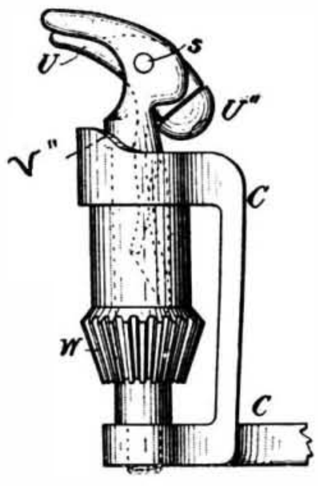


Fig. 9.

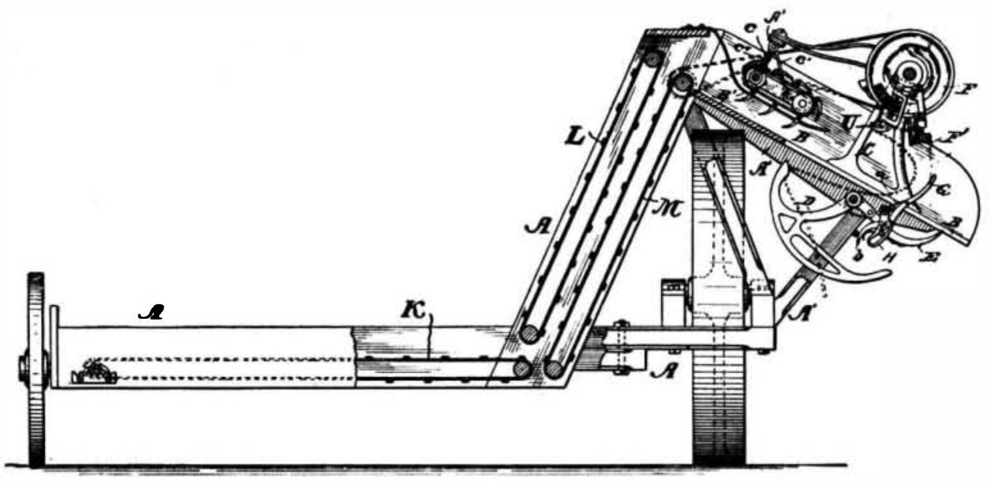


Fig. 1.

A New German Harbor.

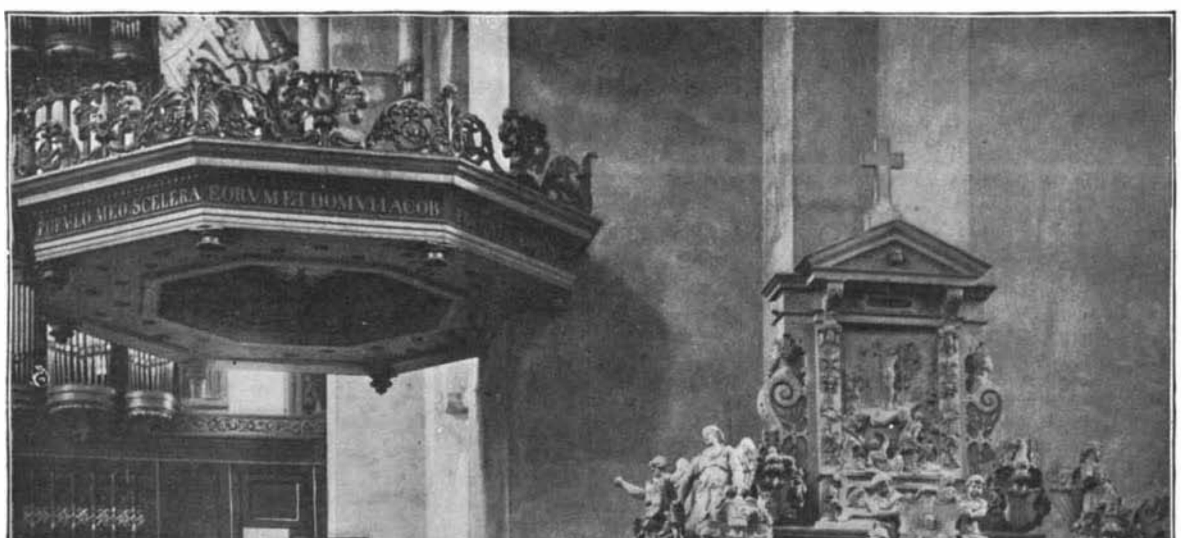
A harbor affording increased conveniences for deep sea fisheries has just been completed at Geestemunde, near Bremerhaven. The Prussian State spent about one and one-half millions of dollars on this work. The harbor is 3,940 feet long, 263 feet wide, and 14·5 feet deep at low water. Coal yards and storage houses are provided, and the present arrangements permit of the simultaneous unloading from fifteen ships. A special electric light plant and special water works have been constructed for this harbor. The government expects that these improvements will greatly assist German fishermen, says Uhland's Wochenschrift, in their struggle with foreign competitors.

THE PULPIT OF THE CATHEDRAL OF TREVES.

Of all the countless thousands of tourists who rush up and down the Rhine on the steamers, probably not one per cent ever visit the old city of Trèves, or Trier, as it is called in Germany, though it is one of the most interesting places in the empire. Trèves is situated on the right bank of the Moselle, and can be reached from Coblence by rail or by the river Moselle. A tribe of Belgic Gauls who occupied the territory were conquered by Cæsar, in B. C. 56. In the reign of Diocletian, Trèves became the capital of Belgica Prima, and during the fourth century it was frequently the residence of the Roman emperors. After the introduction of Christianity, the old Roman city became the residence of bishops, archbishops, and electors, until Clemens Wenceslaus, the last elector, transferred his residence to Coblence, in 1786, and in 1815 it was ceded to Prussia.

The city is picturesquely situated in a rich plain surrounded by vineclad hills and wooded heights. Several of the Roman structures still remain in very fair preservation. The principal monuments are the Porta Nigra (a fortified city gate), the brick basilica, the Roman palace, the amphitheater, Roman baths, and the Igel monument, one of the most interesting Roman relics north of the Alps. Even the cathedral itself derives from the Romans. It is one of the oldest churches in Germany, the nucleus consisting of a quadrangular basilica erected by the Emperor Valentinian I (364–375) for commercial purposes and the administration of justice. The church, which was made out of the basilica was partially destroyed by the Franks, but was restored in the original style some time about 550. It was again devastated by the Normans and was restored and increased in size about 1025. The vaulting of the nave and aisles dates from the thirteenth century. The interior contains several monuments worthy of note, and in the high altar is the "Holy Coat" without seam, which is exhibited at rare intervals. This is one of the most famous, if not the most famous of relics.

One of the best bits of detail in the building is the pulpit shown in our engraving, dating from 1572. It was the work of Hans Ruprecht Hoffman. The pulpit is approached by an imposing staircase whose entrance is masked by a doorway. This doorway is heavily overlaid with ornament, though, fortunately, of a good period. The armorial bearings are effectively introduced. The pulpit proper rests on an octagonal column, the facets of the column having small engaged statues. The reliefs on the pulpit are quite high and are well up to the best German work of the period, though they are hardly as pure as the Italian work of the period which had preceded it. A carved canopy completes what is perhaps one of the finest pulpits north of the Alps. For our engraving we are indebted to the Blätter für Architektur und Kunsthandwerk.



PULPIT OF THE CATHEDRAL OF TREVES.

Our Mails in the Early Days.

"In Washington's first term an effort was made to speed the mails—to move them at the rate of one hundred miles in twenty-four hours, or about four and a half miles an hour. This would have been a notable advance, for the carriers were then taking nearly thirty hours between Philadelphia and New York. The roads were bad and there were many slow ferries. . . . In 1776 there were only twenty-eight post offices in the Colonies; in 1795 there were four hundred and fifty-three, and in 1895 there were 70,064. The rates of postage when the department was organized under the Constitution were high; for thirty miles, six cents for one letter sheet; for sixty miles, eight cents; for one hundred miles, ten cents, and so increasing with the increased distance to the maximum, twenty-five cents for distances over four hundred and fifty miles. Stamps were not in use in those days, nor was the sender of a letter required to pay the postage in advance. The postage, six cents or twenty-five cents, as the case might be, was written by the postmaster on the letter, and if the sender paid the postage the word 'paid' was added; if he did not, the postage was collected of the person to whom the letter was addressed. These rates soon yielded a surplus over the cost of the service, spite of the franking privilege which the law gave to congressmen and the heads of departments. . . . The demand of the newspapers and periodicals of every class for cheap postage, seconded by their subscribers, has led to a reduction of rates greatly below the actual cost to the government. In his report for 1892 the Postmaster-General, after stating that the present letter rates pay twice the cost of the letter mail, says that the book and newspaper mail is carried at a loss of six cents a pound. In recent years the Post Office Department has been characterized by a very progressive spirit, and it is now rendering, not a perfect service, but a high class service. No other department has more nearly kept pace with the marvelous development of our country."—Ex-President Harrison, "This Country of Ours," in Ladies' Home Journal.

Arrest of Assimilation.

Mr. A. J. Ewart has carried out a series of experiments on the power of arresting assimilation in green plants exercised by certain agencies: Dry and moist heat, cold, desiccation, partial asphyxiation, etherization; treatment with acids, alkalies and antipyrine; accumulation of the carbohydrate products of assimilation; immersion in very strong plasmolytic solutions, prolonged insolation, etc. He finds, says the Journal Linnean Society, that if the cell remains living the induced inability to assimilate is only temporary; the cell continuing to respire during the whole time of arrest.

In the great majority of cases no visible change in the chlorophyl is associated with an arrest of assimilation. Cells in which the green color of the chlorophyl is quite masked by the presence of a brown or reddish brown pigment may exhibit a distinct power of assimilation. In certain cases isolated chlorophyl bodies may continue to assimilate for a short time after removal from the cell to which they belong.