for their own benefit. Other senators, who pretended to know something about the Union Pacific Company, had said that the company was liable to become insolvent any day, and if that should come to pass, the result would be that the first mortgage bonds would be foreclosed, and the Government lien would be cut off, and this Congress would be held respon sible for it.

The importance of Senator Stewart's foreshadowing is made apparent by the fact that the Government has already issued $56,852,320 in bonds to the Pacific Railroad, upon which the company assumes to pay the interest; but if the first mortgage is suffered to be foreclosed, of course the people must be taxed to pay the interest on the whole of the above issue of bonds.

## SPRINGS, THEIR POWER AND USES.

The peculiar property possessed by various materials, which has received the general name of elasticity, exhibits itself in many ways. Some substances manifest it, when compressed, in a high degree, while bars of the same material may be bent without developing elastic power to any great extent. Others on the contrary, exhibit great elastic power when bent, and comparatively little upon compression. Others, again, may be stretched without manifesting much elasticity, while upon bending they show it in a high degree.

Springs may be classed as follows: Flat, straight, or bar springs, coiled springs, spiral springs, and block springs, intended to resist compression, usually made of rubber, and in common use on railroad cars, etc., convex disks, concave disks, or a union of the two latter in a corrugated spring.

In metallic springs it is found that the elastic power resides in great measure near the surface. A well-tempered bar spring will lose much of its elastic strength by filing off a very thin scale from its surface. This fact has never yet been explained satisfactorily.

Power may be applied to springs in four ways. They may be stretched, compressed, bent, or twisted. The elasticities developed in the same material by these different methods of application, are not demonstrated to possess any ratio to each other. In fact, the mathematical data relating to springs are extremely meager, and it is greatly to be desired that some accurate experimenter would give to the world some tabulated results that could be relied upon with certainty as a guide in construction. At the present time there is nothing of this kind, so far as we know, that can be referred to.

It is evident from the fact above stated—namely, that the elastic power of springs lies, in a great part, near or upon their surfaces—that the form of the metal which presents the greatest surface will give the maximum power, within certain undetermined limits. The doubling of the thickness, the width remaining constant, will not give double power, while doubling the width will nearly double the elastic power if the thickness be the same.

But while the elastic force is found to be in some way dependent upon the surface, it is also evident that there must be some ratio which the thickness should possess in regard to the other proportions, in order that the maximum effects should be maintained. It is easy to see that were the leaves of an ordinary elliptical carriage spring much reduced in thickness their strength would be impaired.

At present the determination of the strength of springs is left almost wholly to experiment. It is plain also, that whatever data may be determined for springs having proportional dimensions, and considered as being formed of homogeneous material, and of the same temper, nothing but experiment could determine their strength with accuracy, for, although dimensions may be accurately determined, the quality of the metal and exactness of temper can never be relied upon as constant. Approximate results, however, might be obtained of great use in the construction of this important element of machinery.

The uses of springs seem constantly multiplying. A large number of most important machines, such as printing presses, and the like, employ them in almost all their forms. In many clocks, and all watches, they are the prime movers, while their employment for all sorts of vehicles need not be more than alluded to.

A class of rather visionary inventors have vainly (as yet) endeavored to use them as the propelling power for vehicles, and we receive many communications requesting our views upon the feasibility of so doing. While there is theoretically no impossibility, in the idea of such propulsion, we think we can see so many practical difficulties in the way of its accomplishment as to render its success extremely doubtful. These practical difficulties are so well known that they need not here be specified. Mechanical skill may possibly eventually overcome them, but let not the mistake be made that a spring possesses any more power than is delegated to it. It is only a magazine of power, and can give only what it has previously received. We should have considered this last remark unnecessary had it not been that the tone of some communications lately received indicates that their authors have not fully purged themselves of the old illusion of the perpetual motion.

## PROTOPLASM.

Protoplasm is the scientific name for a substance which modern science has demonstrated to be common to all living things from the lowest plant to the highest animal organization. Prof. Huxley demonstrates that it may in itself exhibit all the phenomena of life. It contains oxygen, hydrogen, nitrogen, and carbon. Before these elements can form living protoplasm, they must unite to form the binary compounds known as water, carbonic acid, and ammonia. In the presence of pre-existing living protoplasm these compounds form a complex living substance, new protoplasm, which, Prof. Huxley so aptly terms the "physical basis of life." He says: "To this complex combination, the nature of which has never been determined with exactness, the name of *protein* has been applied. And if we use this term with such caution as may properly arise out of our comparative ignorance of the things for which it stands, it may be truly said that all protoplasm is proteinaceous, or, as the white or albumen of an egg is one of the commonest examples of a nearly pure proteine matter, we may say that all living matter is more or less albuminoid."

The living protoplasm of animals, a good example of which is seen in the white corpuscles of the blood, has not the power to influence the combination of the above-named compounds into new protoplasm. This power belongs only, so far as is at present known, to vegetable protoplasm, which, however, is not on that account to be considered as distinct from animal protoplasm. The latter has the power of converting dead animal or vegetable protoplasm into living animal protoplasm.

In this view protoplasm is the primary "matter of life," the first step from the inorganic into the organic world.

## SKINNING AND STUFFING BIRDS.

The preservation of the skins of animals and stuffing them so as to preserve their natural appearance, is an art requiring considerable skill and taste. It is also of great utility in the study of natural history, as well as a very pleasing pursuit for amateur collectors.

We are requested by several correspondents to give some information upon the skinning and stuffing of birds. While no amount of verbal instruction can give practical skill and artistic taste in the preparation and mounting of specimens, what we may say will perhaps be useful as a guide to those who have just begun to exercise this instructive and amusing art.

It is more difficult to properly prepare and mount bird skins than those of other animals, as the preservation of the plumage in an unruffled and unsoiled state, is the point to be aimed at, and feathers, if broken, are very hard to re-adjust properly.

In killing birds with shot the feathers are very apt to be more or less damaged and soiled with blood, which, if it be permitted to dry on the plumage, will be difficult to remove without some permanent disorder in its arrangement. These evils may be in a great measure avoided if the sportsman will attend to the following directions: He should take the field provided with a small box of cotton wool, a bottle of water, and a small shallow dish of some kind to hold a small portion of water at need. He should also be equipped with some small sable brushes, such as are used in water color painting, and a short piece of stiff wire with the end rounded. As soon as he has shot a bird he should aim to get it in hand as soon as possible, and plug the shot holes with cotton to prevent further bleeding. In doing this he will find the wire above alluded to a very useful instrument. When the bleeding is stopped, he should next cleanse the feathers from the blood which has already flown, by using the water which he carries for the purpose and the brushes. If the blood is thus removed before it dries, it can be so completely washed off as to leave no stain even on the whitest feathers, and at the same time their texture may be preserved from damage. Should any of the feathers become so much bent as to be difficult to straighten, they may be restored measurably by soaking in hot water.

Before skinning, the principal dimensions of the bird should be taken and noted down for reference in mounting. The first incision should be made longitudinally backward from the lower point of the breastbone. From the beginning of the operation to the conclusion, all fluids should be constantly absorbed by cotton wool, the greatest care being taken that they do not flow out and soil the feathers. As fast as the skin is separated from the body a thin layer of cotton should be inserted to prevent its adhering to the flesh and for purposes of absorption. Through the incision made as directed the entire process of skinning must in general be performed. When the skin is stripped down from the muscular portions of the legs, they must be cut off on the inside of the skin with scissors or a knife so as to leave the feet attached to the skin. The tail is likewise cut off on the inside at its attachment to the back. The body can then be suspended from a hook and the skinning proceed toward the head by turning the skin inside out. When the wings are reached the skin should, if possible, be removed as far as the joint constituting the elbow, but if it is found difficult to do this without tearing the skin, the bone may be severed as low down as practicable, by use of cutting pliers or strong scissors. Great care will be needed to avoid breaking the delicate membrane which constitutes the external ear upon the heads of birds which are nearly or quite bald. Care is also required in manipulating the eyes, the external membrane of which ought, if possible, to remain unbroken. The brain is removed from the skull through incisions made well back through the roof of the mouth. All loose flesh and fat about the neck, tail, and legs, should be removed from the skin. For this purpose the skin on the wings may be cut through on the inside, when it covers those parts from which the bone and flesh could not be removed. The parts liable to decompose may then be rubbed over on the inside with arsenic, or arsenical soap, which will effectually prevent decay.

The skin is now ready to be stuffed, which although it seems simple in description, requires considerable skill. If glass is not used for the eyes their orbits should first be stuffed through the mouth with cotton. Next the upper parts of the throat should be filled with the same material. A roll of cotton should now be inserted through the first incision, and pushed up through the neck to the base of the skull. Then the body should be filled, during which process the wires for supporting the bird when mounted should be inserted into the legs, neck, and wings. This completes the process so far as it can be described in words, with the exception of sewing up the opening through which the stuffing has been performed. This requires no special skill to be performed neatly.

Some slight variations in the method are requisite, according to the character of the bird. For instance, a very large bird may require to have the neck cut off when the skull is reached, and the skinning of the head to be performed by an incision from the outside down the back of the skull.

In mounting birds there is room for considerable display of taste in the adjuncts. A branch of the tree which the bird most affects, with artificial leaves, may be used with good effect as a support for the feet. The natural beauty of the plumage may be enhanced by suitable contrasts of color in the lining of the case where they are kept. An aquatic bird may be shown holding a fish in its mouth, such as it commonly obtains for its food, and many other fancies will suggest themselves to those who wish to excel in the art.

The directions we have given will, if observed, enable any ingenious person after a little practice to skin, stuff, and mount a bird creditably.

## WHY DON'T BOYS LEARN TRADES?—MECHANICAL LABOR.

Our recent agitation of this question and subject has brought us a number of communications. We do not propose to iterate and reiterate our statements or suggestions. We have already stated the facts, and pointed out the possible and practicable remedy. It is perfectly simple, and entirely feasible. But we give the gist of a few of the communications we have already received, in order to show the general feeling on the subject, and in the hope that those in whose hands the remedy lies may be induced to apply it. A young man, signing himself "Eugene Dunbar, of Holliston, Mass.," says: "There are many boys, myself included, who would be very glad to learn some good trade. For several years I have been very desirous to learn the trade of a locomotive machinist, but, although not too proud to take an apprentice's position, I have not met with success in my endeavors to obtain a chance to learn the business."

Another writing from Georgetown, D. C., referring to our article published on page 169, current volume, under the heading, "Why is Mechanical Labor Objectionable?" says: "Education is everything. But just so long as we train our young people in literature and the classics, we must necessarily breed a race of men and women lazy in the qualities demanded by mechanical labor. Our school system needs a thorough remodeling. Our farmers' sons, after passing through a course of literary training lose all taste for the noble art of cultivating the soil. We should have a more healthy state of society, if, at school or college, our children were thoroughly instructed in a practical knowledge of mechanics and agriculture. The cultivation of the soil demands for its intelligent management a knowledge of chemistry, botany, geology, of fruits, trees, rearing of cattle, of the properties and uses of manures, etc., all of which afford pleasure, and give healthy mental and physical occupation. He who is once initiated into this science of sciences, and its application, will not quit the cultivation of the soil for any meaner profession. Literary training, instead of being the principal object of school education, should be considered a recreation, and the practical should take precedence."

E. W. Dean, of Norwich Town, Conn., also writes that he has passed through the ordeal, having been a clerk three years, where his hands were kept soft and white, and then became a machinist's apprentice. This was hard on his hands, and insured his receiving the cold shoulder from his acquaintances, who before welcomed him. He, however (very wisely, in our opinion), prefers his position of independence as the master of a useful art than as a mere caterer to the tastes of purchasers of finery.

The following from the Philadelphia *Morning Post* is allied to the general subject, and we therefore copy it: "The late report of the directors of Girard College shows not only the great changes that have in late years taken place in our social and business systems, but a very unpleasant result in regard to the college. There are now forty boys in the institution who are ready to go out, but who are obliged to remain because there is no one willing to receive them under indentures, as provided by the will of Girard. The system of indentured apprenticeship having fallen into discredit and disuse, these boys are unable to find masters, and must, therefore, remain in the college, occupying the places of many who are ready to enter, thus interfering very much with the usefulness of the institution. There is, it appears, no legal way of disposing of these pupils, who have gone through the prescribed course, and have drawn from the college all the benefits to which they are entitled.

"According to the will by which the institution was founded and governed, these boys must be bound out to learn a suitable trade. That patiently waiting for persons willing to take them under these conditions will be of any avail we doubt. Every month, every year will find fewer and fewer business men adhering to the old system of apprenticeship. Every year the number of boys who have graduated but cannot leave the college, will increase, until in time the whole establishment will be filled with its alumni, to the total exclusion of new scholars, and this body of graduates must, we suppose, stay there until they are old men, and every time an octogenarian drops off, a boy may be admitted.