a sphere is quadruple of the whole superficies of an equilateral cone inscribed in the same sphere, and the solidity of the former cone is eight-fold that of the latter."

9th. "A sphere hath that proportion to an equilateral inscribed cone as 32 to 9."

10th. "A sphere hath the same proportion both in respect of solidity and surface to the equilateral cone circumscribed about it which 4 hath to 9."

11th "A sphere, a circumscribing cylinder and a circumscribing equilateral cone, both with respect to solidities and whole superficies, bear the continued proportion, respectively, to one another, as 4 : 6 : 9."

Archimedes set great value upon his discovery of the sesquilateral proportion of the right cylinder and internal touching sphere, as enunciated in the 6th property above ; such that he would have a figure of it engraved upon his tomb.

It is a matter of argument why he should prize this above other discoveries which he made, and above machines put into practical use, and which would seem to have given him a wider fame than the discovery of any abstruse mathematical relations or inherent properties of lines and surfaces.

There is one ratio for the three.

But so it was, he valued the discovery of purely mathematical fact far above any practical display of prepared matter, or mechanical combinations, whatever may have been the efficiency of its performance or the prodigiousness of the force which it developed.

Archimedes' discovery received a very important as well as interesting addition at the hands of the learned Andrew Tacquet, the author of the old book in question, and the two combined are given in the 11th property above with a figure, inscription, and translation.

It is singular indeed that bodies whose surfaces and sections present so many difficulties in practice should in themselves, as wholes, bear so simple a relation, one to another.

Y.

On the Employment of Burning Wire, as an Illuminating Agent, Especially for Photographic Purposes. By PROFESSOR ROSCOE.

From the London Practical Mechanic's Journal, April, 1864.

Professor Roscoe exhibited the light emitted by burning a portion of a fine specimen of pure magnesium wire 1 mm. in diameter and 10 feet long, which had been manufactured by Mr. Sondstadt. Professor Roscoe remarked that it afforded him great pleasure to be able to state

that a suggestion made by Professor Bunsen and himself in their photochemical researches, and printed in the Philosophical Transactions for 1859, page 922, was about to be practically adopted. Mr. Sondstadt is now commencing to manufacture the metal magnesium on the large scale, and the first important application of the metal is the employment of burning magnesium wire as an illuminating agent, especially for photographic purposes. In the researches above mentioned, Professor Bunsen and the speaker had examined the photochemical action of the sun compared with that of a terrestrial source of light, and for the purpose of this comparison they chose the light evolved by the combustion of magnesium wire. They showed that a burning surface of magnesium wire which, seen from a point at the sea's level, has an apparent magnitude equal to that of the sun, effects on that point the same chemical action as the sun would do when shining from a cloudless sky at a height of $9^{\circ} 53'$ above the horizon. On comparing the *chemical* with the *visible* brightness of these two sources of light it was found that the brightness of the sun's disk as measured by the eye when the sun's zenith distance was $67^{\circ} 22'$, is 524.7 times as great as that of the burning magnesium wire, whilst, at the same zenith distance, the *chemical* brightness of the sun is only 36.6 times as great. Hence the value of this light as a source of the chemically active rays for photographic purposes becomes at once apparent. The extract from the memoir referred to is as follows:—

“The steady and equable light evolved by magnesium wire burning in the air, and the immense chemical action thus produced, render this source of light valuable as a simple means of obtaining a given amount of illumination expressed in terms of our measurement of light. . . . The combustion of magnesium constitutes so definite and simple a source of light for the purpose of photochemical measurement, that the wide distribution of this metal becomes desirable. The application of this metal as a source of light may even become of technical importance. A burning magnesium wire of the thickness 0.297 millimetre evolves, according to a measurement we have made, as much light as 74 stearine candles of which 5 go to the pound. If this light lasted one minute, 0.987 metre of wire, weighing 0.1204 grm., would be burnt. In order to produce a light equal to 74 candles burning for 10 hours, whereby about 20 lbs. of stearine is consumed, 72.2 grms. of magnesium would be required. The magnesium wire can be easily prepared by forcing out the metal from a heated steel press having a fine opening at bottom; this wire might be rolled up in coils on a spindle, which could be made to revolve by clock-work, and thus the end of the wire, guided by passing through a groove or between rollers, could be continually pushed forward into a gas or spirit-lamp flame in which it would burn.”

Professor Roscoe stated that great credit was due to Mr. Sondstadt for the able manner in which he had brought the difficult subject of the metallurgy of magnesium into the present satisfactory position, and expressed his opinion that, even in photographic purposes, the appli-

cation of the metal will prove most important. Mr. Brothers, Mr. Parry, and other photographers present, corroborated Dr. Roscoe's opinion respecting the value of such source of light for photography. Since the meeting Mr. Brothers made an experiment upon the magnesium light, which he reports as follows:—

"The result of an experiment I have just tried is that in 50 seconds with the magnesium light I have obtained a good negative copy of an engraving—the copy being made in a darkened room. Another copy was made in the usual way in daylight, and in 50 seconds the result was about equal to the negative taken by the artificial light. The sun was shining, but there was a good deal of fog in the atmosphere."

To the Editor of the Journal of the Franklin Institute.

SIR:—The propriety of introducing the word "equivalent," in patent claims, has been a subject of much discussion and difference of opinion among both patentees, and the officials of the Patent-Office.

The following argument was written with the hope of obtaining an official decision which would set the question at rest for the future. It was submitted to the Commissioner of Patents, who, by granting the patent, acknowledged the pertinence of the grounds advocated in the argument.

Argument in the matter of the Application of R. HEYS for Letters Patent for Variable Valve Motion for Steam Engines.

To the Honorable Commissioner of Patents.

SIR:—The contents of the official letter of December 7th, 1863, have been carefully perused, and the suggestions of the Examiner in charge of this case duly considered.

The official letter contains the following:—"It is well understood that the law regards real equivalents as secured to you without the use of the language (the equivalents to the same) in your claim. It is therefore regarded as superfluous."

I regret that my opinion on this point is at variance with that of our able Examiner.

The word "equivalent," in the claim of a patent, is, according to my humble views, not only not superfluous, but in very many instances a word of the most vital importance, a word, the insertion of which an applicant for a patent has a right to insist upon, unless the Office can give references of a character which demands the limiting of the claim to a special combination and arrangement of parts.

When an inventor presents an application for a patent for an improvement on the invention of another, it is the very proper practice of the Patent-Office, to require the applicant to word his specification in such terms as to acknowledge the rights vested in his predecessor.