any purpose, and that, as the scale of the original surveys is reduced, their value becomes less. In England the large scales have superseded the small scales, and even in India there is no scale for the surveys smaller than one inch to the mile. In France, as recently as 1878, surveys of the whole country, to be published on 1 : 10000, were recommended by a commission specially organized to consider the subject. In nearly all these countries it will be observed that surveys are plotted on scales about three inches to the mile, and some on scales much greater.

A map is understandingly designated by the purpose for which it was compiled, as each purpose may require the representation of different features and greater emphasis on special features ; and if referring to the land, they are topographical maps, as they represent topographic features, though perhaps not all of them.

I believe Mr. Baker is also in error in designating hydrographic and physical surveys under the head of nautical surveys. The latter class of work has its own meaning, is understood as being less rigorous than measurements upon the land, as, indeed, must be the case from the nature of the operations and the methods necessarily employed in their execution. It is more nearly a branch of hydrographic surveying, and is usually classed there or as exploration, although it may embrace a margin of land in the survey. The maps produced by this method are generally intended for nautical purposes, and its use is confined almost exclusively to the ocean and definition of the coast-lines.

Physical hydrography develops forces as well as forms : it seeks a cause for an effect, and thus perfects a hydrographic survey. In the same sense a geological survey would be the perfection of the topographic. But while similar in conclusion, they are different in method ; for in the hydrography we measure the forces now at work, while in geology we must deduce them, and can but estimate their power. I would therefore reverse Mr. Baker's classification, and designate nautical surveys and physical hydrography as subdivisions of hydrography.

The preceding discussion relates to the determination of facts as they now exist. But surveying as generally understood embraces also the opposite of this, or the marking on the ground of lines previously agreed upon; which marks may in turn become facts in future surveys. This class of work is generally connected with engineering operations ; but it is also the character of boundary work, and the usual operations in mining surveys. In the case of a railroad or canal, it consists in locating upon the ground the line that has been determined upon, with its cuts, embankments, etc., as marked upon the drawings made from the topographical survey ; in the case of a boundary, to locate a point or line on a given meridian or parallel, or to run a line in a certain direction from a given point, or both ; and in mining, the location of a new shaft or heading, or any of the many operations connected with the engineering work of a mine. Mr. Baker has grouped this class of work into two divisions, — "boundary" and "construction" surveys. But, it will be observed, the work is all of the same character, and might therefore with perfect propriety be grouped in one class, under the term already well understood by surveyors and engineers, — "location."

We thus have three divisions — mensuration, exploration, and location — in which may be grouped different classes of work according to the nature of the operation, and which would usually be subdivided by the purpose for which the survey was made, or the method upon which it was conducted, and sometimes a combination of both. These subdivisions will readily suggest themselves, but would make too long a list for insertion.

In conclusion, permit me to add a few words on what Mr. Baker declares "a well-recognized principle, especially among engineers, that of two maps, or works of any kind, made for the same purpose, and serving that purpose equally well, that one is best which is cheapest." This implies, that, of two things exactly alike, the one that costs the least is the best. If they are alike, the price cannot affect their utility for the purpose for which they were designed, though one cost ten times the other. The cheapest would probably be most satisfactory to those who had to pay the bills ; but, if both were the same price, there could be no choice for any reason. We may readily conceive, however, that if bids were offered to make two maps or works of any kind, that should serve a specified purpose equally well, the cheapest would be most favorably considered in the majority of cases ; but, if the work was to be executed by two bodies of men of like skill and experience, we should have to conclude that one party was seeking an unusual profit, or that the other did not intend to live up to the contract, for it is inconceivable that two bodies of intelligent men, honest and experienced in their trade or profession, would execute a similar work with any great variation in the cost.

HERBERT G. OGDEN.

Washington, D.C., April 9.

English Examinations.

A SHORT time since, the public was greatly amused at a book containing a collection of ludicrous mistakes made by children in their examination-papers. Much merriment was excited by these poor little attempts at wisdom, and doubtless not a few persons laughed at the blunders of their own children, not perhaps understanding that some of this stupidity might have been inherited. Nor did the teachers who culled these blighted flowers seem to realize that many a thoughtful reader might be in doubt as to whether such evidence was intended to prove the incapacity of the children to learn, or the inability of the teachers to teach. Then human nature asserted itself in a cry of derision at the whole system of school education, and this was as manifestly uncalled for as the first outburst of cachinnation.

The method of examining college and university students is another serious matter that demands our attention. At the moment, the main agitation is in England. The recent expressions of opinion by eminent Englishmen as to the results and tendencies of the examination system there in vogue are appalling. There can be no doubt that the matter is one of grave importance. The examination system of England compels men to cram, — to become mere memorizers of facts, to substitute a hasty and temporary knowledge of these for reasoning, and to become learners of other men's ideas and discoveries to the exclusion of the ability to discover facts and create ideas for themselves. The result of this form of education is to make absorbers and not producers of knowledge, — as Shakspeare says,

> "Small honor continual plodders ever won,
> Save bare authority from others' books."

Such a condition is one of intellectual serfdom. The individual becomes dependent on others for advance in knowledge. His power to originate is not developed. He becomes a mere book, except that he costs more than a book, and is worth far less, less convenient to handle, less complete, and generally of far less use, — a kind of an old edition, lacking many pages, index, and author's name, badly bound, and full of omissions and errors.

The effects of the English examination system are readily seen in the many "cram" books that are published in that country, and which lack system and didactic worth. Most of them are professedly helps in preparing for examinations. The virus is also at work in this country, and earnest educators should lose no time in resisting its inroads. The result of this agitation is an outcry of the thoughtless against examinations of any kind. This, I think, is wrong. That bad effects are produced by certain kinds of examinations is very true ; but that all examinations have therefore an evil tendency, I emphatically deny. So far, the consideration has not extended as thoroughly as it should to the nature of the examination from a didactic standpoint. That a certain class of examinations yield bad results, proves, not that all kinds of examinations are worthless, but that that particular kind of examination does not give satisfactory results. That may be because the examination is wrong in principle, because it is not the one called for by the work done, because it is imperfect, because it does not really show that the student knows any thing about the subject, nor because the examiner does not know how to examine. I venture to say that a considerable number of the teachers in colleges and universities, although men of undoubted learning and ability, and in many instances investigators of acknowledged reputation, do not pay much attention to the pedagogical side of their subjects, and, least of all, do not attempt to make a study of the principles and methods of examining. The science and art of examining are

really most important branches of pedagogy. Good examiners are rare, even among a body of eminently successful teachers.

Varied as may be the questions, ingenious and cunning as may be the side-issues woven in and easily overlooked, skilful as may be the attempts to trip the student, hidden as may be the pitfalls and snares, (and how quickly does an old student recognize them!) the average examination-paper calls for but little more on the part of the student than an accurate memory of facts, and some little ingenuity in twisting them. By it may be ascertained the nature and amount of facts that the student has gained. By it cannot be ascertained the increase in intellectual power of the student, his ability to apply these facts, the nature of the effect of the particular study upon his intellect, his ability to proceed independently in the study of the subject, the development of original thought in him, his interest in the subject, his perception of the value of the subject to him, or whether he has been imbued with the true spirit of that subject. Has he received "sacks full of dry leaves," or has he seen "the living, growing tree"? Has the study been presented to him as the mortal, short-lived body, or the immortal, upward-soaring soul? The student tells about the odor, color, taste, and form of substances he has never seen, and of physical phenomena he has never observed. He quotes from books he has not read, cites facts which he cannot establish, defends theories in which he does not believe, and proves to the satisfaction of the examiner statements which he doubts at heart. If the examination does not show more than a memorized knowledge of facts, it amounts to the old *a b, ab; b e, be;* it is a waste of time and energy; it's a hypocritical farce. The young student feels it to be one, and the older student and the teacher know that it is one.

Numerous remedies have been prescribed, and some are certainly excellent. Examining committees are a step in the right direction. If each member questions the student, the result will be that he will soon show what real progress he has made in the subject, and also how well he has been taught. But these committees, while good in theory, rarely carry out their work with much success, for a natural delicacy is felt in pushing hard the student of a colleague; and the majority of the committee-men have, as a rule, quite enough to do in examining their own classes. A bright, keen man of business often makes a good examiner. He does not know much about the subject, and really wants information. To enlighten such a man, and satisfy his inquisitiveness, the student has to assume the part of teacher, and soon shows if he really knows any thing about the subject beyond a mere parrot-like repetition of disconnected facts. Such an examination, however, is always incomplete, and often too long. Neither can such an examiner go through a whole class.

As in all other matters, to make examinations of value, the subject must be investigated and the principles found out. We must know what objects are to be attained, and then we must follow, as best we can, not an empirical routine, but a philosophical procedure; not like professors in the University of Laputa, but remembering that we live in the nineteenth century.

The mind acts successively in three ways; viz., by observation, comparison (judgment), reason. These are broad divisions, and may of course be subdivided, but it would be beyond the scope of this paper to go into the details of classification. Having obtained facts by observation (and I include here not alone the physical and chemical properties of unorganized and organized matter, but statements of events, and of subjective data, etc., such as may be obtained by reading), the mind compares the mental images so gained, and perceives wherein they resemble each other and wherein they differ. The next step is reasoning, — inductive when the step is from the particular to the general, and deductive when it is from the general to the particular. These four actions of the mind should always be tested in an examination, that it may show what effect the study of the subject has had on these four typical mental processes, and how well the mind has been trained to act in this fourfold way by the study of the subject.

A student may tell us all about Napoleon and Washington as glibly as if he were reading from a book. But let him be asked wherein these two men resembled each other, and wherein they differed from each other, and the glibness disappears like a flash; for the mind must now apply its facts, compare the images, and note similarities and differences. The student begs for time to think, — a sad reflection on his previous answers. I will also include memory as a faculty of the mind. It should always be tested by an examination, but it is a very difficult matter to say just what value is to be placed on it. It is a treacherous and elusive faculty. It may be temporarily active, yet in the main torpid. It may be slow, yet lasting. Its absence is a fault, its presence is a danger. It has many forms, and plays many a deceitful *rôle*. While memory is the antecedent necessity of thought, it is still a subservient faculty. It is the useful slave, but a tyrant when master. I would make it work to its full limit, yet not honor it with medals. It is my tool, my library, my sword, my medicine, but it is not *I*. The wise teacher and examiner know well how to bring out its full value, and yet not to be led astray by its dazzle. Readiness of perception should also be taken into account, but this is still more difficult to value than memory. Men reach their objective aims in different ways, some quickly, some slowly. The important point is to be sure that they really do attain them.

The difficulty with the examinations in vogue in England, to judge from the complaints recently published, is that they fall too entirely under the first head. They test the students' powers of observation alone, and allow the substitution of memorizing for thinking. While they fall under observation, these examinations do not at all test or train the students' real or full powers of observation. In physical science, for instance, the school-knowledge of the properties of matter learned from books is not to be compared with the worth of the same knowledge gained by actual experiment on the part of the student. No amount of "cram" can ever teach a student the possible differences and similarities between the images that his memorizing of facts has stamped on his mind with more or less vividness and durability. The skilled examiner can ring changes on them without end. Nor can "cram" help to any extent in reasoning. Inductions and deductions can be ground out in an endless stream, even by the average examiner; but the experienced questioner, studying the mind before him, as one dissects some delicate organism, tests its working, examines its products, and notes its behavior under varying conditions, forming a fair opinion as to what it is intended to do, and how well it may be expected to do it. Nor need any two examinations ever be alike; assuming, of course, that the teacher is himself a real teacher, and not a mere animated phonograph.

Should examinations be so conducted as to test the mind in the way indicated, there would be of course a great turmoil, for hundreds of students would fail to pass. As the blame for the failure of the student to understand what he studies is usually, and to a certain extent with justice, thrown on the teachers, there would be another wild outcry on their part. All of this agitation would result, however, in what is really demanded, — a form of examination that should show the condition and working of the student's mind as affected by each particular subject, and that should also demonstrate the ability of the teacher, not only to impart information, but to develop minds by means of his particular subject. It will require great courage on the part of teachers to give examinations that shall show whether the students really know any thing about the subjects of their studies. It will be difficult to assign marks to such examinations that shall be entirely satisfactory or exact; but the education of the student in facts and principles, the development of his mind by them, and his ability to observe for himself and to use his knowledge in the production of new knowledge, will be attained. These, and not the representation of mind-power by figures, when no unit of mind-power is known, are the real objects of education; for the ideal man of to-day is not he who simply acquires knowledge, but he who makes knowledge. Production, not absorption, is the standard by which men are to be judged. Knowledge alone is not power, it is the ability to use knowledge that constitutes power.

Examining, or testing the condition and action of the mind, is a subject of great pedagogical importance. It certainly seems evident that the present agitation about examinations will end in proving, not that examinations are of no value, but that many examiners do not yet fully understand the facts, principles, and methods of examinatory science.

PETER T. AUSTEN.

New Brunswick, N.J., April 13.