

be de-electrified after it leaves the machine, and this de-electrification may be performed, not only by the means described above, but also by the action of the "X" or cathode rays. This may be effected by passing the wool in front of a Crookes tube, arranged to emit these rays in the well-known manner.

The idea seems theoretically good, but scarcely in a shape which will attract the majority of spinners. However, it may be useful for extreme cases where humidity and other means stubbornly fail to give relief.

### CLOTHING IN COLD CLIMATES.

Protection against the cold was secured to the prehistoric man living in the temperate and arctic regions by the use of skins and furs of animals. All of these materials that can be secured at the present time find a ready use for the same purpose, and in the extreme northern latitudes provide the only covering that will protect man from the rigors of that climate.

The inhabitants of the tropics near the sea level, on the other hand, find such clothing unnecessary as a protection against the cold. Cotton, linen and other vegetable fibres provide the covering required to hide nakedness, for ornament or to guard against the inequalities of temperature and moisture.

In the colder climates the scarcity of furs and skins and the difficulty of securing them doubtless proved a hardship to man from the beginning of his life on this planet. An animal furnished but one skin, and had to be killed for that.

The necessity for an additional supply of clothing was the mother of invention of the processes of carding, spinning, weaving and knitting the hairy covering of animals into covering for the body. It is a matter of regret that no account of this early revolution in the clothing industry has been handed down to us. Human nature then was probably much the same as now, and we can readily imagine the strenuous objections raised by the dealers in hides and skins to the new methods by which one animal was used over and over again to supply cheap and inferior clothing for the people. They doubtless argued that their goods, skins and furs, were much warmer and vastly more durable than the woven and knitted substitutes by which the people were cheated and the price of skins reduced. Their objections were unavailing, as the new methods of textile manufacturing by hand were well established at the dawn of history and continued with but slight modifications down to the time, a little over one hundred years ago, when the invention of the Hargreaves' jenny, the Arkwright spinning frame and the steam engine marked another epoch in textile manufacturing.

To be useful to man, yarn must be woven as well as spun. Machine spinning and hand weaving, however, formed a chain whose strength was measured by its weakest link, viz., the hand loom, and the improvements effected by Hargreaves and Arkwright would have been of but comparatively slight benefit to mankind without the power loom, which was invented soon afterward by Cartwright.

The benefits resulting from these improvements in spinning and weaving cloth cannot be overestimated. They increased the production and reduced the cost of one of the great necessities of life, clothing, and made it possible for a small fraction of the human family to clothe the rest, who were thus left free to devote their energies to other fields of human endeavor in industry, science and the arts. It is very fitting that posterity should erect monuments to Hargreaves, Arkwright and Cartwright.

But a new difficulty now presented itself. The immense

quantities of cloth that could be produced by the new spinning and weaving machines called for a corresponding increase in the supply of raw material. The power loom was needed to realize the advantage of the power spinning machines, and now the full benefits of both were threatened by a scarcity of raw material. The cotton fields of our own Southern States solved this world-wide problem as regards the principal supply of clothing for the inhabitants of the tropics and an important part of the clothing for the rest of mankind.

A great deficiency still existed. It was not in the heat of the tropics, but in the chill atmosphere of the temperate zones that man was at his best. The cold of these regions acted as a stimulant to both mind and body, but at the same time warm clothing for the body was essential. He must have wool, and, to keep pace with the development that spinning and weaving made possible, he must have plenty of it. Nature was not so generous with wool as with cotton. The raising of sheep was, as it still is, slow and precarious. The supply of wool was insufficient for the necessities of mankind.

At this juncture some one, we are not certain who, perhaps more than one deserves the honor, discovered that *woolen cloth could be converted into wool and used again for producing a new supply of clothing, which could again be converted into wool, and the process repeated indefinitely.* The honor of this discovery is claimed for three persons, Benjamin Parr, Benjamin Law, and a Hebrew clothing dealer of London. Whoever he may be, he should be numbered among the great benefactors of the human race for having discovered a means of cheaply and suitably clothing men in those portions of the earth most favorable for the development of the race.

The disproportion of the world's wool supply to the needs of mankind is shown by a comparison of the yearly production of clean wool with the population of the earth. The statistics for both can at best be but approximate. Any probable error would not, however, materially effect the per capita portion.

In a German work, *Wollproduction und Wollhandel*, recently published by Dr. W. Senkel, statistics of the clean weight of wool produced in the various countries are given, from which we estimate the yearly production of clean wool throughout the world at 1,379,000,000 pounds.

The population of the earth is estimated at 1,440,000,000, but of this number, the people, estimated at 271,000,000, living within an equatorial belt extending around the earth and bounded on the north by the Tropic of Cancer, and on the south by the Tropic of Capricorn, may be omitted from any calculation as to the consumption of wool. Many of them wear no clothing whatever. The rest find clothing made from vegetable fibres to answer every requirement. Eliminating this portion of the earth's population, we find 1,169,000,000 inhabiting the regions north and south of this torrid belt who require woollen clothing to protect their bodies from the cold. Dividing among this number the wool grown each year, we find each person's share to be 18 87/100 ounces of clean wool.

A large portion of this weight is lost in the processes of manufacturing the wool into cloth. This shrinkage is greater in making worsted than in making what is termed carded woollen cloth, but would average 30 per cent. The 18 87/100 ounces of clean wool allotted to each person would, consequently, produce but 13 2/10 ounces of woollen cloth. This weight of cloth would be equal to a piece of men's wear winter weight goods 35 inches square, or to a piece of summer weight cloth 44 inches square. This insignificant patch is the yearly portion for each person, if all the wool grown on sheep were manufactured into cloth. A man's suit requires 3½ times as