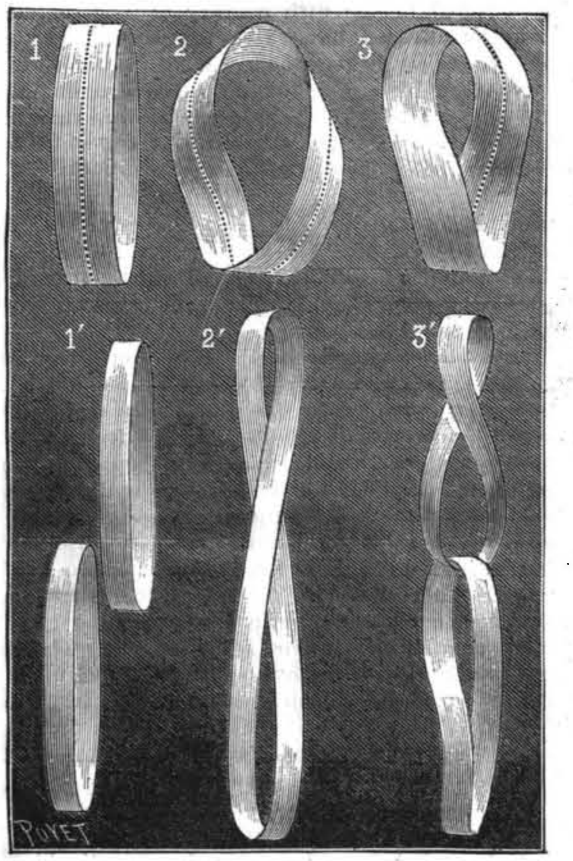
EXPERIMENT WITH PAPER RINGS.

The annexed engraving, from *La Nature*, shows the method of preparing paper rings for the performance of a curious experiment. Take three strips of paper, 2 inches in width by from 2 to 5 feet in length, and with one of them form a ring, as shown in Fig. 1, by pasting the two ends together. Before pasting the ends of the



EXPERIMENT WITH PAPER RINGS.

second ring, give the paper a single twist (Fig. 2), and before completing the third ring give the strip two twists. These twists in the completed rings (1 and 2) will be so much the less perceptible in proportion as their diameter is greater.

If we take a pair of seissors and cut through the circumference of ring No. 1 in the direction shown by the dotted lines, we shall obtain two rings, as shown in No. 1′. Proceeding in the same way with ring No. 2, we shall obtain a single elongated ring, as shown in No. 2′, and with No. 3, two rings which are connected like the links of a chain, as shown in No. 3′.

A NEW METHOD OF CONSTRUCTING PROPELLER SCREWS.

For several years past I have been engaged in studying the application of electricity to the propulsion of small boats, and I now desire to communicate to readers the conclusions to which I have been led by my experiments upon the operation of the screw, as well as a new method of constructing the latter.

My motor, which, with a minimum weight and size, develops very great power, gives its maximum of performance with a velocity of several thousand revolutions per minute. We have here, then, very different features from those presented by steam motors, which, on account of the inertia of their oscillating parts and the limited resistance of certain portions, are unable to practically exceed quite a low speed. Instead of reducing the velocity of the motor by the method of transmission, it has seemed to me more advantageous to allow the screw to have a very high rotary speed. It is well known that the resistance of water rapidly increases in measure as the speed of a body moving in it augments; and, in order to obtain a diminution of the screw's recoil, and reduce the loss of live power due to the whirling of the mass of water set in motion, we ought, therefore, to approximate the conditions offered by a screw that takes its bearing point upon a solid nut.

This high speed necessitates a large reduction in the pitch of the helix, which is likewise a favorable condition, since the resultant of the forces due to the inertia of the water, acting upon each element of the surface of the blades, advances toward the direction of the axis—the direction in which the useful effect must exert itself. There likewise results less of a tendency in the water to take on that rotary motion that gives rise to a centrifugal stress, which forces it to escape through the circumference of the helix, and is, as well known, the cause of jarring and loss of live power.

Experiment has confirmed this view of the subject, for, upon increasing the rotary speed up to 2,400 revolutions per minute, the performance of the screw very notably increased, while at the same time the boiling of the water astern was observed to diminish, the jarring to cease, and the motion to become perfectly regular and easy.

As these experiments necessitated the trial of a large number of screws of variable shape and pitch, I was led to devise a method of construction much simpler than those that are in use. The making of the mould for a helix is, in fact, an operation that requires quite a deep knowledge of geometry, since it includes the making of working drawings of the blades, of developing and laying down quite a large number of cylindrical sections concentric with the blades, and of cutting out templets, which, when afterward centered, permit of carving in a wooden mould the curves of the sections that are afterward connected by surfaces in which the sensation of continuity, and, consequently, the skill of the workman, plays a great role. The result is that such pieces can be made only by a small number of special workmen, and that the net cost of them is high.

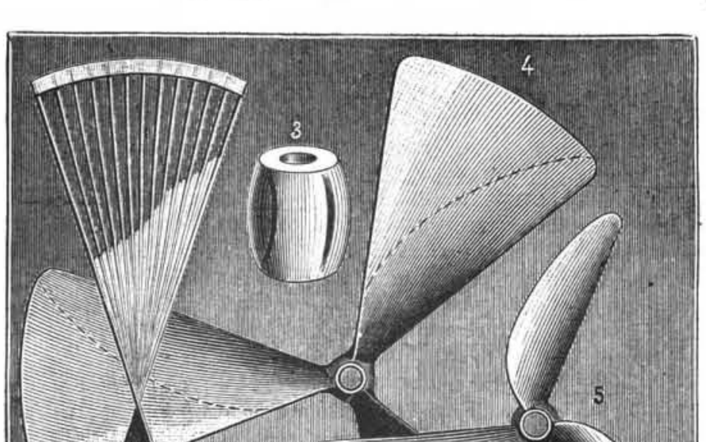
On the contrary, the new mode of construction presents such simplicity that any workman can thereby make a model of a screw. It is as follows:

In a cylinder of a diameter equal to that of the boss of the screw, I make a helicoidal groove, an operation that the gear lathe performs with perfect regularity. I afterward take a series of metallic rods, of a diameter equal to the width of the groove, and insert one of their extremities in the latter at right angles with the axis of the cylinder, pressing, as I do so, one closely against the other, so as to secure a contact. We thus, with the greatest ease, form a helicoid of determinate pitch. It only remains to connect the outer extremities of the rods by means of a strip of thin metal, to which they are then soldered in order to fix their position, and to likewise solder together the lower extremities, and finally to fill in the spaces between the rods with an easily fusible metal. In this way I obtain two surfaces, with which the rods are flush, and which sensibly coalesce with the geometric helicoid, having exactly the pitch that was chosen.

Moreover, I can form the geometric helicoidal surface perfectly by making one of the angles of the tool coincide with the tracing of such surface on the cylinder. If it be desired, curved blades may be cut out on the surface thus formed, and the face that is not designed to act can be strengthened by means of some plastic material. In this way, there may be easily obtained, at slight expense, a mould, by means of which perfectly regular screws of definite pitch may be cast.

As the mould is of a non-distortable substance, deprived of core, it will remain as a standard for verifying either the products of casting or such screws as have got out of true by use.

The screw with variable pitch, which is so complicated and so difficult to make, can be formed with the same ease. This method of manufacture may likewise render services in teaching, by permitting of rendering the generation of the helicoid tangible, this being a surface whose form and properties are understood with difficulty through diagrams and drawings.—*G. Trouve, in La Nature.*



CONSTRUCTION OF A HELIX.

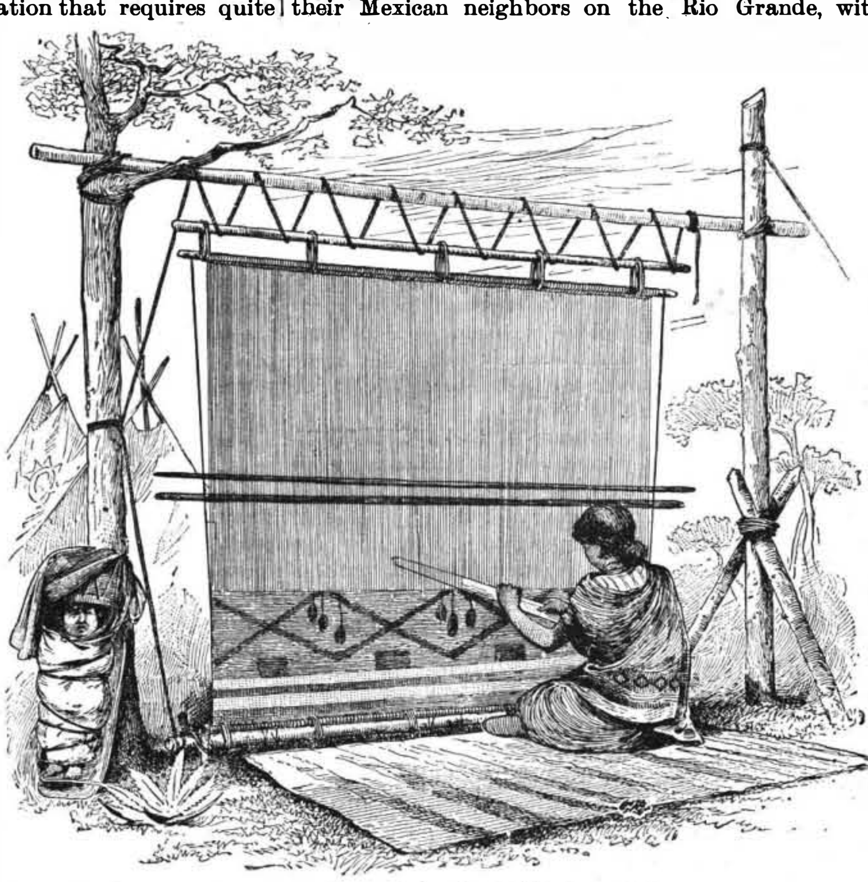
1. Grooved Cylinder. 2. Details of Grooves. 3. Boss. 4 and 5. Three-bladed Screws.

HOW THE NAVAJO INDIANS MAKE BLANKETS.

BY W. MATTHEWS.

The art of weaving is undoubtedly of high antiquity among the American aborigines, and was brought to great perfection long before the advent of the white man. My reasons for thus believing cannot be discussed in the limited space here allotted to me. Probably in no tribe on our continent at the present time are higher results in weaving obtained, or ruder means employed, than among the Navajo Indians of New Mexico and Arizona, and among none, perhaps, has the craft of the weaver been less europeanzied. Hence a brief description of their processes and appliances cannot fail to interest the student of this art.

In preparing their wool, the Navajos now use the hand card, purchased from the Americans. Previous to the introduction of this tool, a tedious method of picking with the fingers and rolling between the palm was employed. They still spin their wool with the old distaff, consisting of a simple rod of wood thrust through a hole in the center of a round disk, although their Mexican neighbors on the Rio Grande, with



METHOD OF WEAVING A NAVAJO BLANKET—INDIAN WOMAN AT WORK.

whom they have had con tant intercourse in peace and in war for the past three hundred years, use the spinning wheel. And although they probably possess sufficient ingenuity to make wheels, and undoubtedly have ample means to purchase them, they have never adopted them. They cling to the older and simpler implement.

Their most important native dyes are the following:

A dull, brownish-red (approximating the tint of burnt sienna), a deep black, and a brilliant yellow. The red dye is a decoction of the bark of alder, mixed with the bark of the root of mountain mahogany (*Cerocoearpus*). The yellow is a decoction of the flowers of a species of *Senecio*, with a crude native alum (*almogen*) for the mordant. The black dye is made by throwing into a strong decoction of the twigs of aromatic sumac (*Rhus diversiloba*) a calcined mixture of pinon gum with a mineral substance called by the Navajos *tse kon*.

Besides these colors, they had, in old times as they have to-day, wool of three different natural tints, viz., the white of the ordinary sheep, the rusty brown of the so-called black sheep, and the gray wool of the gray sheep. So, before the introduction of new colors by the whites they had a fair range of tints wherewith to execute their artistic designs.

In time the Mexicans gave them indigo, and, as far as I have observed, this is the only dye which the Spanish Americans introduced. With this, by varying the strength of the solution, they color their wool of different shades of blue, and by adding their native yellow they make different shades of green.

But the Mexicans brought them another material, which has added even more than indigo to the beauty of their fabrics. This is the bright scarlet cloth known