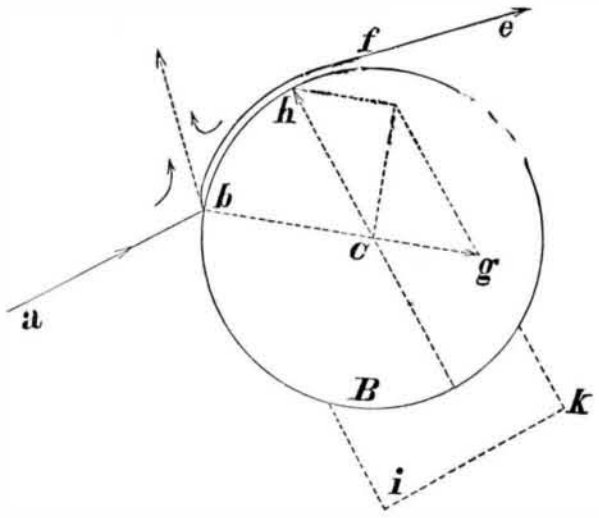
A THEORY OF THE BALL PUZZLE.

Mr. Hugo Bilgram, of Philadelphia, has written the fol lowing explanation of the ball puzzle described in the SCIENTIFIC AMERICAN SUPPLEMENT, page 576, volume II. :

A current of air, *a b*, striking the ball, B, will not, as might be expected, be reflected in the line from *b*, nearly at right angles to *a b*, but will follow the course, *b f e*. The reason can be explained as follows: Any current of air has a tendency to carry along with itself the surrounding air; but the current, *b d*, can be supplied from one side only, while on the other side, in the angle, *d b f*, a rarefaction of air takes place. The current will therefore be deflected by the pressure of the atmosphere, and take the course as shown. The impact of the air, at *b*, produces the force, *c g*, while the surplus pressure of the column of air, *i k*, over the rarefied conditions under the current, *b f*, exerts the pressure, *c h*. These two forces united produce a vertical force equal to the weight of the ball. The rarefaction of



air, between *b* and *f*, as well as the deflection of the current, can easily be demonstrated by experiment.

Ourselves as Others See Us.

We all like to know what others think of us, even if their opinion makes us wince; and recognizing this fact, a bright newspaper man has been chatting with the representatives of the foreign nations at the Centennial show to learn their notions of our country and ourselves. The phlegmatic Turk is astounded at our inquisitiveness. "They come up to your stand, handle your goods, ask you all sorts of impertinent questions, never apologize for troubling you, but address you invariably with the inevitable 'how much.'" We fear the Turk makes a fair criticism. The Frenchman thinks our mode of life, so far as eating is concerned, is detestable. "Your mode of living," said one of the commissioners, "is the cause of illness among your women, which must affect the whole race. The undue use of ice water, ice cream, iced drinks of all kinds, the abuse of pepper and salt, are all injurious. You need a public school to teach the art of proper feeding." The Belgian also detests our mode of living and our cooking. He thinks our national stomach must be out of order—not far out of the way—and we eat too much meat. While we are exceedingly sociable, we have no *cafés*, and drink too often and too quickly; this is also the Belgian's criticism. The Frenchman, so far as our character is concerned, thinks "the high appreciation of number one does much to stunt the development of morality." The Spaniard declares us to be "the most cordial and hospitable people in the world." The Italian thinks we lack sentiment and principles. "To achieve what you have done," said one of the Italian Commission, "you have had to make a god—the dollar—and a machine of your country, a money-making apparatus." But the American women puzzle the Italian the most. Says this same commissioner:

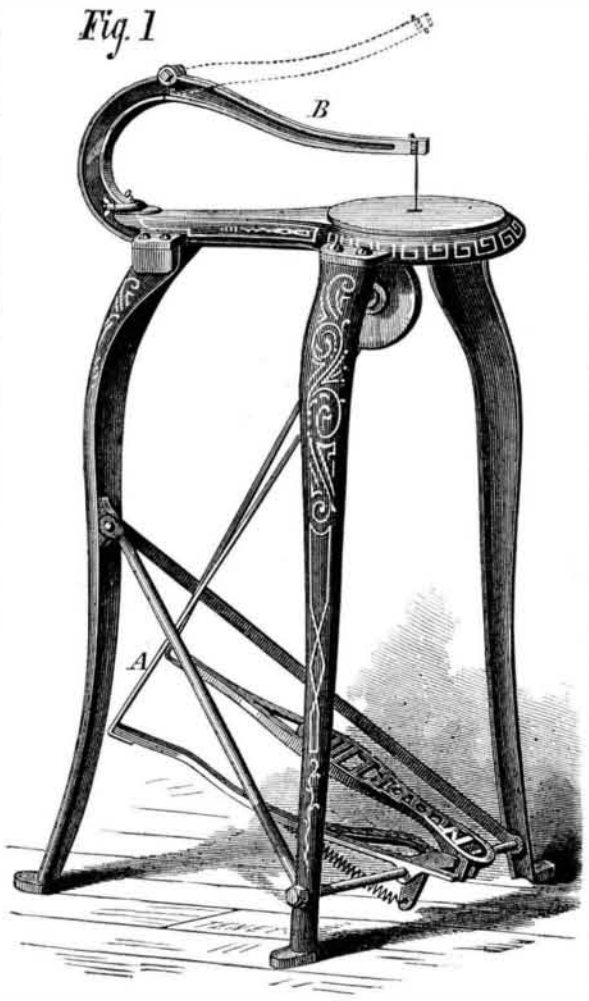
"I ask myself concerning them: Is it innocence, virtue, ingenuousness, or what? They are the most impertinent creatures I ever saw. They go up to a foreigner with the most perfect *sang froid*, stare him out of countenance, ask him if he is married, how many children he has, where he comes from, and I know not what. Their excessive freedom of manner to our hot-blooded people seems what I hope it is not. But they take the most extraordinary liberties. Fancy a pretty girl of eighteen laying her little dimpled hand on your arm and asking you, naively or boldly, I know not which, how you like the American ladies? What the deuce can one think?"

Like the Frenchman and Belgian, the Italian is disgusted at our cooking. "You need a thorough reformation of your *cuisine*," said one. "You have little or no variety of food, and oh! you lack good wines! If you only had our wines, you would have less public drunkenness." The German laments the absence of domestic life; but he seems to regard America as a sort of promised land, and thinks it especially a paradise for working men. The Austrian, like the Turk, is disgusted with the national impoliteness. Said one: "The people are pleasant enough, but they do not know the use of the words 'please' and 'thank you,' and seem to imagine that for the admission price of fifty cents they purchase the services, as guides, instructors, and playthings, of all the exhibitors." And then we are woefully ignorant. "Most of the American visitors here," said the same Austrian, "don't know the difference between Austria and Australia, and ask me how I like living in the bush. One old lady asked me, just now, where is the Belgian and Brazilian stands? You know, the place where they make bug jewelry, jewelry out of bugs,' and that is only one instance from many hundreds." The Dane thinks our middle classes not so well educated as those of his own country. The Mexican is particularly struck by the abuses of our street car travel and our hacks. He would have stringent laws to prevent the overcrowding of the street cars, and, to stop the extortion of the hackmen, capital punishment. The Dutchman doesn't like our women, thinks they are weak and puny, compared with their buxom girls. And the opinion of the Chinaman is compressed into the following expressive sentences: "Much likee Melica. Costee muchee money livee in Melica, costee little money livee Chilee. Chilee man make muchee money in Melica; Melican man makee d—n little money in Chilee."—*Boston Weekly Globe.*

THE "MODEL" SCROLL SAW.

We illustrate herewith a new scroll saw, excellently suited for amateur use. It is capable of cutting wood up to one and a half inches in thickness, of holding blades of all sizes, from one fourth inch down to the finest made, without adjustment, and it works rapidly and smoothly. It offers beside the advantage of not being driven by a crank motion from the treadle, but by devices which have no dead centers, and which therefore maintain the machine in continuous movement. By pressing down the treadle, the strap attached thereto is caused to rotate a noiseless clutch, Fig. 2, by which the balance wheel is driven. The latter, by means of an eccentric, moves the arms to which the saw is attached. The clutch merely touches the balance wheel when driven forward, but becomes entirely disconnected therefrom when it is stopped, so that the wheel is thus left to run free. When the motion of the balance wheel slackens, the treadle, which has been drawn up by the reverse

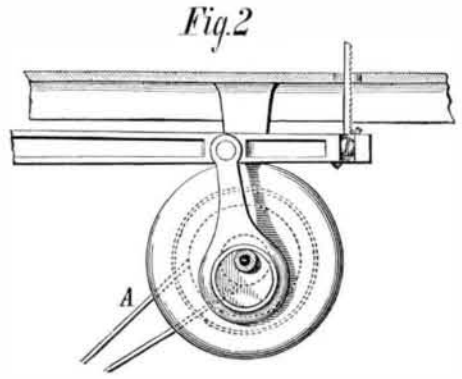
Fig. 1



rotation of the clutch shaft, by the spring arm and strap, A, Fig. 1, into its normal position, is again pressed down and the wheel receives fresh impulse. The saw starts at once in the right direction; and the thinner the material cut, the less frequently is it necessary to work the treadle.

The upper saw arm is jointed at B, so that it can be raised entirely out of the way of the work when changing the blade from one hole to another in sawing inside portions. To hold the saw, the elasticity only of the upper arm is used; and in fastening the upper end of the blade, it is therefore merely necessary to push down the arm until the desired strain is obtained. This of course can be varied to suit the

Fig. 2



size of saw and the kind of work. The machine, we are informed, is made in quantities on special apparatus and to standard gages. It is entirely of metal, and has no adjuncts beyond the six saws which are supplied with it. The arm holding the saw works on steel points, and is jointed to the connecting rod by an adjustable bearing which takes up the wear. The main shaft is of Stubs' steel. The space under the arm is fifteen inches in the clear, and thus allows of sawing to the center of a piece thirty inches in diameter The balance wheel is so adjusted that there is scarcely any vibration even when the machine runs at from 1,000 to 1,200 revolutions per minute. The finish is ornamental, and the workmanship is neat and good.

For further information address the manufacturers, Messrs. Bush & Smith, West New Brighton, Staten Island, N. Y.

RUBBER OVERSHOE MAKING AT THE CENTENNIAL.

The inventors of the rubber overshoe were the Indians

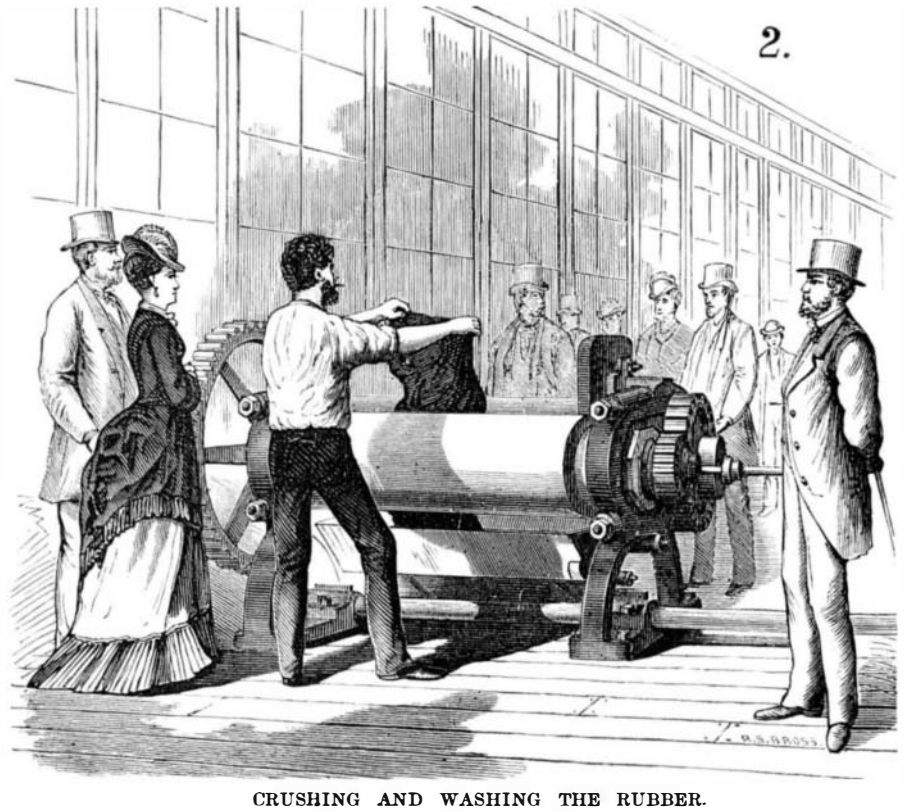
RAW RUBBER. THE VULCANIZING OVEN. VARNISHING THE SHOES.

who inhabited those portions of Brazil where the caoutchouc tree most abounded. Their method of manufacture consisted in making a rude last of clay, which was covered repeatedly with layers of the juice, each coating being allowed to dry before the next was applied. When a proper thickness was attained, the mold, with its elastic covering, was held over the smoke of a wood fire for a time, and the clay was then broken out. It was not until 1825 that the rubber shoe made its appearance in the United States; and then Thomas C. Wales, a Boston merchant, imported a few of the crude Indian productions from Brazil. Rough and ungainly as these feet coverings were, their superiority over goloshes, which were nothing more than wooden shoes or clogs, and which furnished the only means, beyond extra thick leather boots, of protecting the feet during wet weather, was soon perceived. Mr. Wales thereupon sent to Brazil a large number of American lasts of better shape than those used by the native makers; and such a trade in the shoes speedily arose that, at the end of three years, no less than half a million pairs were exported from Brazil to Europe and America.

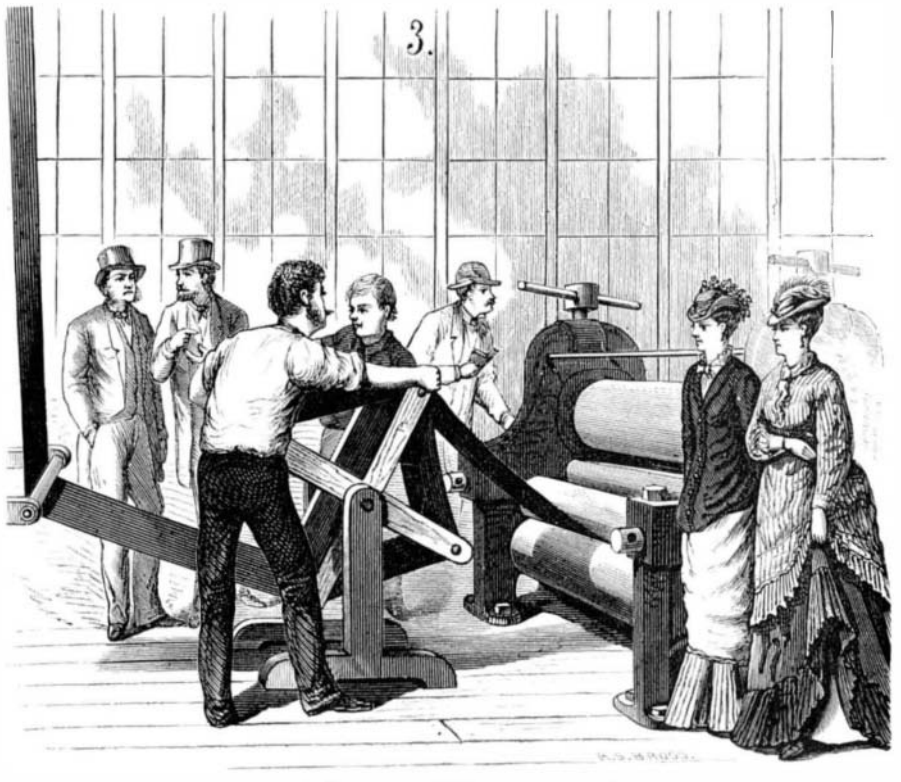
Several years before this time both English and American inventors had been seeking for means of utilizing the caoutchouc gum. In 1797, one Johnson obtained a patent in England for waterproofing cloth by covering it with rubber in solution. Hummel, of Philadelphia, followed in 1819, with a gum elastic varnish. Then Macintosh, in England, made in the same year waterproof garments which still bear his name. These efforts were, of course, known in the United States; and the rubber overshoe had no sooner become almost an article of necessity when the results of the cogitations of American inventors over the subject began to appear, in the shape of attempts to make the shoes cheaply by the processes already understood. In 1832 Wait Webster, of New York, patented a process for attaching soles to gum elastic shoes; in the following year the first American factory for the making of rubber shoes, hose, etc., was established in Roxbury, Mass.; but the mode of manufacture in those days differed greatly from that now in vogue, a fact proved by an exhibition of leather boots at the Fair of the American Institute of 1833, which had previously been sent by J. M. Hood, of New York, to South America, to be varnished with the fresh juice from the tree. The Roxbury factory created a wonderful impetus in the trade, shares of its stock sold for many times their original value, and at once six more companies embarked in the manufacture. In 1835 Charles Goodyear invented his nitric acid process for depriving rubber of its adhesiveness, and this was at once applied to the fabrication of the shoe, effectually supplanting other modes of production. It was itself, in turn, supplanted by Goodyear's great invention of the vulcanizing process; and this last, although it has been greatly modified since its origination, is now employed. Such is the briefly told history of the rubber overshoe, an article of apparel now almost indispensable, and one that is manufactured in this country at the rate of some six million pairs per year.

It was an excellent idea on the part of the National Rubber Company, of Providence, R. I., to exhibit not merely their goods at the Centennial Exposition, but also to transport thither a set of machinery, and to show to the visitor the manner in which rubber shoes are made. The annexed engravings represent the different operations, now in progress in Machinery Hall, by means of which the rough lumps of crude rubber are converted into the handsomely finished shoe. A mass of raw rubber is represented in Fig. 1. This, cut

into suitable pieces by hand knives almost as large as swords, is thrown between a pair of fluted cylinders, Fig. 2, between which it is masticated and washed by streams of hot water, emerging in the mat-like form also represented in Fig. 1. Next follows grinding, for from fifteen to twenty minutes, between hot, smooth cylinders; and while the rubber is undergoing this process, the sulphur, tar, and other compounds to be mixed with it are added. The material now begins to form itself into a sheet; and after going through a pair of cylinders which stamp upon it the patterns of the shapes in which it is to be cut, besides ornamentation, etc., it is led to a reel, as shown in Fig. 3. Meanwhile the black cloth, which is to form the backing, is led to the same reel, and as the latter is turned, alternate layers of rubber and cloth become wound about it. It remains now to consolidate the two materials, and this is done by passing the double sheet through heavy calender rollers under great pressure. From the sheets, thus prepared and of varying thickness, according to the parts which they are destined to form, the various portions of the shoe are cut (Fig. 4), the workman following the stamped pattern with his curved knife. There are nine portions which go to make up the anatomy of the overshoe: the lining, the filling sole, the outsole, the insole, the forming strip up the heel, the strip around the shoe, the heel piece, the heel stuffing piece, and the junior or auxiliary heel piece; the respective uses of all these are sufficiently indicated by their names. As fast as they are cut out, they are passed to girls who sit beside a high table, perched on elevated stools. Running midway of the table are iron racks, and on pins thereon rest the asts upon which the shoes are formed. The operation of



CRUSHING AND WASHING THE RUBBER.



MAKING THE RUBBER INTO SHEETS.

CUTTING OUT THE RUBBER SHOES.

putting the shoes together, which we illustrate in Fig. 5, is by no means a difficult one, although it requires some skill The lining and inside are attached to the last, and then the various pieces follow in succession, being secured in place by india rubber cement. Varnishing (Fig. 6) is next in order, and then it might be supposed that the shoe was complete—that is, to all appearances; but to feel the rubber is soon to be undeceived. It is soft and literally flabby; and although it has the shape of a shoe now, there is no reason to doubt but that, after a week's wear, the owner would find it half a dozen or so sizes too large, and more resembling a bag than a shoe. But here the vulcanizing process steps in to render the material hard and firm, yet elastic, and in a condition that, while the shoe may wear out, the shape will remain to the end. In Fig. 7, in rear of the varnisher, a pyramidal iron carriageis shown, which a workman appears to be pushing into an open doorway. Across the framework of this carriage are tiers of bars, and on these bars are fastened the lasts with the varnished shoes upon them. When the carriage is filled it is pushed into the vulcanizing oven, a small brick chamber beneath which are large coils of steam pipes. The steam heat is gradually brought to about 270° Fah., causing, in about seven hours, the complete vulcanization or union of the rubber with the sulphur and other ingredients, and leaving the shoes in fit condition for wear.

Mr. James Lick.

M. James Lick, the California millionaire, through whose munificence the construction of the million dollar telescope was some time ago provided for, died in San F rancisco a few days ago. Mr. Lick was born in Fredericksburg, Pa., in 1796, and was taught the cabinet maker's trade. About twenty-four years of his life were spent in South America, working as a mechanic at piano and furniture manufacture. He was an excellent workman and fortune favored him. so that he amassed some $40,000. With this capital he went to California before the acquisition of that State by the United States, and, foreseeing the rise in value of real estate which followed the settlement of the country, invested his money in land. Meanwhile he started a flour mill, where it is stated he made the best flour offered in the California markets, and which always commanded a dollar or so a barrel above ruling rates. During his successful milling business, however, he never lost sight of his land investments, and he was constantly on the alert to buy up government titles given to soldiers and other tenures of property which the owners at that time believed would never become very valuable. In this way he acquired the ground on which the Lick House in San Francisco now stands, for $40. That building Mr. Lick had built under his personal supervision, his mechanical knowledge standing him in good stead in constructing the elegant fittings of rare wood which embellish the halls and parlors. He likewise erected other large buildings on his land, most of which is in the heart of San Francisco, the city having grown round and upon it.

Not long ago, as we explained at the time, Mr. Lick set aside some $5,000,000 from his immense fortune for various charitable purposes, and for the construction of an immense telescope, vesting the funds in trustees. Subsequently he reconsidered his project, and sought to change the conditions of certain portions of the gift, and in this way became involved in dissensions with his trustees which gave rise to the report that he had abandoned the project. It is hoped that no legal controversy may arise to prevent a construction of the magnificent telescope, to cost one million dollars, as provided for originally by the deceased. Mr. Lick leaves one son only, a man about 50 years of age, who was attending the Centennial Exhibition when his father died.

How to Lay Shingles.

Not one half the persons who lay shingles when making a roof on a building have any correct ideas in regard to making a roof that will be absolutely rain-tight during a driving storm of rain. We have frequently seen men shingling, who, when they would meet with a worthless shingle, say once in laying two or three courses, would lay this poor shingle among the good ones, saying: "It is only one poor shingle, one shingle cannot make a poor roof." But one poor shingle will make a leaky one. If firstrate shingles are employed, and one poor one is worked in among every 100, that roof might about as well have been without any shingles. If any poor shingles are to be used, let them all be laid together near the upper part of the roof. The best of shingles will not make a tight roof if they are not properly laid, while the same shingles would make an excellent roof if laid as shingles should be laid.

The correct rule for laying shingles of any length, in order to form a roof leak-tight, is to lay the courses less than one third the length of the shortest shingles. For example, when shingles are 18 inches long, many of them will not be more than 17 inches in length. Therefore five inches is all that the courses will bear to be laid to the weather with surety of forming a good roof. The shingles must be three thicknesses over the entire roof. If they are not three thicknesses—if now and then a shingle lacks a quarter or half an inch of being long enough to make three thicknesses—there will in all probability be a leaky place in the roof at such a point. Moreover, when the lower courses lack half an inch of extending up far enough to receive the rain from the outermost course, in case the middle course were removed, it would be just as well to lay them seven or eight inches to the weather as to lay them only five, or five and a half, inches. Many shingles are only 16 inches long, and many that are sold for 16 inches long will hardly measure 15 inches. In this case—if the roof be rather flat, say about one quarter pitch—four and a half inches is as far as they should be laid to the weather. In case a roof were quite steep it might answer to lay the courses four and three quarter inches to the weather.

When buildings are erected by the job, proprietors should give their personal attention to this subject, and see that jobbers do not lay the courses a half inch too far to the weather.

There is another important consideration which is too frequently overlooked in shingling, which is breaking joints. Careless workmen will often break joints within half an inch of each other. When the joints of the different courses come so close together, the roof will most certainly leak. Why should it not? There is nothing to prevent it during a heavy rain. Unless a roof is steeper than a quarter pitch,

MAKING THE RUBBER SHOES.

much care should be taken to break joints not less than one and a quarter inches. Let all workmen and helpers be taught the vast importance of rejecting every poor shingle, except when the upper courses are being laid.—*Canadian Mechanic's Magazine.*

An Effort to Preserve the Main Exhibition Building.

The Philadelphia *Ledger* says that preliminary steps have been taken toward the permanent preservation of as much as possible of the utility and beauty of the Centennial Exhibition buildings and grounds. The suggestion has taken strong hold of a number of energetic and influential men, who have expressed their readiness to give the undertaking both moral support and material aid.