Correspondence.

Burrowing Sea Urchins.

To the Editor of the Scientific American:

The inland waters between Vancouver Island and the mainland abound in marine life, especially with sea urchins, which are eaten by the Indians who live upon those waters.

The sea urchin is frequently found in burrows, accompanied by clams, cockles, crabs, oysters, etc. They enter the burrow while quite young, and as the mouth of the burrow is frequently quite small, they soon grow too large to get out, and they now conform to the shape of the burrow, instead of the burrow being enlarged by them.

I have never seen a case where there were any indications that the burrow had been enlarged a particle by the sea urchin.

The burrows are made by a species of mollusk, which are found nowhere else than in those burrows, which are sometimes 4 inches deep in solid rock; commencing on the surface in contact with the water, the opening may not be larger than the head of a pin. It gradually increases in size until occasionally they are 1½ inches in diameter. No matter how many mollusks are in one piece of rock, they never interfere with their nearest neighbor.

After the death of the mollusk, and as the action of the water on the rock wears it away and the openings become larger, these burrows form places of retreat for myriads of tiny creatures whenever danger is at hand.

Lynn, Mass. Dr. M. C. S.

A Census Problem.

In the United States one hundred years ago the proportion of persons living in cities to those living in the country was as one to twenty-five. The recent census shows that the present proportion is one to three. This decrease in the rural population is general throughout the country, and has given rise to various theories touching the cause. It is an interesting question. Public attention is directed largely at present to social and economic problems, and their consideration is enlisting careful and earnest thought. It is not always possible to determine the reason from the result, but consensus of intelligent opinion on any question aids in reaching a logical conclusion.

The growing disproportion between the urban and the rural population of the United States may be attributed to a variety of causes. It has been accounted for by some of the most careful students of sociology upon the ground that the social instincts of men draw them together into communities and that the tendency to desert the farm and to seek homes in the towns and cities is due to the distaste for solitude which is common to the human race. This will not entirely explain the phenomenon, although it is doubtless true that it is one of the motives which has helped to bring about the present conditions. Economic influences have also played an important part in causing the change which is so rapidly equalizing the census in the country and the cities. Labor-saving machinery makes it as easy now for one man to produce a thousand bushels of wheat as it was formerly to produce one hundred bushels. The railroad has become the wagoner of the farmer, and the necessity of employing men to haul the products of the soil to market has been practically done away with.

The packing houses now do the most of the butchering for the farmers, the creameries make the butter which he consumes, the canning factory and evaporator work up his fruit, and thus in almost every direction the demand for labor has been curtailed and the work of the farm narrowed down. The vast production of agricultural machinery has drawn the young men from the farm to the manufacturing centers. The multiplication of schools and colleges has attracted the well-to-do farmers to the towns and cities to educate their families. The decreased profits of agriculture have induced many people to abandon farming for more lucrative pursuits. The railroads have brought the rural population within easy touch of the world, and the city, which was once so remote, is now easily accessible, with all of its charms and attractions. These are among the reasons which are assigned for the exodus from the country to the city. Whatever may be the true cause of its decline, the spirit of contentment which once prevailed among the farmers no longer exists. Whether the old conditions of happiness and prosperity which once made agriculture an inviting pursuit will ever return, is a problem which is yet to be solved, and it is a question which may well awaken serious concern.

The brawn and the brain of this nation have come chiefly from the rural districts. The bone and sinew of the country is not derived, as a rule, from the great cities. The most illustrious names in American history are associated with the farm. Washington, Jefferson, Webster, Clay, Lincoln, Grant, and a host of other great men who aided in shaping the destinies of the republic came from the country. The nation cannot view with indifference the influences which may impair the source from which its most sturdy population, mentally and physically, has proceeded. Is there any just ground for the fear that the movement from the country to the towns will long maintain its present volume? Does not the logic of events point to an early reaction? The towns and cities cannot remain crowded beyond their capacity to afford a livelihood to their population. When that point is reached there must be a receding wave, and the movement of population will be in the other direction. There is a basis for the belief that the equilibrium will be restored by the law which makes agriculture the essential source of prosperity and the foundation upon which the commercial interests of the country rest.—*Kansas City Star.*

The Process of Fulling.

BY FINISHER.

The first operation in the wet finishing of a piece of woolen goods is known as fulling. Before the cloth is ready for the fulling mills it must have undergone the two preparatory steps of dry finishing, burling and mending. Then, before the fulling proper takes place, one thing more remains to be done, the great benefits of which are constantly becoming more fully recognized. This step consists in the sewing or tacking together of the selvedges of the piece, before it is run into the mill. There is more than one good reason why this is a wise course, and the careful finisher should take them all into account before he condemns the plan as useless. Since the piece is always turned with the face of the cloth inside, no flocks can come in direct contact with the face of the goods. This is an advantage of no small moment, especially upon light-colored fabrics. Further than this, the soap which is used in fulling is not so likely to strike the face of the cloth sooner in one place than in another, and thus give rise to uneven fulling. Again, since the sides are double and of the same thickness as the center of the piece, they will receive the same amount of pressure and friction, and for this reason full more exactly like the middle of the piece than they otherwise could. Last of all, when the selvedges are thus tacked together with the face of the cloth inside, this face cannot rub and chafe against the sides or rollers of the mill. We are now ready for the fulling process, which has been called the mother of finishing.

There is probably no one operation in the whole range of woolen finishing that exercises such an important bearing on the appearance and value of the finished fabric. It is in this process that the first great change takes place which lays the foundation for all the after-work of the department. Hence it is that if, through ignorance, carelessness or neglect, this foundation be faulty or imperfect, nothing that the finisher can possibly do afterward will serve to avoid the most disastrous results.

The fulling process, together with a knowledge of its application and effects, dates as far back as we have any information whatever concerning textile manufacture. And it is a fact that there has never been a people, civilized or savage, who has used sheep's wool in the making of textile fabrics but has both appreciated and utilized its wonderful properties. Further, we might say that like all operations which are indispensable, the means and appliances for its use have continually changed and improved.

What, then, is the aim of the fulling process? We would say that the aim of this process is to so entwine the fibers of the yarn that has been woven into the form of cloth that whereas they once lay loosely beside each other in the unfulled fabric, they may after fulling become more compact and uniform, presenting a firm, smooth and even surface for the after-processes of wet and dry finishing. The fiber must possess certain essential properties before it can possibly undergo this process. The most important of these is that known as the felting or fulling property, which is developed to its most perfect degree in fine merino wools. The nearer to the nature and properties of ordinary hair any grade of wool approaches, the less of this essential does it possess.

The three artificial means which are always necessary in the operation of fulling are heat, moisture and friction. Soap is used in fulling, because wool from its very nature cannot sustain the required friction without the aid of moisture. The machine which produces the friction, and retains the heat thus generated, and the soap which produces the moisture, are the three agents employed in the art of fulling as it is practiced the world over.

Fulling mills and machines, although of several different styles, are all applications of the same general principles. First, we find the old-fashioned fulling stocks or hammers. These we speak of as old-fashioned, not because they are out of date and useless, but simply for the reason that they have been superseded by more modern contrivances which do quicker and generally better work. But there are some styles of finish which cannot be obtained in any way except by the use of the stocks. There is a soft woolen fabric, much in vogue for the past few seasons, made in imitation of the Scotch cheviot, which can be finished in no other way. Three-quarters of an hour in the stocks with plenty of soap brings our goods out with a feel and a body which cannot be produced in the rotary fulling mill. We cannot say then that the stocks are entirely useless when we pronounce them old-fashioned.

The first decided improvement on this machine was the narrow rotary or German fulling mill. This mill was meant to full only one piece at a time, and is used to-day more for fulling heavy overcoatings and blanketings than for the finer grades of cloth.

Then, last of all, there is the improved broad rotary mill, which is made so that two, three or even four pieces may be fulled on the one roller at the same time. These are, indeed, a marked improvement on the machines above mentioned, and yet even the broad rotary possesses disadvantages which cannot be overlooked. One of these lies in the fact that owing to their size they but imperfectly retain the heat generated by the friction. This heat is an absolute essential to the success of the operation, and if lost in any way, must be supplied and maintained by outside means.

Now, when our piece with the selvedges sewed on together is ready for the fuller, it is run into the mill, and the two ends are carefully stitched across. Then it is well to allow the piece to run for a few minutes dry before applying the soap, and afterward the soap is poured on gradually and evenly over the whole length of the piece. The manner of applying the soap, and the amount of it used, are two important points to be noted in the successful operation. If too much soap is used, the cloth is apt to be clammy and disagreeable; if too little, then it will be spongy and imperfect; if more soap is applied in one part of the piece than in another, the fabric will full unevenly, and if the soap is too strong or too hot, this, along with the heat and friction of the mill, will seriously affect not only the color, but the life and durability of the fibers themselves.

As to the best means of soaping, the soaping machine doubtless takes the lead, but where such is not at the disposal of the fuller, an ordinary tin pail with half inch spout will answer every purpose. By this means a small gradual stream of the liquid soap can be slowly directed against the cloth, and even distribution at once effected. In the application of the soap all depends upon evenness in the distribution, and if this is not obtained, there will surely be unsatisfactory results in the finished cloth. As to the amount of soap necessary, it will be best to bear in mind two or three facts. The amount of felting the piece is to receive, the time required to full, and the kind of stock there is in the fabric, all have an important bearing upon this matter. Too little soap or short stock, or soap not rich enough for the friction and time required for fulling, will be sure to lead to unending trouble.

The goods will never begin to full until they become worn. But when the heat is once generated, then it is all important that it be kept as uniform as possible. If at all practicable, great fluctuations in the temperature of the mill must not be allowed. It is not possible, however, to give the exact standard at which the temperature of the mill should be kept. This would naturally vary with the kind of goods in hand. Experience is the best teacher. The idea of hanging a small thermometer inside the mill as a guide in keeping the temperature regular and sufficiently high is by no means a bad one, and may be practiced with success.

The troubles which come up in the fulling process and the means of overcoming them will be discussed in a later paper.—*Manufacturers' Gazette.*

Plants as Reagents.

From the results given it appears that by means of beer yeast it is possible to recognize the presence of 0·0005 grm. of phosphate in 1 liter of water, which corresponds to 5-10,000,000ths of the weight of the liquid. But agricultural plants are also reagents of an extreme delicacy and accuracy. The author gives as an example the sugar cane, the dominant food of which is calcium phosphate. With the complete manure the cane gives a harvest of 57,000 kilos. per hectare. If we omit the phosphate, the yield is only 15,000 kilos. Hence 600 kilos. superphosphate, containing 90 kilos. phosphoric acid, determine an excess of crop of 42,000 kilos. per hectare, which represents 70 times the weight of the phosphate and 466 times the weight of the phosphoric acid. If referred to the 4,000,000 kilos. of vegetable soil covering the surface of a hectare, the phosphate represents less than 1-6,000th part of the weight of the soil, and the phosphoric acid less than 1-40,000th. The author hopes to fix the limits of this method.—*Georges Ville.*

Remedy for Roaches.

Take three pounds of oatmeal, or meal of Indian corn, and mix it with a pound of white lead; moisten with treacle so as to form a good paste, and put a portion down at night in the infested building. Repeat for a few nights alternately, and in the morning remove the paste and the corpses to a convenient place.