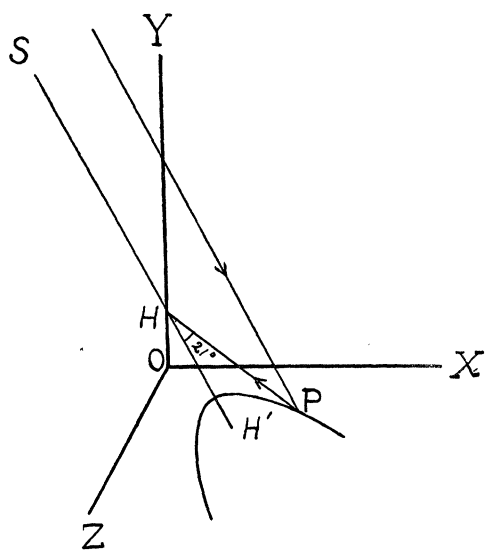
fined, although the boundary between the two was somewhat indistinct. There was, however, no question whatever about the existence of the definite colors.

The appearance of the bow may, perhaps, be better understood by reference to the accompanying figure in which the XZ-plane represents the ground, while the observer is standing at the origin, his head being at H. The shadow of the observer's head would then fall upon the plane at XZ at H', and the bow appeared on the ground between the feet of the observer and the shadow of his head, and extended on either side in the manner indicated in the sketch.



Assuming the simple explanation of the rainbow to apply in this case, the figure of the bow would be given by the intersection of the XZ-plane with the 42° cone (red rays), generated by the rotation of the line HP about SHH' as an axis, at an angle of 21°. The form of the bow is, of course, dependent upon the altitude of the sun. With the sun at the horizon, and for altitudes up to 21°, the figure would be a hyperbola; at 21°, it would be a parabola. At altitudes of the sun above 21°, we would have an ellipse, becoming a circle at the zenith with its center at the origin of coordinates.

The phenomenon was readily observed on the morning succeeding the first observations, but three days later, when another heavy dew appeared, no trace of the bow could be seen. During this time the grass had grown considerably, and the irregularity in height appeared to prevent the reflection of a sufficient amount of light. The existence of the bow has not yet been noted on any lawn on which the grass has attained considerable size.

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NOTES ON INORGANIC CHEMISTRY.

CENSUS BULLETIN OF CHEMICALS AND ALLIED PRODUCTS.

THIS 'Bulletin,' prepared by Professor Charles E. Monroe and Dr. T. M. Chatard, which has just been issued, is extremely interesting reading and is full of valuable information. It is in effect a brief review of the chemical progress of this country in the last decade, with glimpses of the progress elsewhere, when this would seem to have a bearing upon possible future development here. Thus are treated at some length the catalytic production of sulfuric acid, the manufacture of soda from the natural soda of the West, wood distillation, fertilizers, explosives, and particularly chemical substances produced by the aid of electricity. It is interesting to note that the value of the principal products reported in this 'Bulletin' is $221,217,217 as compared with $163,547,685 reported in the census of 1890. Except in the potash industry, which is insignificant, there has been an increase in every department, but hardly as great as might have been looked for, considering the greatly increased attention given to the application of science to industry. Possibly this is more readily understood from the statistics of chemists employed in the establishments treated of in this report. From this it appears that the total number so employed in the United States is 276, about half the number employed by six coal-tar color firms of Germany. The largest number employed in any one industry is 52, in paints and varnishes. Those in the coal-tar products number 7, to which should prob-

ably be added a part of the 13 engaged in the dye-stuff industry.

Among all the industries, the largest percentage of increase has been in that of wood distillation, including the production of wood alcohol, acetate of lime, and charcoal. The increase was from $1,885,469 in 1890 to $5,775,455 in 1900. This is, however, by no means so significant as the statistics of the soda industry, which increased from five million dollars in 1890 to over ten millions in 1900. Owing to lower price, this represents nearly a quadrupling of production. What is more important in this industry is that this country is now practically independent of foreign supply. In 1890, 60 per cent. of the soda ash and sal soda and over 70 per cent. of the caustic soda used were imported, while in 1900 only 9 per cent. of the former and less than 5 per cent. of the latter were manufactured abroad.

Considerable emphasis is laid in the 'Bulletin' on the possibilities of the alkali lakes of the Sierra Nevada as a source of supply. The production from this source has been restricted by the lack of a market, owing to the cost of transportation. With the development of the industries of the Pacific slope, and the demand from the other side of the Pacific Ocean, it is probable that these remarkable supplies can be utilized to a much greater extent than in the past. Mono Lake alone contains enough soda to supply this country at its present rate of consumption for a hundred years, Owens Lake enough for fifty years, while other smaller lakes could considerably more than double this amount.

Nearly one half of the 'Bulletin' is taken up with a 'Digest of Chemical Patents,' giving an abstract of all chemical patents issued from the founding of the United States Patent Office up to 1900. This was prepared by Mr. Story B. Ladd, and is of great value. Its value would be still more increased if it could be carefully indexed by subject and by patentee, and issued as a separate publication.

In this connection it is worth while to note that the 'Bulletin' calls attention to the inequitable patent laws of this country, by which a foreigner can, by obtaining an American patent, enjoy the monopoly of sale in this country, even though the article in question may be manufactured abroad, and owing to competition may be sold at a low price everywhere else in the world (except in England, whose laws in this respect resemble ours). On such an article the tariff serves only to increase the price to the American consumer, who is by the patent prevented from enjoying any benefit from competition. This is undoubtedly the chief reason which has hindered the development of most chemical industries in this country except those of the heavy chemicals. J. L. H.

BOTANICAL NOTES.

A WORD AS TO INDEXES.

It is time that reform was made in the indexing of botanical books. There appears to be an impression among index-makers that people want their indexes sorted into various kinds, so that we find, for example, an 'index of illustrations,' an 'index of English names,' an 'index of Latin names,' an 'index of synonyms,' etc. If this thing goes on we may have, in addition to the foregoing, indexes of the names of persons cited; indexes of experiments, descriptions and discussions; indexes of original paragraphs; indexes of second-hand paragraphs, etc. Probably nearly every user of books will agree that more than one index is a nuisance. When one takes up a book to look for Mahonia it is awkward and annoying to find that it is not in the 'index of Latin names' but must be sought in the 'English index.' How is one to know where to look for Sapodilla, and Sassafras? In some recent indexes the first is given in the English index, while the second occurs only in the Latin index.

It may be said that after all our inveighing against indexlessness we ought to be doubly thankful for two indexes, instead of making complaints, but here, as elsewhere, it is possible 'to have too much of a good thing.' Let not the book-maker, in his zeal to avoid indexlessness, inflict upon his readers an evil which is only one remove from that in its power of annoyance. Give us a good index, and let