Dobereiner produced a lamp of an elegant character. You will see it represented in this diagram. Here is a vessel in which hydrogen gas is collected. The hydrogen gas is formed by the action of sulphuric acid and water upon zinc. These acting upon the zinc produce hydrogen, and the hydrogen rises here, and as it is formed it expels the acid from the vessel, so that it no longer acts upon the zinc. I have in this way a reservoir of hydrogen; and now if I take a piece of spongy platinum, which has the power of absorbing oxygen from the air and condensing it within its pores, and bring this platinum in contact with the hydrogen, you see that it gets red hot, and ignites the hydrogen. Thus, you see that this plan of applying hydrogen for the purpose of acting upon the oxygen condensed in spongy platinum is a method by which a light can be obtained. The spongy platinum absorbing oxygen, presented oxygen to the hydrogen, and caused the formation of water, and in the formation of water so much heat was produced that the hydrogen became ignited, and a light was obtained. One disadvantage which prevented it being universally adopted was simply this: that the least speck or fouling of this spongy platinum puts the lamp out of order. For instance, this may have been in order five minutes ago, and it may be out of order now. Some dust or dirt may have got upon the spongy platinum. Still, the application was so elegant that it drew the attention of scientific men to the importance of getting an instantaneous light.

The next invention consisted in mixing phosphorus and sulphur in a bottle, and then taking them out upon a splint of wood, which was rubbed, and a light obtained in that way.

Then came the method of getting a light by means of chlorate of potash and sulphuric acid. Here I have some chlorate of potash mixed with sugar, and I place a little of it on a plate. I will not put too much because of the fumes. I now dip this rod in sulphuric acid so as to get a little on the end of it, and with this I touch the mixture of chlorate of potash and sugar. The sulphuric acid liberates the chloric acid, which gives oxygen to the sugar; the sugar burns, and an instantaneous light is obtained in this way. Captain Manby used this process for firing off his safety mortars, and thus drew considerable attention to this mode of obtaining a light. An application of this chlorate of potash and sulphuric acid to match making was now made. There were two applications: one was older than the other. The method which was first introduced consisted of having a little bottle of asbestos. Here is one of the old kind, which many of us can recollect. This asbestos is moistened with oil of vitriol, and the chlorate of potash and sugar, instead of being separate, as I showed you there, are put upon the end of the match, and you dip it in the sulphuric acid, and the chlorate of potash and sugar mixture gets ignited, and the light is got in that way. Well, that was the first application of the old experiment of chlorate of potash and sugar. Then there was another. I am sorry to say that I have only one or two of these ancient matches left, and they will soon be gone altogether. The plan was to take the chlorate of potash and sugar, and wrap it in a piece of paper, and to have the sulphuric acid sealed up in a little glass globule inside the mixture. The mode of using it was, if you had a pair of pincers at hand, to break the globule with them, and so ignite the match; but if you had not a pair of pincers in readiness, you did it between your teeth; and if you were very clever, you might do it without getting the sulphuric acid into your mouth, or burning it with the explosion. This match had a great objection—that chlorate of potash and sugar always go off violently, and the sulphuric acid in the globule, although in small quantity, was spirted over the dress, and destroyed the dress whenever it came in contact with it.

The first friction-match was introduced in 1832. The mode in which these friction-matches are made, many of my hearers who lived in 1832 will recollect. I have a lively recollection of it. The mode was this—sulphide of antimony was mixed with chlorate of potash. Here the sulphide of antimony gave sulphur, just as the sugar gave a combustible to the chlorate of potash. This was put upon the end of a piece of wood; and the friction was produced by drawing this through a piece of sandpaper. I have there some antique matches of all kinds, which are now very valuable because they are very difficult to obtain. My experience as a boy with regard to these friction-matches was that with considerable adroitness you might get a light after pulling off the ends of half a box; and then when it did come, it came with such violence and explosion that it projected a considerable quantity of the ignited matter over the hands and burnt them. You might get a light for 6d. or 8d.; at least, that was my experience as a boy. My seniors may have been more successful.

In 1834 the phosphorus-match was invented. In this, after a time, sulphur became substituted for sulphide of antimony, und it was a great improvement upon the old congreve. At first the phosphorus match was violent in its action, and it projected its melted materials over the fingers unless you held it carefully, and the reason of that was that nothing but chlorate of potash was used as the oxidiser. The friction produced the heat necessary to ignite the phosphorus; the chlorate of potash gave it the oxygen, and it burnt violently. After a time manufacturers learnt that it was better not to take chlorate of potash by itself, but to mix it with some less energetic oxydising agent—as, for instance, with saltpetre or nitrate of potash, or with peroxide of lead, or with some agent less energetic than the chlorate of potash. In this way the phosphorus-match became much improved in character. The sulphur which was used to carry out combustion, and to get up sufficient heat to make the wood ignite, was also gradually substituted in the better kind of matches by melted stearine. The wooden match was dipped into melted stearine, and all possibility of fumes of sulphur was in this way obviated. The common phosphorus-match became gradually improved, and its use has now increased to such an extent, that it may surprise you to know that there are some chemical works in this country where they make nine millions of matches daily. In France and England alone 300,000 pounds of phosphorus are annually made into matches, and as three pounds of phosphorus are sufficient to tip five or six million of matches, you can conceive what a large industry this has become. But the larger the industry has