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CONTENTS.

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Legal Status of Expulsion Resolution by a Chapter. In the order issued by the Court of Common Pleas of Pennsylvania against the Philadelphia Chapter of the American Institute of Architects, commanding the restoration of Addison Hutton to membership, the futility of trying to regulate architectural practice in an ethical way is fully demonstrated. The case in question consisted in the flagrant disobedience of the member of a Chapter of its edict in regard to the propriety of entering a competition which is deemed to be so questionable as to debar any architect of probity from entering. A resolution was passed by the Chapter to which Mr. Hutton belonged stating its position in regard to the competition for the Pennsylvania State capitol building, as follows:

Resolved, That participation in the competition for the completion of the State Capitol at Harrisburg, under the program submitted by the Chapter, is non-professional, that the program is loosely drawn and offers little promise that the designs submitted by architects will be considered on their merits.

Resolved, That the said program issued by the Capitol Building Commission is calculated only to encourage favoritism and injustice; that it obligated the Commission in no way to select the best designs or architects, and that therefore we advise all architects in Pennsylvania not to enter the competition.

The unanimous adoption of this resolution made any participation in the competition by a member an unprofessional act, and Mr. Hutton's expulsion followed. It was held in the legal proceedings to secure reinstatement that, while the Chapter contended that the resolution was properly adopted and that it had a right to establish such a prohibitory order in view of the by-law which was passed for that very purpose, it was held by the expelled member that all the powers of the Chapter were those expressed in its charter alone, and that the Chapter had exceeded its authority in the adoption of the prohibitory resolution. This contention was upheld by the court. The case is particularly stated that the position of the architectural organizations in the matter of expelling members for unprofessional conduct may be shown, as it illustrates the inability of the architectural organization to establish a code of ethics and secure its recognition by its members in any other way than by the sense of professional loyalty and moral responsibility among its members. It can only be sustained by the action of each individual, and where a member disregards rules which his professional confrères deem proper, there is no legal method by which he can be punished. It has been found in all such cases that the association was helpless, and the member still secure in his rights if he chose to contest them, and the only action which would legalize expulsion was non-payment of dues. It seems to us that this is as it should be. The architectural association is not a trade union. It is an organization by professional men for the advancement of their art by association. It should have no legal status any further than protection of its property or the security of its financial status. Its ethics should stand alone upon the moral sense of the individual and in his professional loyalty should be found a stronger guard against conduct that is deemed unbecoming than any rule for his discipline or expulsion. It will make the examination of members both in regard to their professional and their moral standing more rigid before admission, and thus advance the influence of the organization as a whole.

THE ECONOMIC NEED OF TECHNICAL EDUCATION.*

BY VICTOR C. ALDERSON, DEAN OF ARMOUR INSTITUTE OF TECHNOLOGY, CHICAGO.

THE day of the untrained man is past; the day of the technically trained man is here. At no time have the untrained, the unfit, the poorly prepared been so ruthlessly weeded out of the professions, the arts, the trades and business callings as they are to-day. The incessant demand, heard by him who has "his ear on the ground," is for young men in the vigor of manhood, whose eyes, ears and hands, as well as minds, are trained to do the work demanded in modern industrial pursuits. Those who stand midway between the active industrial workers on the one hand and the oncoming groups of young men on the other, like the administrative officers and professors of our technical schools, are able to take a broader and more comprehensive view of the field of supply and demand than most others.

The pedagogical reason for the existence of manual training in a school curriculum is identical with the reason for the existence of drawing, singing, numberwork, sciencework or reading — no more and no less. To be perfectly fair and impartial, then, it must be admitted that the term "Manual Training School" is as erroneous as "Mathematical Training School," "Science Training School" or "English Training School." The names primary, grammar and high school are quite sufficient, for in each school mathematics, English, science and manual training should enter as coördinate subjects. Manual training should no more give name to a secondary school than philosophy should be the describing feature of a university. Rather should shopwork, science and hand manipulation be an integral part of the curriculum of all grades of schoolwork, from the kindergarten up. The simple handwork of the kindergarten, the sciencework of the primary school, sewing and cookery for girls and carpentry for boys in the grammar grades, are all movements in this direction. The manual training of the future, and the very near future, will be handwork of some kind adapted to the ability of the student, whatever may be his stage of advancement. Manual training will then lose the distinctive feature it now holds as an adjunct to a high-school course, and become one means of education applicable to all grades of instruction.

Most, if not all, recent improvements in educational methods in this country have been purely academic or philosophic; they have been evolved by musing in the library, or perhaps from classroom experience; but none of them have resulted from a close acquaintance with the real conditions of the industrial and business warfare into which the student enters when he leaves the school. The so-called "systematical development" given to young people is but a twentieth-century way of training a "jack-of-all-trades." The one thing needful will not come from teachers' conferences, nor county institutes, nor the august meetings of school superintendents, for the attendants at these assemblages have not, and can not get from their experience, the proper point of view. The great majority of the public-school teachers are women whose environment has been limited by the home, the school and some social functions. The number of men engaged in teaching who have done serious practical work outside of the schoolroom is small. The academic circle which they tread reminds one of the Illinois farmer whose circle of experience was to raise more corn to feed more hogs, to buy more land — to raise more corn to feed more hogs, to buy more land — *ad infinitum.* Educators of to-day should break out of the circle in which they are traveling and look at matters from a new point of view. This should be from the vantage ground of the factory, the workshop, the railroad or the counting-room; it should be industrial and commercial rather than academic. The practical needs of everyday workers should be considered, after a scientific study of conditions at present existing. There should be no prejudgment by the social or educational philosopher who knows not the difference between a "shaper" and a "milling machine," and evolves theories of what ought to be, but never is. Industrial life in its relation to national growth and prosperity, in its influence on international competition, and in its demands upon educators, offers interesting fields of investigation. This change of view from the speculative and philosophic to the practical and industrial will result in many desirable changes for the betterment of our system of education. Hitherto the speculative element has been supreme; the time has come for this influence to be tempered by the introduction of more rational and scientific views.

With advancing civilization, with the luxuries of yesterday becoming conveniences to-day and necessities to-morrow; with our products going to faraway lands in competition with local goods, with competition becoming sharper day by day, with the margin of profit becoming steadily narrower, it is found necessary to seek new lines of economy. In the accurate application of the laws of science, an almost limitless field is open. Mere practice, no matter how long continued, can not long avail against theory followed by intelligent application. A stupid fireman can burn up the profits of his establishment by ignorant firing; an engineman was recently discovered running an engine for no other purpose than to get exhaust steam to heat his building. He was a "practical man of long experience." A soap manufacturer who had depended upon the "knack" of one workman for many years, nearly went into bankruptcy when the man died, for no one else seemed to have the requisite "knack"; but the employment of a trained chemist without the "knack" regained for him his lost business. A large railroad company recently saved more than half a million dollars in six months by equipping a laboratory in connection with its machine shops and putting in charge a technically trained man — one who could unite theory with common sense. Day by day the demands for scientific and technical training become more and more emphatic. The present age has truly been called the age of science, but with this designation the story is only half told. Pure science to be of the greatest value must be applied. The application of science to industry has made this the age of technical education; it has changed many of the conditions of life and has given rise to new problems, the solution of which depends in a high degree upon men who have received a technical education.

Technical training, in its broadest significance, should be made to include professional schools, as of law, medicine, theology, engineering, dentistry, pharmacy, the special research work of universities, as well as the more modest schools for the textile industries, the mechanic arts or domestic science. Although professional training may, in this broad sense, be termed technical, yet for the present purpose it will be best to limit its significance and apply it only to the arts and crafts. A dozen years ago the introduction of manual training was always preceded by a spirited controversy; to-day its value is generally conceded and its introduction is becoming fairly common. Not only is it incorporated into the high-school curriculum, but it is fast going where it especially belongs — into the graded schools, as an organic part of educational training. In another dozen years the necessity for advocating manual training will probably have ceased. What new features will be advanced to take its place? What new element in educational progress will be demanding recognition? In all probability it will be secondary technical education. Leaving out of consideration the two extremes — unskilled labor at the foot of the educational ladder and those professions at the top which demand a preliminary college training — there are many vocations in the middle ground for which a technical training is necessary. This broad field has been cultivated very little in this country. England, France, Holland, Belgium, Germany, Austria and Switzerland have all done more than we have, and it may not come amiss to examine the system of technical education in one of these countries.

Switzerland is best known to Americans as a region of mountain scenery, but it is an object lesson for us in a manner not yet fully recognized. The natural conditions under which the Swiss people have struggled for the past six hundred years have been so burdensome and their industrial success so pronounced that Switzerland is to-day the best of the European countries in which to study the close relation which exists between the technical education of the masses of the people and national industrial prosperity. There are fewer people in all Switzerland than in Greater New York; the largest city, Zurich, contains only 150,000 persons; the area of the country equals the combined area of but three of our smallest States, Massachusetts, Connecticut and Rhode Island; of this area twenty-nine per cent is utterly unproductive even for the frugal Swiss; twenty-one per cent is forest; twenty-five per cent is meadow and grazing land; thirteen per cent is under fruit; twelve per cent is under crops and gardens; the country has no seaport, no navigable river and no lake of commercial size; she has little or no natural wealth; she must import her raw materials, work them up into salable form and export them; lines of transportation are expensive and rates high; the amount of fertile soil is meager, and would scarcely make a respectable-sized western ranch. In the United States we have been allowed to blunder at will, to be improvident and wasteful; we cut down our forests with reckless disregard for the future. Twenty-six years ago Switzerland enacted a law that her forest area should never be reduced; and since that time for every tree that has been cut down another has been planted. Forced by almost cruel natural limitations to rigid economy, both of material and labor, required to solve the problem of industrial success under exacting requirements, Switzerland has given us a solution which it behooves us to examine with considerable care. That solution is the careful, systematic education of each citizen, be his station in life high or low, so that his efforts will be efficient enough to meet competition in similar lines of work the world over.

Like the United States, Switzerland has no national school system. The constitution of the federation allows the federal government to establish a polytechnicum, a federal university and other institutions of higher instruction or to subsidize such local schools as may be selected. Provision for elementary instruction must be made by the several cantons, but the federal government in most cases subsidizes these cantonal schools. There is no federal university, but six cantonal universities exist at Basel (founded in 1460), Zurich (1835), Berne (1834), Geneva (1873), Fribourg (1889) and Lausanne (1891). The polytechnicum at Zurich (founded in 1854) is supported entirely by the federal government. The school covers the higher scientific and technical fields in a most thorough manner. For accuracy of instruction, completeness of equipment and high professional standard, it is the peer of any technical school in Europe. It has the proud distinction of having more of its graduates holding positions of responsibility and of attracting more foreign students than any other continental technical school. With a most complete cement-testing laboratory; a mechanical laboratory covering every possible demand that can be made upon it; with a department of

*Paper read before the Western Society of Engineers, and published in the journal of the society June, 1902.

electricity equipped regardless of expense; with extensive departments of chemistry, forestry and agriculture; with a new department devoted to the testing of building material alone, it is evident that the federal government has provided liberally for the most advanced instruction in technical lines. There seems to be no fear in the minds of the Swiss that a man can be too scientific, or that too deep a study of the scientific basis of industrial questions is possible.

Next below the Zurich Polytechnicum are three technica, or technical schools, offering less theory and more practice, and relating their work more closely to the trades and industries. One is located at Bienne; the second, at Winterthur, is noted all over Europe for the thoroughness of its instruction and the success of its graduates; the third is at Burgdorf, where Pestalozzi taught his first school and where Frœbel at one time was developing his philosophy of education. This group of technical schools gives scientific character to the entire Swiss system of technical education.

The trade and industrial schools, to be carefully distinguished from the group first described, have been established to teach the homely trades, and are a conspicuous feature in the educational and industrial life of Switzerland. They are found in every canton, and are intended to make the local industries more successful. Some cantons with a population not over 300,000 have as many as a hundred of these schools, enrolling more than 3,000 students.

The watchmaking schools have had a long existence, the Geneva school beginning as early as 1770 with the desire of a journeyman watchmaker, Louis Fargare, to learn more of his trade than the ordinary school instruction provided. Besides the school of watchmaking at Geneva, which has a worldwide reputation, and has contributed largely to the success of the Swiss watches, other schools exist at Locle, La Chaux de Fonds, Neuchatel, Fleurier, Solothurn, Bienne, Porrentruy and St. Imier. In these schools the course covers from three to five years; the age limit is thirteen or fourteen years; vacations are few and brief. At Locle the school is open every day in the year except Sundays and holidays. At Neuchatel three weeks vacation is allowed in summer. The tuition is invariably higher for foreigners than for natives. At Fleurier the charge is $1.93 per month for natives and $4.83 per month for foreigners. The pupil on entering one of these schools enters into a contract of apprenticeship with the school authorities. At St. Imier a contract must be signed by the parents or guardian. At Porrentruy the pupils are on probation for the first three months, and may be dismissed if found unfitted for the work. At Solothurn pupils must pass a theoretical examination and afterward a practical test before entering fully upon their apprenticeship. If they leave before the expiration of their contract, a fine of not more than $1.93 per month may be exacted for the unexpired term. The amount of practical work is greatly in excess of the theoretical. At La Chaux de Fonds theoretical instruction is given for only ten hours per week in the first year, twelve hours per week in each of the second and third years, eight hours per week in the fourth and only seven in the fifth year. All the rest of the time is given to practical work. The object of these schools is primarily to give instruction in every detail of the art of watchmaking. How well they have succeeded all the world knows; but it is not so well known that these schools have converted regions naturally fit for nothing but growing pine trees into important industrial centers.

In 1888 a school of metal-working was established at Winterthur, as a part of the Industrial Museum, under federal control. The object was to educate skilled workmen for the various branches of fine metalwork. Attendance is in the form of apprenticeship; the course three years in length, and the age limit fifteen years. At Brienz, the present center of the wood-carving industry, a school of wood-carving was organized in 1883, under municipal control. Tuition is gratuitous, but a contract of apprenticeship is required. This school has a fully organized faculty; instruction covers not only the art of wood-carving, but the distinctive characteristics of the different woods and the manufacture of all needed tools. Not only are the usual styles of carving studied, but special attention is given to the plants and animals peculiar to the Alpine region, as every tourist in that country knows. No better illustration of the value of technical education can be found than in the straw-plaiting schools like that at Wattwyl. These had a very humble origin, and were established to teach the people in the poorer regions of the sub-Alpine districts a useful occupation. The result has been to create a new industry and to convert regions naturally poor into flourishing industrial centers. There are also shoemakers' schools, with a peripatetic staff of instructors who give short courses wherever classes can be formed. They also issue publications to the trade, dealing with subjects of technical interest, as the structure of the human foot or the reasons of the military authorities for the specifications relating to the contracts for boots and shoes for the army. Somewhat different in plan is the school of silk-weaving at Wipkingen, near Zurich, which is owned by the Association of Silk Manufacturers of Zurich. Only a few of the graduates of this school are ordinary weavers; most of them hold superior positions, as proprietors, superintendents or master weavers. The School for Carpenters and Shoemakers, founded at Berne in 1888 by municipal authority, but aided by cantonal and federal grants, is peculiarly interesting. Instruction is gratuitous; hours of instruction are from 7 A.M. to 6 P.M., with a free dinner at noon. The object of the school as published is distinctly utilitarian, namely, to teach thoroughly a trade, to investigate the latest improvements in the trade and to meet the increasing competition of foreign labor by putting domestic labor on a high plane of efficiency.

The needs of women are by no means neglected. A private school of ladies' tailoring and needlework, with a three years' course, at Zurich; a trade school at Berne, teaching plain sewing, ladies' tailoring, embroidery, ironing, cookery, housekeeping, mending and making children's garments; a housekeeping school at Worb which is self-supporting and has more applications than vacancies; a housekeeping school at Buchs, with a three months' course, popular with young ladies about to be married; a trade school at Basel, which has enrolled nearly three thousand pupils since its organization in 1879; a school of art and needlework at Zurich, with a curriculum of such artistic, educational and scientific merit as to make it a model for other schools; schools at Berne and Lenzburg to supply the demand for trained and competent household servants. All these emphasize the necessity for giving women, as well as men, a technical training.

Industrial art schools exist at Geneva and Zurich. The one at Geneva is the oldest in Switzerland, founded in 1751, and is attended chiefly by persons already employed, but wish to devote their spare time to improving themselves in the artistic side of their work. At St. Gallen, the center of the lace industry, a special school devotes its attention to embroidery and designing. In Zurich alone there are seven schools for woodwork; in Fribourg schools for bookbinding, basket-braiding and stonecutting; in Bienne, a school for railroading; at Waedenschwyl, a school for fruit growers and gardeners; at Zurich, Berne and Neuenburg, schools for theoretical and practical agriculture; at Geneva a school for horticulture; at Sursee, Brugg and Lausanne, winter agricultural schools; at Ruti, Fribourg and Lausanne, dairy and cheesemaking schools; at Geneva, Neuenberg, La Chaux de Fonds, Berne and Winterthur, commercial schools. In addition to the already extensive list must be added a large number of institutions designed for the instruction of the humblest members of the working classes. The first of these, a drawing school for apprentices, is now nearly a hundred years old. Between 1820 and 1830 three others were established at Aarau, Baden and Zug; between 1840 and 1850 nine were organized, and between 1850 and 1865 seventy-eight more. Since that time their number has increased with great rapidity, and now reaches into the thousands, while the attendance reaches tens of thousands. Sessions are held evenings and Sundays. The original idea of teaching drawing has been maintained in many, but in others distinct industrial courses in cabinetmaking, tailoring, upholstering and other trades have been introduced.

Swiss education is the result of no single philosophy, no one method, no selfish utilitarian object; it has not been dominated by social reformers nor by mere theorists; it is a composite type, the result of many conflicting views and necessities. Throughout the entire system can be seen, however, an attempt to solve the problem of the relation between education and industrial prosperity. This point of view is the one thing needful in developing our own system of technical education, and the one idea which we can best borrow from the Swiss. With them no valuable feature, either cultural or technical, is ignored. Each branch of knowledge is prized according to its value as discipline or as a distinct aid in professional or industrial pursuits. Their object is not only to train men and women for their vocations, but to build up new industries or at least to extend and strengthen those already established. They have even enriched the humblest callings with many applications of art, skill or science; they have expended money liberally upon every form of technical education which would increase the workingman's efficiency; they have transformed regions naturally poor and barren into thriving communities; they have entered freely into international competition, and have made the world their marketplace; they have shown that technical education is an economic necessity, worth many times its cost. The commercial and industrial success of Switzerland, achieved in the face of great natural obstacles, shows conclusively that the surest foundation for industrial prosperity lies in a complete and thorough-going system of technical education.

Technical education in this country is a product of the last quarter of a century. Before 1875 only a few schools pretended to give a technical education. The first legislation which gave a decided impetus to this form of education for the American youth was the Morrill Land Grant Act of 1862. This act granted public land to the several States, apportioning 30,000 acres for each Senator and Representative, to be devoted solely to the advancement of instruction in the agricultural and mechanic arts. The full effect of this act was not felt until after the beginning of the last quarter of the century, when there was established in almost every State a school to carry out the purpose of the act. From that time on the growth of technological education was remarkable, whether we consider the actual outlay upon material equipment, the increased number of students, the constantly improved methods of instruction or the continued elevation of the standard of instruction. In addition to the governmental aid rendered, many private citizens subscribed liberally to the needs of institutions already established, or made large endowments for new ones. This great advance came from a general acceptance of the view that industry needed the aid and assistance which comes from technical training. With this change of industrial demands came the needed supply in the form of young men trained, not in the classic halls of some favored university, but in the workshops and the laboratories of institutes of technology. These men are educated to understand the fundamental principles of science not merely in their broad, general aspect, but in every matter of practice, detail and application. They supply, to only a limited extent, however, the needs of modern industry, since they furnish merely the highest grade of workers, as does the Zurich Polytechnicum and the technica at Winterthur, Bienne and Burgdorf. They furnish a technical training not for the many but only for the few. What should be done for the great army of workers in our industries, who need at once the skill of the mechanic, together with sufficient intelligence and training to understand the directions of the professional engineers above them? Their number is legion. At the present time this country makes little or no adequate provision for their instruction. This is the realm of secondary education. Whenever we, as a nation, secure the proper point of view, unhampered by the ultra conservatism of the simon-pure schoolman, and approach the subject as the Swiss have done, from a practical, common-sense, industrial standpoint, and build our industries on the solid foundation of science, as exemplified in technical education, then our industrial supremacy will be assured.

The most ringing note on this subject in recent years was sounded by the advisory committee invited by the trustees of the Carnegie gift to present a plan for the technical school which Mr. Andrew Carnegie proposed to establish in Pittsburg. After considering all phases of the question, this committee recommended the organization of three schools, to be called respectively the Carnegie Technical College, the Carnegie Technical High School and the Carnegie Day and Evening Classes for Artisans. The second of these schools was to be most radical. The Carnegie Technical High School as outlined would extend the scope of the present high school to include, besides the subjects ordinarily taught, engineering principles, steam engine and central station practice, patternmaking, machine-tool work, blacksmithing, steamfitting, surveying, machine design, instrumentmaking, founding, photography, glass-blowing and such other subjects as the local industries might demand. The establishment of such a school would be the Americanization of the foreign trade and industrial school; if it were copied and made general, it would solve for us the question of secondary technical education.

In considering so radical a measure, some important features should be emphasized, in order to avoid misapprehension. The main idea in such a plan would be to take a boy just graduating from the grammar school and give him a good secondary education, together with a training on one or more technical or trade lines. Such a scheme would be unsuccessful if the school were to be maintained on the usual high-school lines of to-day; it would necessitate a highly elastic or elective plan of operation, because no individual could successfully study all the subjects offered. The routine courses in physics, chemistry, mathematics and drawing would necessarily be much shortened; but every progressive teacher knows that much of these subjects, as at present taught, is of little value in strictly technical pursuits. Each one can be revised and reduced to advantage. Much of the laboratory, drafting-room and testing work now done by the technical colleges could be incorporated into the courses, and we should have technical high schools as real "people's colleges." There can be no reasonable doubt that our technical education in the United States is weakest in this spot. In our high-grade institutes of technology we are training the commissioned officers of our industrial army, but the great mass of non-commissioned officers and privates are left uncared for. As indicated in the report of the Carnegie committee, technical education may be said to run parallel with the general lines of education, and be divided into three parts, corresponding to the grammar, high school and college grades of the established system. The lowest grade is generally picked up in the shop by boys without special training, who have had merely a grammar-school education. It is represented in Switzerland by the Sunday, holiday and evening schools for artisans. It develops the "practical man." The highest grade is represented by the polytechnicum and technica in Switzerland and by technical colleges and institutes of technology in this country. These represent the phase of technical education that demands thorough knowledge of mathematics and the sciences, and is distinctly professional in character. Between these two extremes lies the region of secondary technical education which is represented in Switzerland by the trade school and the specialized technical school. In the United States it is represented by more or less feeble efforts in a few trade schools, in a limited number of private institutions aimed to help the workingmen, and in night schools. Besides these instrumentalities there is another, arisen only within the past few years, which for pure bigness eclipses all other efforts — the schools of correspondence. While our educators have been discussing mere theories and methods and have been building a Chinese wall about their so-called superb school systems, shutting out all who were too large to walk through the narrow gateways which they themselves had made, private enterprise has discovered that half a million young Americans outside the walls were hungry for a technical education. Since they were forbidden to enter the sacred city, technical education was sent out to them. When the history of education shall have been written, no greater reproach will rest upon the educators of this decade than their failure to hear the call of this multitude for an education suited to their needs. Technical education is one of the greatest needs of an enlightened democracy and should not be left to private enterprise. With state normal schools where young men and women can be trained for teaching, with State universities furnishing instruction in agriculture, dairying and stock-raising, besides training engineers and librarians — technical education supplied at State or national expense — it is evident that we are irretrievably committed to the policy of providing technical education at public expense. If the farmer's son can secure at the State university free instruction in scientific agriculture, what good reason is there for depriving the son of a mechanic from securing free instruction in engineering practice, machine-tool work or any other industrial calling at the city technical high school? The answer of the schoolmaster that the public schools are intended not to teach trades, but to develop character, citizenship and general culture, is totally unsatisfactory. We must remember that in order to become a good citizen a man must first secure a livelihood by honest toil; that whatever conduces to greater industrial efficiency in the individual increases the national prosperity and indirectly improves citizenship. Technical education does this. Furthermore, if it is proper to train civil engineers, stock-raisers, butter and cheese makers, librarians and the teachers themselves at public expense, why should machinists, enginemen, carpenters, plumbers and house painters be excluded? No cleavage line can be drawn. If technical education is a good thing for one class, it is equally good for others. Hitherto the ranks of such workers have been supplied by the influx of foreigners trained abroad, aided to some slight extent by apprentices from selected industries. But we should not, as a nation, depend upon any such uncertain supply. We should follow the example of Switzerland and, recognizing the dependence of national prosperity upon technical education, set about the task of providing an education for all classes of workers suited to their lives. The technical high school, if properly equipped and put in close relationship with the trades and industries, will satisfy this national need; it will not be a copy of the European trade school, but rather an adaptation of the trade school which will be in harmony with American thought and American educational ideals.

Industrial warfare is not a new idea, but its sociological effect in giving impetus to technical education during recent years is noteworthy. We are familiar with martial warfare. Our newspapers for the past few years have been teeming with reports of battles, of warfare, of disease and death as the concomitants of war; we have been called upon to pay homage to the prowess which has conquered our enemies on land and sea; we are playing the part of hero-worshipers as we have not done since the Civil War. But in the midst of all this clamor there has been going on, largely unknown and unnoticed, the most bitter, the most relentless war in the history of the world; a war not for territory, not for naval nor military glory, but for wealth, for industrial supremacy, a contest of brain with brain, skill with skill, economy with economy, technical training with technical training. It is only another example of the "struggle for existence." The war in South Africa or the Philippines is less fatal to the workingman than the ceaseless competition of similar workingmen in other countries. It is this unremitting rivalry between workers of the same class the world over that makes the cultivation of the workingman's powers by means of technical education an absolute necessity. That nation that neglects to equip its workmen with the armament of industry — technical education — will surely be defeated and become a decaying nation. These workers should receive immediate and thoughtful attention for they are the bone and sinew of successful national and industrial life. That they should be technically trained through the medium of the technical high school is at the present time the greatest economic need of the American people.

SOME ENGLISH METHODS OF SEWAGE DISPOSAL.*

FOR crude sewage from which only the heavy and coarse matters have been extracted in detritus and screening tanks, land is usually laid out (for intermittent filtration) on the ridge-and-furrow system. The arrangement is very different from that adopted for broad irrigation and known by the same name. The furrows are much deeper and wider, as shown in Fig. 98.† They may be about 12 or 15 inches deep, and from 12 to 18 inches wide at the bottom, with slopes of 1 in 1½. The tops of the ridges may be 2 or 3 feet wide. The sewage is run into the furrows in such a quantity that the depth does not in any place exceed, say, 6 inches. Roots, cabbages, etc., are planted on the ridges, and absorb a considerable portion of the sewage. The remainder filters downward to the underdrains, which may be from 5 to 6 feet deep and 20 or 30 feet apart. If the soil is porous to a great depth, the underdrains are sometimes omitted. Clay soil is useless for filtration. The sewage either remains in the furrows or passes directly through cracks and holes to the drains, without purification.

Intermittency of application is essential to the success of filtration through land. The sewage must be allowed to drain away, and the pores of the soil be thoroughly aerated before another dose is applied, and longer periods of rest must also be given. At Stratford-on-Avon the sewage of nine thousand persons is treated on nine acres of open sandy gravel, half of this area being laid out into ridges and furrows. This portion is divided into eight beds, each of which is subdivided by ridges into four quarters. The sewage is pumped from a tank for ten hours each day, and is applied to the four quarters intermittently for a week. This bed then rests for six weeks, while other beds are being irri-

*From *The Builder*, June 14 and 21, 1902.
†The cuts mentioned in this article are omitted.

gated. Every year the ridges and furrows are leveled and the other portion of the area prepared for filtration.

At Fonthill, East Grinstead, the sewage from a school of about eighty persons was treated under the direction of Mr. Bailey Denton, on an area of three-quarters of an acre, one-third of which was laid out for filtration, and the remainder for broad irrigation. The sewage is collected in a tank and discharged by raising a penstock once or twice a day. A high-level overflow is provided, communicating with the drain leading to the disposal area, so that even if the penstock is not raised, the sewage passes onto the land. Vegetables are grown on the ridges of the filtration area, and roots for the consumption of stock on the irrigation area.

The same engineer carried out a similar scheme for the Berkshire Lunatic Asylum, at Moulsford. In this case the sewage from six hundred to eight hundred persons has been successfully treated on 1¾ acres of deep, porous soil, laid out into eight filtration areas. The subsoil here is of porous sand and gravel, and underdrains were therefore not considered necessary. The sewage simply filters downward into the sub-soil water and can not conveniently be collected after filtration for purposes of analysis.

The sewage may be discharged automatically from a tank by means of a siphon. It must be diverted to different areas by means of small stops, which may be fitted into grooves in the walls of brick chambers after the manner shown at B in Fig. 92. The furrows in each area must be of sufficient capacity to receive the whole of the discharge without flooding the vegetation, and each system of furrows must be complete in itself, without overflow or communication with any other area.

For sewage which has been partly purified by precipitation, or by bacterial treatment in tanks followed by artificial filtration, the land may be laid out into level filtration areas, each surrounded by an earthen ridge or embankment. The sewage is run onto each bed in turn. Similar beds are often used for the rough filtration of storm water, and at one time it was a common practice to plant osiers over such storm-water areas.

Even where broad irrigation is adopted, it is a good plan to provide a number of filtration areas to be used when the state of the crops or the irrigation land is such that sewage can not be advantageously applied.

There is no doubt that intermittent downward filtration through land can, in many cases, be conveniently and satisfactorily adopted for the purification of sewage, but we have already seen that under unfavorable circumstances very little purification indeed is effected. In comparing it with broad irrigation, we may quote Dr. Rideal, who thus summarizes the main faults of irrigation with raw sewage:

"(*a*) Choking and felting of the surface with organic slime.

"(*b*) A surplus of unprepared organic matter, and of ammonia, over the wants of the plants.

"(*c*) In consequence of the above, a deficiency of oxygen and of healthy action in the body of the soil.

"(*d*) Great inconstancy owing to season, temperature and cultivation."

He adds that the faults (*b*) and (*c*) are avoided "to a certain extent" in intermittent filtration through land with copious underdrainage.

The drains, if properly arranged, not only carry off the filtrate, but also serve as aerators, supplying the soil more thoroughly with oxygen and thus "allowing nitrification to proceed more actively."

CHEMICAL TREATMENT.

A thousand and one patents have been taken out for the chemical treatment of sewage, but very few have proved to be of much practical value. For town sewage, containing trade refuse of a strong character, chemical treatment is undoubtedly necessary, in order to precipitate a large portion of the solids, and also in many cases to neutralize the acids in the sewage. The precipitant most commonly used is lime. This is slaked and ground in sewage or water to the consistency of cream or milk. It should be added to the sewage in the channel leading to the tanks, the proportion varying from about five to fifteen grains of lime per gallon of sewage. Sulphate of alumina is also often used, a well-known variety (containing a small proportion of sulphate of iron) being known as alumino-ferric. These chemicals, however, do no more than clarify the sewage. The effluents from the precipitation tanks, although less foul than the original sewage, are still liable to decompose, and further purification is therefore necessary. This may be effected on land in one of the ways already described, or by some method of artificial filtration. Chemical treatment of this kind is expensive and results in the deposition of a large volume of sludge, which is often difficult to get rid of. It is now known that domestic sewage and even town sewage containing a moderate proportion of trade refuse, can be purified by bacterial agency, and it is not likely that chemical precipitation will in the future be often adopted for private sewage-disposal works, where only domestic sewage has to be treated.

A more interesting form of chemical treatment is that based on the researches of Dr. W. E. Adeney, of the Royal University, Dublin, and practically applied by the Oxygen Sewage Purification Co., under the direction of Mr. W. Kaye Parry and others. This system is devised to assist the bacterial changes in sewage by the addition of chemicals, and is not therefore a mere precipitation process. The following account of it is condensed from the evidence given by Dr. Adeney to the Royal Commission on Sewage Disposal. The two conditions of primary importance in the purification of sewage are: (1) A very large and continuous growth of bacteria, and (2) a constant and adequate supply of oxygen for their use. The oxygen may be obtained from the air, as in natural and artificial filtration, where the pores of the filter contain a store of air in close proximity to the surfaces on which the bacteria may grow. Dr. Adeney suggests that oxygen may be supplied to the sewage by means of chemicals, in addition to that furnished by the air; thus, the insoluble higher oxides of manganese may be employed for furnishing the necessary oxygen for the aerobic fermentation of the *suspended* organic matters, and small quantities of nitrate of soda may be used for supplying oxygen to effect a similar purification of the *dissolved* organic matters. When compounds of manganese are employed for clarifying the sewage, sludges are obtained which, when drained and kept in heaps, undergo slow aerobic bacterial fermentation, resulting (in the presence of a sufficient quantity of peroxide of manganese) in the complete fermentation of the solid organic matters in the sludge. The process, therefore, is a somewhat complex one, supplying oxygen in two forms, the one for the purification of the sludge and the other for the purification of the sewage from which the sludge has been deposited.

The installation of this system at the Chapelizod Police Barracks, co. Dublin, is shown in Fig. 99. The works are designed to purify a quantity of sewage not exceeding 1,200 gallons a day. Four circular tanks, 4 feet in diameter, of the Dortmund type, are built around an octagonal sludge well. The sewage flows through the straining chamber A and over the wheel B, which regulates the supply of the chemical reagent (known as "oxanite"), and can be diverted by the sluice marked S^1 into tank No. 1, from which it passes through a low-level communicating pipe (C^1) into tank No. 2 and, rising to the surface, overflows into the sluice box (S^2) at the same level as it entered No. 1. The other tanks are similarly arranged; any one tank can be cut out of the circuit by means of the valves and sluices when it requires cleaning. The communicating pipes are furnished with circular inspection eyes, covered with gratings. Each tank has a conical bottom, communicating with a 6-inch iron pipe (V^1, V^2, etc.) leading to the sludge well, this pipe being fitted with a sluice valve. To receive the sludge a bucket is lowered by a differential pulley, traveling on a circular overhead rail (shown by dotted lines on the plan) so that the bucket can be hung under any one of the four sluices. On the valve being opened the thickest sludge from the bottom of the tank passes out, and when the bucket is full the sluice is shut down and the bucket raised to the surface. All the work is performed from the floor level, and it is found that only one bucketful has to be removed each day. The sludge is air-dried and used in the garden of the barracks. If a tank has to be emptied, it is cut out of the circuit and the contents are run into the sludge well and pumped therefrom by means of a chain pump P. A ladder, L, affords access to the bottom of the sludge well. The whole of the apparatus is contained in a chamber measuring 20 by 16 feet inside, the height from floor to ceiling being only 7 feet. Ample light is provided by means of five windows and five top lights. The tanks are rendered inside with Medina cement.

The effluent from the tanks at Chapelizod Barracks is not filtered in any way, but in most cases further treatment will undoubtedly be necessary.

SUB-IRRIGATION.

This method of disposal may be regarded as a modified form of broad irrigation. The principal feature is the discharge of the sewage a few inches below the surface of the ground instead of over the surface. The advantage of this arrangement is that the sewage is not exposed to view; ponding is also avoided, and a nuisance is not so easily created. On the other hand, the sewage is not likely to be so thoroughly purified, as bacterial activity decreases from the surface of the soil downward.

The system was originally devised by the Rev. J. M. Moule, better known as the inventor of an earth closet, but was improved by the late Mr. Rogers Field, who adopted it for the sewage of schools and other buildings. It has also been adopted in America by the late Col. G. E. Waring and others.

The sewage should first pass through a settling tank, in which the heavy solids are deposited, and the coarse matters (such as paper and straw) retained. A certain amount of grease will also be collected in the floating scum. From this chamber the sewage passes into a larger tank, where it is stored for a period varying from twelve to twenty-four hours, or even longer. Unless the sewage must be pumped to a higher level, an automatic siphon may be fixed to come into action when the tank is full and to discharge the sewage into the main drain leading to the irrigation areas. Fig. 95 shows a pair of tanks, differing only in detail from the arrangement recommended by Colonel Waring. The inlet to the settling chamber A dips slightly below the level of the overflow, so that the sewage is diverted downward; deep trapping may lead to the accumulation of grease at the mouth of the drain. A screen wall divides the settling chamber into two parts, B and C, the first of which retains the heavy solids, while the second serves as a scum chamber for the collection of grease, etc. The overflow dips deeply into the second chamber, so that the scum is not carried forward into the storage tank D. An automatic siphon E comes into action when the sewage reaches a certain level, and continues in action until nearly all the contents are discharged. The siphon is sometimes placed within the tank, but in this position it becomes foul. In the illustration it is shown outside the tank, but it may with advantage be placed in a manhole so as to be easily accessible for repairs.

The size of the main tank will depend upon the amount of the sewage and the desired interval between the discharges. It can not be too often insisted upon that rainwater should be excluded as much as possible from the sewage drains when a private system of purification has to be adopted.

The sludge and scum accumulating in the settling chamber must be removed when necessary, and can be most conveniently got rid of by digging it into cultivated land. The sedimentation of the sewage in tanks is essential to the success of sub-irrigation, as otherwise the absorption drains are soon choked with sludge.

The arrangement of tanks shown in the illustration is not the best. Undoubtedly bacteria will be at work breaking up the sewage, but the tanks are not proportioned in such a manner as to give thoroughly satisfactory results. The first tank B is really a grit chamber. The second compartment is of the nature of a septic tank with a continuous flow through it, but its capacity is too small to allow great changes to take place in the sewage. These changes will, however, be continued during the filling of the large tank, but it is obvious that the last portions of the sewage to enter the tank will be discharged by the siphon in the state in which they leave the scum chamber C. This subject will be more fully discussed in a later chapter.

Open tanks are sometimes used, but ought to be covered with iron grates or screens to prevent leaves from entering the tanks and passing to the absorption drains.

From the discharging tank D the sewage passes along the outfall drain to the sub-irrigation areas, of which at least three ought to be provided. These areas must be well dug over to a depth of 10 or 12 inches or more and carefully graded. At a depth of 9 or 10 inches from the surface, earthenware channels (Fig. 96) must be laid with open joints and a very slight fall, say 1 in 400 to 1 in 600; on these channels, agricultural drain pipes 2 inches in diameter and in 1-foot lengths are laid with the joints open about a quarter of an inch. Above the joints small segmental caps, with a larger radius than the exterior of the pipes, are placed to prevent the soil falling through the joints, while still allowing the sewage to escape. If a greater fall than 1 in 400 is given to the absorption drains, the sewage will accumulate at the ends of the drains and may burst through to the surface of the ground.

The absorption drains may be laid from 3 feet to 6 feet apart. The total length in each area must be regulated by the amount of discharge from the tank and the nature of the soil. Colonel Waring recommends 1 foot of 2-inch absorption drain for each gallon of sewage discharged, if the soil is reasonably porous, and at least three feet if the ground is impervious clay. Rather more than seven feet of 2-inch pipe will be required to contain a gallon, but the sewage, of course, escapes through the open joints of the drains into the channels and grounds during the period of discharge, and consequently a lower basis of calculation may be adopted. The sewage ought not to enter the absorption drains at a high velocity; to prevent this the last twenty or thirty feet of the main drain from the tank may be laid with a fall of about 1 in 300. The absorption drains must, of course, have their inverts level with the inverts of the mains.

The irrigation areas may be arranged in a variety of ways, according to the configuration of the ground. Two methods are shown in Fig. 97, that at A having four areas and that at B having three. The sewage can be diverted at the points marked *s* into the different groups of absorption drains. The areas must be irrigated in turn, so to admit of one discharge in any area being absorbed and purified, and the ground well aerated before another dose is applied. A longer rest may be given to each area as required by applying the sewage alternately to the other areas. Rows of vegetables may be planted between the drains, and the sewage will be to a large extent absorbed by their roots, or grass may be grown over the whole area.

If the drains become choked with sludge, a period of rest must be allowed, when a great part of the sludge will disappear through the action of bacteria and other organic life. In some cases, however, it will be necessary to take up the pipes and relay them, after removing the deposits. This is not a very laborious operation, as the pipes are so near the surface.

At the Lawrenceville School for Boys, New Jersey, sub-irrigation was adopted for the sewage, the rainwater being excluded from the sewage drains. The scheme was designed for the sewage from four hundred persons, and a large tank was constructed and divided longitudinally into six compartments. Three compartments were used at a time, the sewage traveling slowly forward in the first compartment, overflowing by a dipped pipe to the second, flowing back along this and overflowing to the third and then passing along to the overflow into the discharge tank. Each compartment is 60 feet long, about 3 feet wide and 4 feet deep. The discharge tank is 25 feet in diameter and 8 feet deep, and from this it was intended to pump the sewage about twice a week into the irrigation areas. These consisted of 1¾ acres of ground in which about six hundred feet of 4-inch main pipes and twenty thousand feet of 2-inch absorption drains were laid. The latter were about 8 inches below the surface and 5 feet apart and had an inclination of 1 in 100 to 1 in 130. In practice this inclination was found to be excessive. The scheme appears to have worked well for some time, but the irrigation area proved inadequate after some years, during which the flow of sewage gradually increased from six thousand to twenty thousand gallons a day. It must be said that the ground was not of a suitable character. On account of the proximity of a brook the under drains were laid at an average depth of about 3 feet only and in some places were only 2 feet deep. The ground was of a porous nature, and much of the sewage, therefore, passed directly to the under drains, very little purification being effected.

Sub-irrigation has never been adopted on a large scale in this country, but it has proved useful for private sewage disposal where the irrigated areas are near buildings.

INTERMITTENT DOWNWARD FILTRATION.

This method of disposal, brought into prominence by Mr. Bailey Denton, has been very widely adopted in this country, sometimes successfully and sometimes not. If the ground is of a porous character and in such a situation that it can be underdrained at a depth of 5 or 6 feet, good results will be obtained under careful management. If, however, the ground consists largely of clay, or if the under drains can not be laid at a greater depth than 3 feet, failure is almost certain to follow.

The different results obtained by this method of land treatment may be conveniently illustrated by means of two examples, of which particulars are given in the recently issued appendices to Vol. III of the Interim Report of the Royal Commission on Sewage Disposal. The schemes were designed by one engineer. In both cases the sewage was about 1¼ millions of gallons per day, and included trade refuse as well as domestic sewage. The population in each case was about thirty thousand. No storage tanks were used. In the one case the sewage was treated on fifty-five acres of land and the inspectors reported the effluents to be unsatisfactory on twenty-six occasions in a period of less than two years, and at no time was the effluent found to be satisfactory. In the other case the farm was laid out as to sixty-one acres for filtration and as to twelve acres for broad irrigation. The inspectors' reports for the same period were: satisfactory, 25; unsatisfactory, 0. The slight difference in the area of the land does not account for the great difference in the amount of purification.

Very similar comparisons might be made between broad irrigation schemes, the fact being that the character of the land vitally affects the results. Careless management may also render even a good scheme unsatisfactory.

PAINTS IN ARCHITECTURE.

OIL FOR ZINC PAINT.

IN France, where the use of zinc paints to the exclusion of lead is made compulsory on all public work, it is the custom to use poppy oil for grinding the zinc, if it is to be used for interior work. The principal advantage of this oil over linseed oil is its color, which, being very light, affects the pure white of the zinc very slightly.

For outside work raw linseed oil is used there as here, with this difference, that cold-pressed oil is still an article of commerce in Europe and that French contractors and painters are very particular in specifying manganese dryers for use with zinc paints.

In some experiments recently made for me it was ascertained that with linseed oil refined as for varnishmaking to which about five per cent of good kauri gum had been added in the process of making, the dryers being exclusively manganese (borate), the character of the paint produced on grinding with straight American zinc was entirely changed. The paint proved to be very heavy in body, easy working under the brush and highly elastic. That it was beautifully white goes without saying. My experiments are necessarily incomplete, but so far as can be judged after three months' exposure, I am inclined to recommend this menstruum as highly preferable to ordinary raw linseed oil for use in zinc white paints intended for metalwork.

The paint in question is now doing service on a large greenhouse built of steel and glass. CHARLES JOURDAIN.

VENTILATION.

WE can live without food for weeks, but we can not live five minutes without air. This shows the importance of plenty of fresh air in buildings that are used for the housing or assembling of people as well as those used for the shelter of animals.

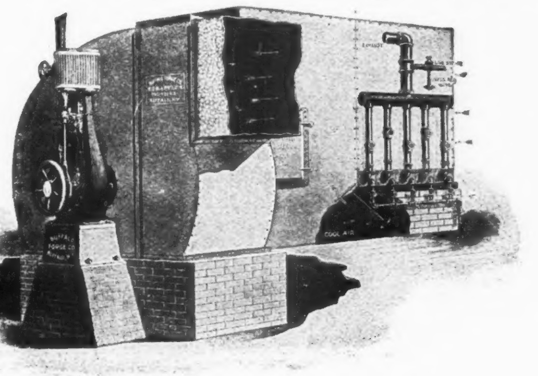
Stage managers should know that if the ventilation is good in their theaters, the audience will keep awake and take more interest in the proceedings, so that a simpler play with cheaper costumes and actors will serve to please the audience of a well-ventilated house fully as much as would a more gorgeous play with grand scenery, splendid costumes and high-priced actors, before an audience stupefied by the dead air of a non-ventilated theater. And from this it follows that a fine production will be a greater success in a well-ventilated theater than in one with little or no ventilation. Hence, from a financial as well as an artistic standpoint, it pays to spend money for ventilating theaters.

The same idea applies to churches and other places of public assembly. If the ministers could know that their auditors feel better physically, mentally and morally when assembled in an auditorium filled with pure air, constantly replenished, they would pay more attention to ventilation and less to eloquence. It would not take so much eloquence to keep the people awake, and a good ventilating system would relieve the minister of much hard work and cudgeling of his brain in the search for inspiring thoughts.

Carrying the idea still further, it pays to ventilate well our factories, salesrooms, offices, etc., so that the workers therein will do more and better work, keep in better health and spirits than when huddled in close, poorly ventilated rooms. As for the proper ventilation of our dwellings, its importance can not be overestimated. Here are where the children live, and their sleeping-rooms at night should have a constantly flowing supply of pure air. This serves more to keep them healthy than all the infant foods, cereals and like mush ever invented.

HEATING AND VENTILATING FAN SYSTEMS.

IN these days no building of any size should be designed without incorporating in the plans some system looking toward adequate heating and ventilating. The old idea that it was only necessary to heat a building, has been discarded, and to-day advanced practice requires the use of a system which at all times ventilates as well as heats. In other words, heating and ventilating must go hand in hand, and this can be best accomplished by the use of the fan or hot blast system. Such plants as designed



TYPE OF APPARATUS FOR SINGLE DUCT APPLICATION.

and installed by the Buffalo Forge Company, of Buffalo, New York, present many features of interest.

In the first place, the fan is preëminently adapted to ventilating purposes. By its use, the volume of pure air supplied to a room may be kept constantly ample, independent of the temperature, which may be varied at the pleasure of the occupants. The modern conception of ventilation is that purification is effected not wholly in itself by the removal of vitiated air and the substitution of fresh, as often believed, but by the simple process of dilution or diffusion of gases, whereby the introduction of fresh air into a body of impure air acts simply to reduce the percentage of harmful constituents in the resulting combination to a point consistent with hygienic requirements. Pure country air contains four parts of carbonic acid in ten thousand parts of air by volume, and a room is considered well ventilated when it contains but six or eight parts. The fan system, with its constant supply of fresh, warm air, is the only feasible method of keeping the purity of the air in large buildings up to the standard, and any system less positive in its action must entail harmful vitiation. Inadequate, to say the least, is any arrangement whereby the air in a room directly heated, as from steam radiators, and where the chimney action of vent ducts is relied upon to maintain healthful conditions; for ventilating purposes, in other words, natural forces are not sufficiently positive and unvarying.

The fan is most usually situated in the basement and as centrally as possible, in order to avoid radiation and frictional losses, as well as unnecessary lengths of galvanized iron ducts leading to the vertical flues. The simplest arrangement as applied in factory buildings, cotton mills, etc., is the single-duct system, where the fresh outside air is either drawn or blown through the heater by the fan and discharged into the main duct, branches of which lead to risers supplying the various rooms. The temperature may be regulated by the amount of steam supplied to the heater, built in sections of valved coils, and also by dampers or valved registers, located in rooms to be heated and ventilated.

Another arrangement is the double-duct system, as applied in various forms of public buildings. Here the fan blows through the heater and supplies one main duct with warm air and another with either cool or tempered air. Two such main ducts run along the basement ceiling to a mixing damper at the bottom of each riser; by means of this damper the temperature of the air passing up the riser may be varied without changing its volume. These dampers may be regulated from the various rooms by hand, or thermostats may be installed to give perfect automatic control. Still another arrangement is of the single-duct type. From the risers the air is discharged through register faces located about eight feet above the floor at a low velocity toward the outer cool walls of the room, falling gradually as it cools and passing out the vent faces at floor line which open to the ventilator on the roof. A constant abundant air supply at the proper temperature is thus assured. The sustained action of the fan produces a slight excess of pressure in the room, which prevents leaks and cold drafts from without, and which, aided by natural draft action, creates a good current up through the vent ducts in the warm inner walls. With the supply above the head-level of the occupants, a thorough distribution without drafts is secured, with a temperature that will not vary two degrees in any portion of rooms of well-constructed buildings. When it is remembered that such a system combines practically perfect heating and ventilation with marked fuel economy, its widespread application is not to be wondered at.

Heating and ventilating fans are made usually with steel-plate housing, arranged for top or bottom horizontal discharge, or at special angles under varying conditions. The most usual forms are the top horizontal discharge, full and three-quarter housings, and the three-quarter housing discharging at the bottom into an underground duct. The fan wheel proper has wrought-iron tee arms cast into the hub and carrying the curved steel-plate blades, conical side plates, to which the blades are riveted on each side, giving additional rigidity. These fans are built in sizes up to thirty feet in diameter and driven with peripheral velocities up to five thousand feet per minute.

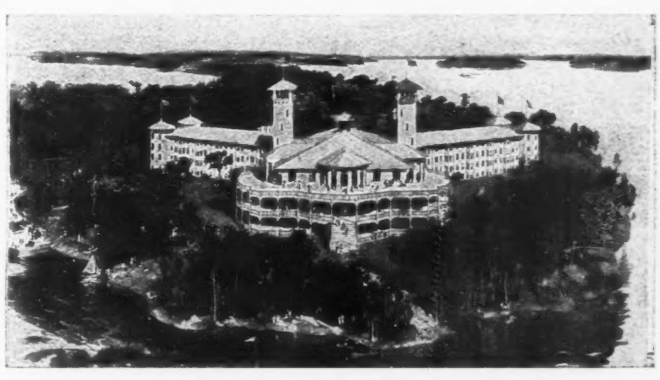
The illustration of this article shows a Buffalo Forge Company three-quarter housing steel-plate fan drawing air through the heater, and arranged with by-pass underneath. The fan is direct-connected to a Buffalo upright engine, with cylinder above the shaft. Various other arrangements are employed. The fan may be of the full housing type, blowing through the heater, which in turn may have a brick or a steel-plate covering. Different styles of direct-connected engines are used, or the fan may be belted to a Buffalo horizontal automatic cut-off engine. Economy is gained by using the exhaust of the fan engine in the heater. The latter is built up of steam piping in sections, with connections for regulating the distribution of the steam, whether live or exhaust. When both are utilized, the air in its passage comes in contact with the coolest pipes first and the hottest last, so that maximum economy and heating effect is thus obtained. It is interesting to note in this connection that heaters have been built by the Buffalo Forge Company containing more than six miles of piping.

Methods of heating and ventilating in schools, office buildings and large structures of all sorts have of late years received the attention they have deserved. The result has been an unqualified verdict in favor of the fan system as the only feasible scheme for a proper attainment of the desired end.

A UNIQUE SUMMER HOTEL.

IT is not every architect that has the opportunity that Mr. Beaumont Jarvis, of Toronto, the designer of the hotel at Lake Rosseau, in the Muskoka district of Ontario, enjoyed, to lay out a plan that reaches into the surrounding country and subsidizes the view in every direction and forms a trust as it were and a monopoly as well with all the breezes that blow.

It is not so many years ago that the country of the Muskoka was only known to the few fishermen and canoeists that threaded the waters of the lakes and rivers lying east of the Georgian Bay, but their tales of wonderful forests, trout-infested streams and islands lying like emeralds in the setting of amethyst lakes,

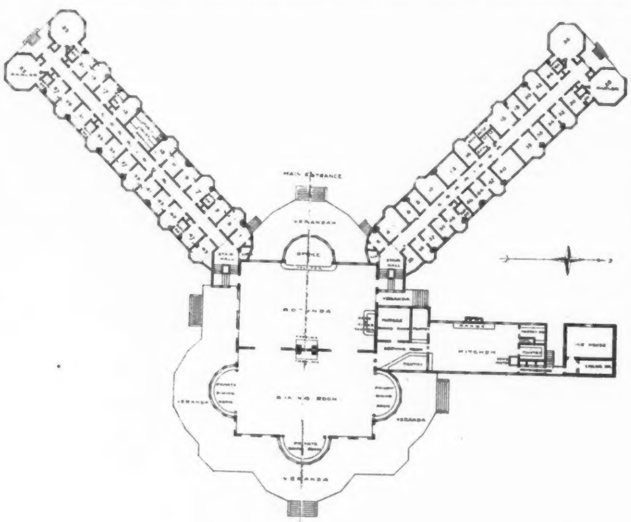


ROYAL MUSKOKA HOTEL, LAKE ROSSEAU, ONTARIO, CANADA.

drew others, and now this paradise is peopled each summer with those who are fortunate, if not deserving. For to spend a week or a month in Muskoka is as near supreme happiness as comes to mortals. It is, after all, due to the enterprise of the Grand Trunk Railway System that this enjoyment has become possible to the many. It has not only placed first-class trains with quick connecting time-tables upon the several lines that reach into the country from Buffalo and other points, but has promoted the building and equipment of steamers, has encouraged the erection of hotels such as the Royal Muskoka, and opened up in every way this recreation place that is peerless in this country.

Though in Canada, it is only four hours' ride from Buffalo or one night from Chicago. It can be reached from the great lakes through the Georgian Bay via Parry Sound, and a few days' visit to Lake Rosseau and the Royal Muskoka hotel makes a pleasant break in the Georgian Bay steamer trip. It seems needless to speak of the fishing, both for trout and black bass that abound in all this country to a greater degree than any other district on the Western Continent, and to the hunter, while he can not enjoy the shooting in the summer season, he has the pleasure of seeing the deer as they cross the lakes or feed at dawn or early morning amid the reeds along the margins, and the pleasant excitement of a brood of partridges running from his feet to the nearest cover.

The large photographs which are found in every ticket office of the Grand Trunk Railway give evidence of the superb pictures



MAIN FLOOR PLAN
ROYAL MUSKOKA HOTEL
LAKE ROSSEAU
ONTARIO, CANADA

the camera can preserve for the visitor to the Muskoka country, and the literature of travel which is carefully prepared and elegantly printed for distribution gives accurate information that can be absolutely relied upon.

Aside from the purely recreative feature of the Georgian Bay country and Muskoka district, it has other charms. To the geologist it is a mine of interesting study. The queer formation of the rocks are full of minerals, from gold, silver and copper to mica and malegnite. Outcroppings of limestone appear in the midst of the granite ledges. Sandstone is also observed in the most extraordinary combinations. To the botanist the flora is as varied as it is luxurious, and every tree known to the temperate zone can be found in its environment. The naturalist, too, can study animal life, from the moose, king of the woods, to the many varieties of humming birds that set the honeysuckles trembling, for, except the summer visitor and an occasional lumber camp or Indian reservation, the whole country lying east of Georgian Bay and north of Lake Ontario, known as Kawartha Lakes, Lake of Bays and Muskoka districts, is as wild and primeval as when it was first discovered by Champlain in the seventeenth century.

CORRESPONDENCE.

SENATE OF THE UNITED STATES COMMITTEE ON THE DISTRICT OF COLUMBIA, WASHINGTON, D. C.

Editor, Inland Architect: June 19, 1902.

DEAR SIR,— In THE INLAND ARCHITECT for February, on page 5, is an excerpt taken from the report of the Senate Committee on the District of Columbia in regard to the improvement of the park system of the district, in which occurs the statement that after Mr. Burnham was appointed a member of the Park Commission the commission to build the Pennsylvania Railroad Company's station in Washington was given to him. As a matter of fact, before he went on the Commission he had already begun to draw plans for the Washington station at the request of the Pennsylvania Railroad, although the formal announcement that he was to be the architect of the station had not been made. The report itself has been corrected in accordance with this fact, and as you have since published the report in full, I desire to call your attention to the correction.

The Senate and the District of Columbia are under the deepest obligations to Mr. Burnham for his disinterested work in connection with the Park Commission; and in the realization of the plans, which even at the present session of Congress have been provided for to a remarkable extent, the people of the country also will come to understand how very much of the work of the Commission, of which Mr. Burnham was the president, means. I am

Very respectfully yours,

CHARLES MOORE.

NEW PUBLICATIONS.

PLANNED upon new lines for the purpose of presenting a comprehensive account of the character and environments of architectural training at Pennsylvania, the "Biennial Review" of the School of Architecture of the University of Pennsylvania sets forth in detail the requirements of the course from the entrance examinations to the completion of the fifth or graduate year. To this end, typical problems have been selected whose demands are printed in full, together with one or two of the best solutions offered in each case by the students. The scope of the work in design ranges from the simpler composition problems of the second year, among which we notice "an entrance to a small public library," "a mausoleum for a country estate," "a restaurant for a fashionable watering-place," to the severer tasks imposed in the fourth and graduate years. Of the former, "a nautical amphitheater," "a presidential mansion," "a municipal hospital for the insane," sufficiently indicate the interests considered. The work of the graduate year is more mature and indicates extended tests of the student's powers of composition as well as his discrimination in handling the practical details of competition work of the highest class. Mr. Thornton Oakley's "Study for a University Group" and Mr. Julian Abele's "Metropolitan Cathedral" are typical examples of this, and reflect the highest credit on both instructor and pupil. The course in interior decoration is represented by schemes dealing with rooms as a whole and by several charming individual pieces, such as furniture, wall papers, lamps and other decorative objects. Supplementing all this work are the course in drawing from the cast and from nature.

OUR ILLUSTRATIONS.

Residence, Denver, Colorado.

Church Interior, Howard V. Shaw, architect, Chicago.

Residence, Los Angeles, California. Hunt & Eager, architects.

Residence, Los Angeles, California. Locke & Munsell, architects.

Ladies' Dormitory, Beloit College, Beloit, Wisconsin. Patton & Miller, architects.

Carnegie Library, Sheboygan, Wisconsin. Patton & Miller, architects, Chicago.

Stephenson Public Library, Marinette, Wisconsin. Patton & Miller, architects, Chicago. The front and rear views are shown.

Residence for Edwin S. Fechheimer, Winnetka, Illinois. Augustus B. Higginson, architect. Exterior and interior views.

Competition design for administration building, Municipal Hospital, Washington, D. C. T. G. D. Fuller and Theodore Wells Pietsch, associate architects.

Photogravure Plate: Residence of F. L. Ames, Chicago. Frost & Granger, architects.

Correction: The photogravure plate numbered among the illustrations of our "Regular Edition" for June, and which bore the title "House, Chicago. Pond & Pond, architects," was from the design of Architect Ernest A. Mayo.

PHOTOGRAVURE PLATES.

Issued only with the Photogravure Edition.

Residence, Oak Park, Illinois.

Residence, Oak Park, Illinois. Frank L. Wright, architect.

Southern Pacific Railroad Station, San Francisco, California.

The Henneberry Building, Chicago. Howard V. Shaw, architect.

Residence of W. T. Fenton, Chicago. Wilson & Marshall, architects.

Residence of B. Carpenter, Lakeside, Illinois. G. B. Higginson, architect.

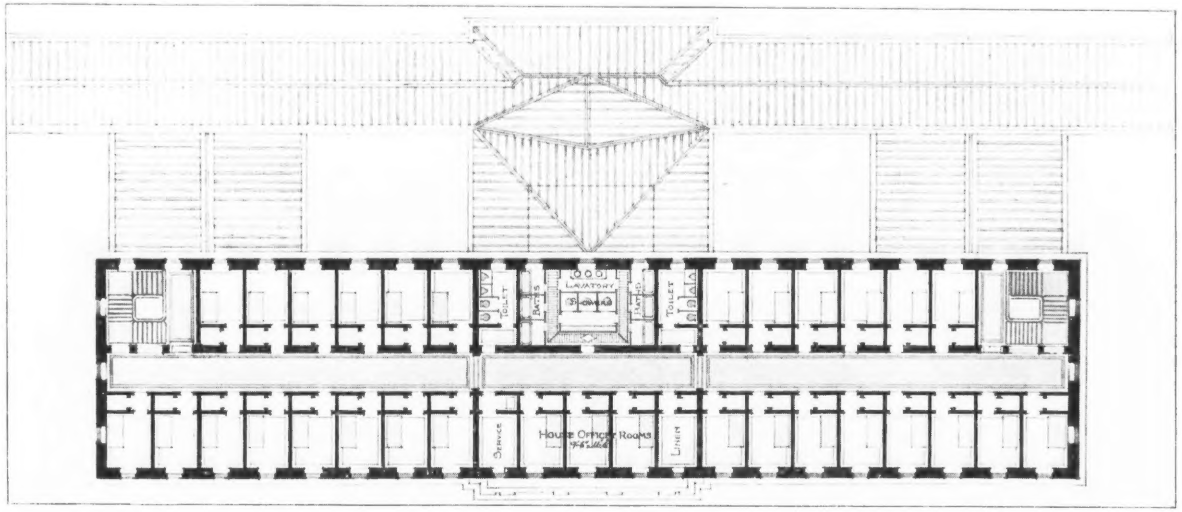
Residence of W. H. Merrill, Jr., Lakeside, Illinois. Arthur Heun, architect, Chicago.

ASSOCIATION NOTES.

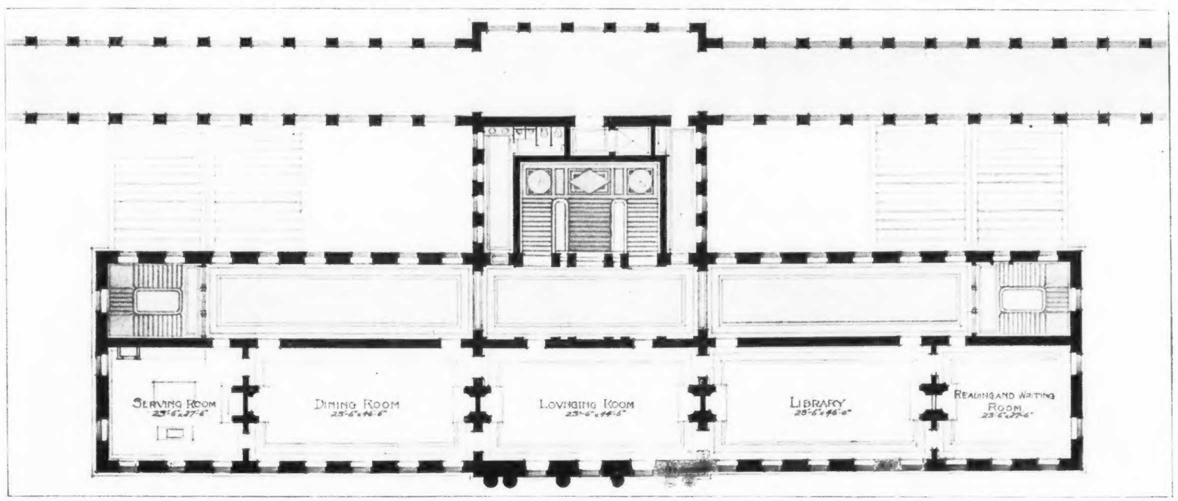
THE ARCHITECTURAL LEAGUE OF AMERICA.

The following are the officers and committees appointed for the year 1902: President, Frederick Stymetz Lamb, New York; vice-president, Clarence H. Blackall, Boston; treasurer, Julius F. Harder, New York; corresponding secretary, H. K. Bush-Brown, New York; recording secretary, William E. Stone, New York; Frederic Crowninshield, New York; David Knickerbacker Boyd, Philadelphia.

The committees appointed are: Publicity and Promotion — Ernest J. Russell, St. Louis, chairman; Joseph C. Llewellyn, Chicago; Frederick Stymetz Lamb, New York. Current Work — Charles C. Pfeil, St. Louis, chairman; William C. Hays, Philadelphia; J. P. Hynes, Toronto. Codes of Ethics and Competition — Julius F. Harder, New York, chairman; Frederick W. Striebinger, Cleveland; Charles M. Shean, New York. Education — Emil Lorch, Detroit, chairman; Percy Ash, Washington; John W. Case, Detroit. Exhibition Circuit — William Laurel Harris, New York, chairman; Walter H. Kleinpell, Chicago; Carleton Monroe Winslow, New York. Publicity and Records — Emil Lorch, St. Louis, chairman; Albert E. Skeel, Cleveland; Herman Kregelius, Cleveland. Supplementary Committee on Publicity and Promotion — David Knickerbacker Boyd, Philadelphia, chairman; Clarence H. Blackall, Boston; James M. Howlett, New York; Albert E. Skeel, Cleveland; Dwight Herald Perkins, Chicago.



THIRD FLOOR PLAN.



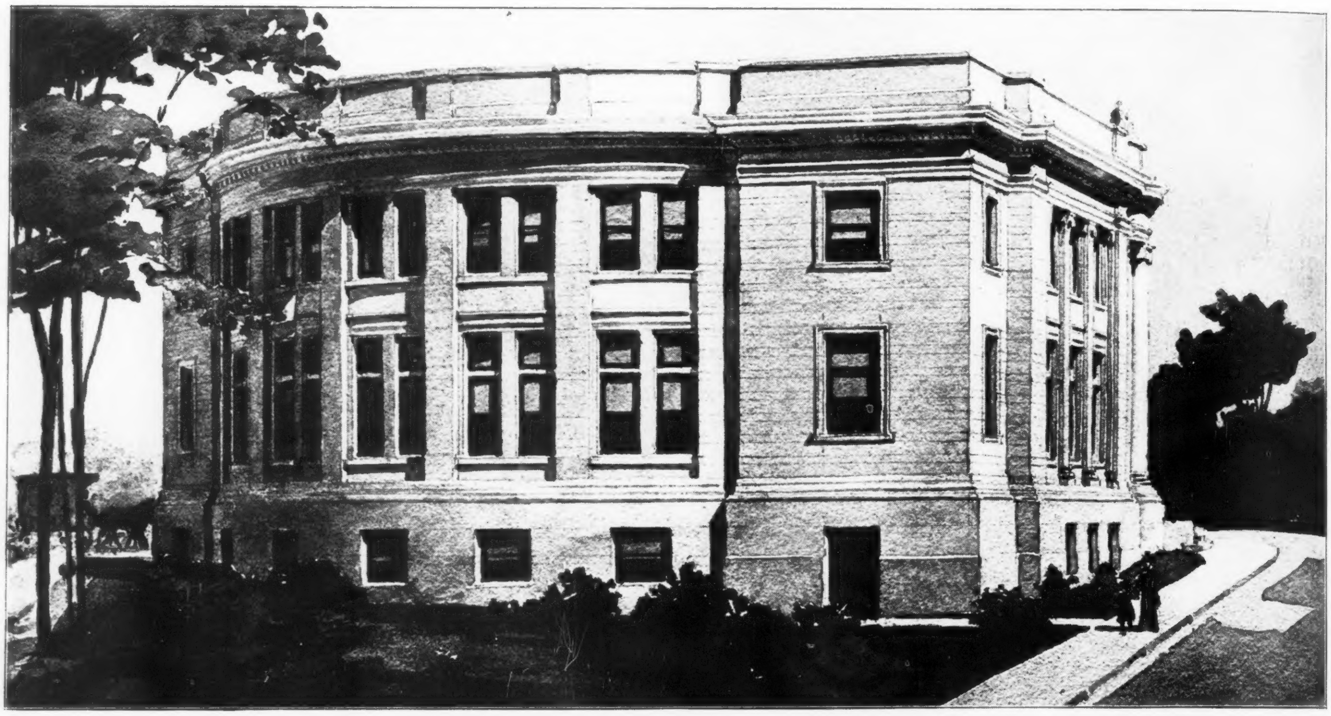
SECOND FLOOR PLAN.

RESIDENCE AT LOS ANGELES, CAL.

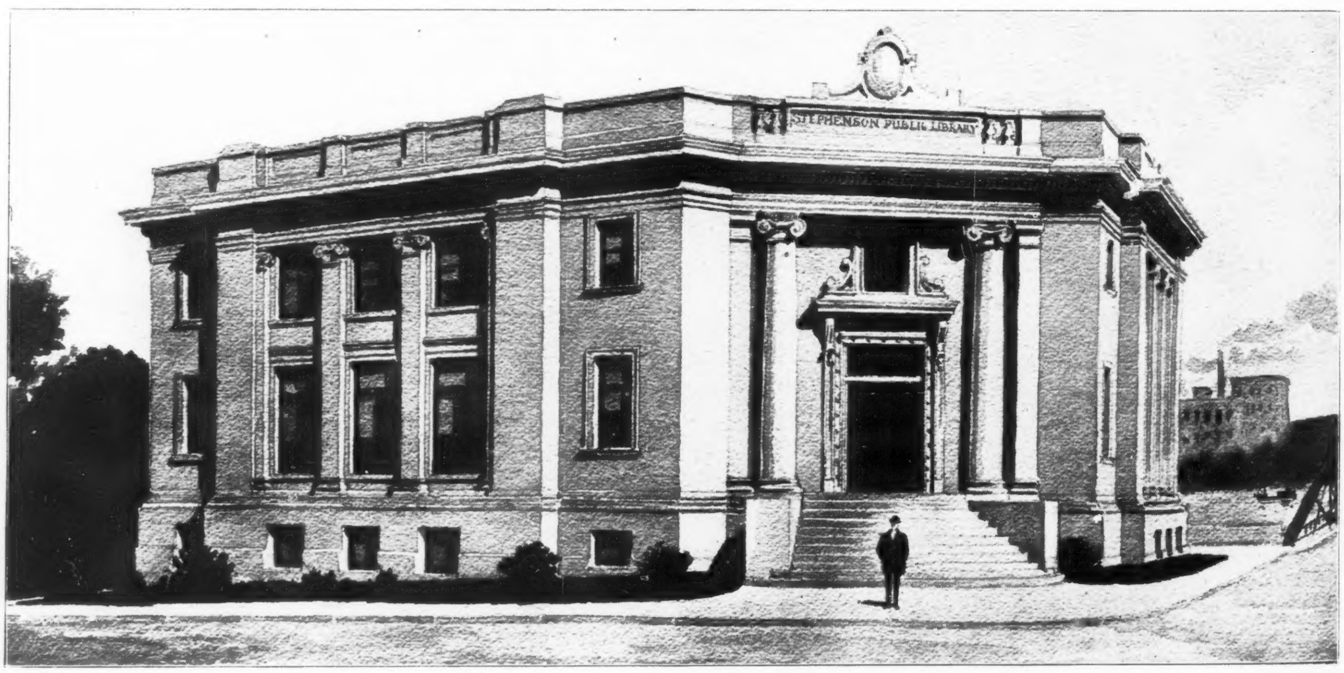
Hunt & Eager, Architects.

CHURCH INTERIOR.

HOWARD V. SHAW, ARCHITECT, CHICAGO.



REAR VIEW.



FRONT VIEW.

STEPHENSON PUBLIC LIBRARY, MARINETTE, WIS.

PATTON & MILLER, ARCHITECTS, CHICAGO.

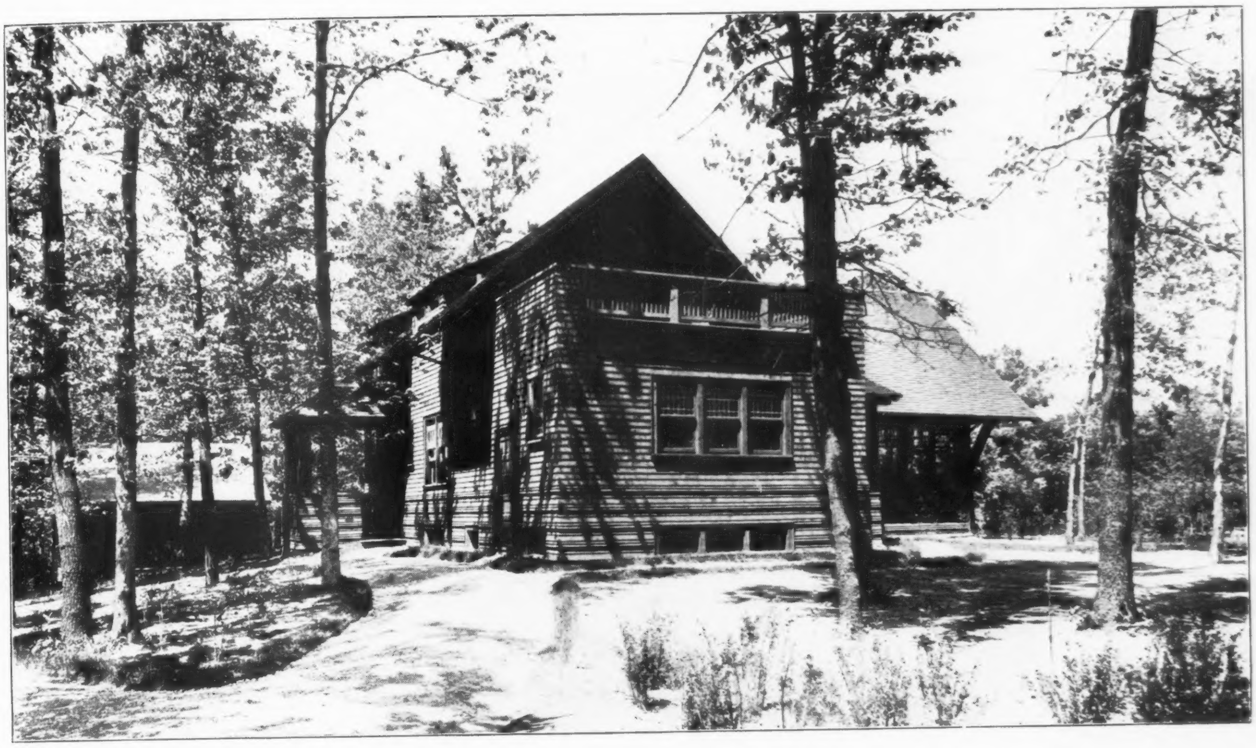
VIEWS OF RESIDENCE OF EDWIN

AUGUSTUS B. HIGG

RESIDENCE OF F. L. AMES, CHICAGO.

FROST & GRANGER, ARCHITECTS.

INLAND ARCHITECT PRESS.

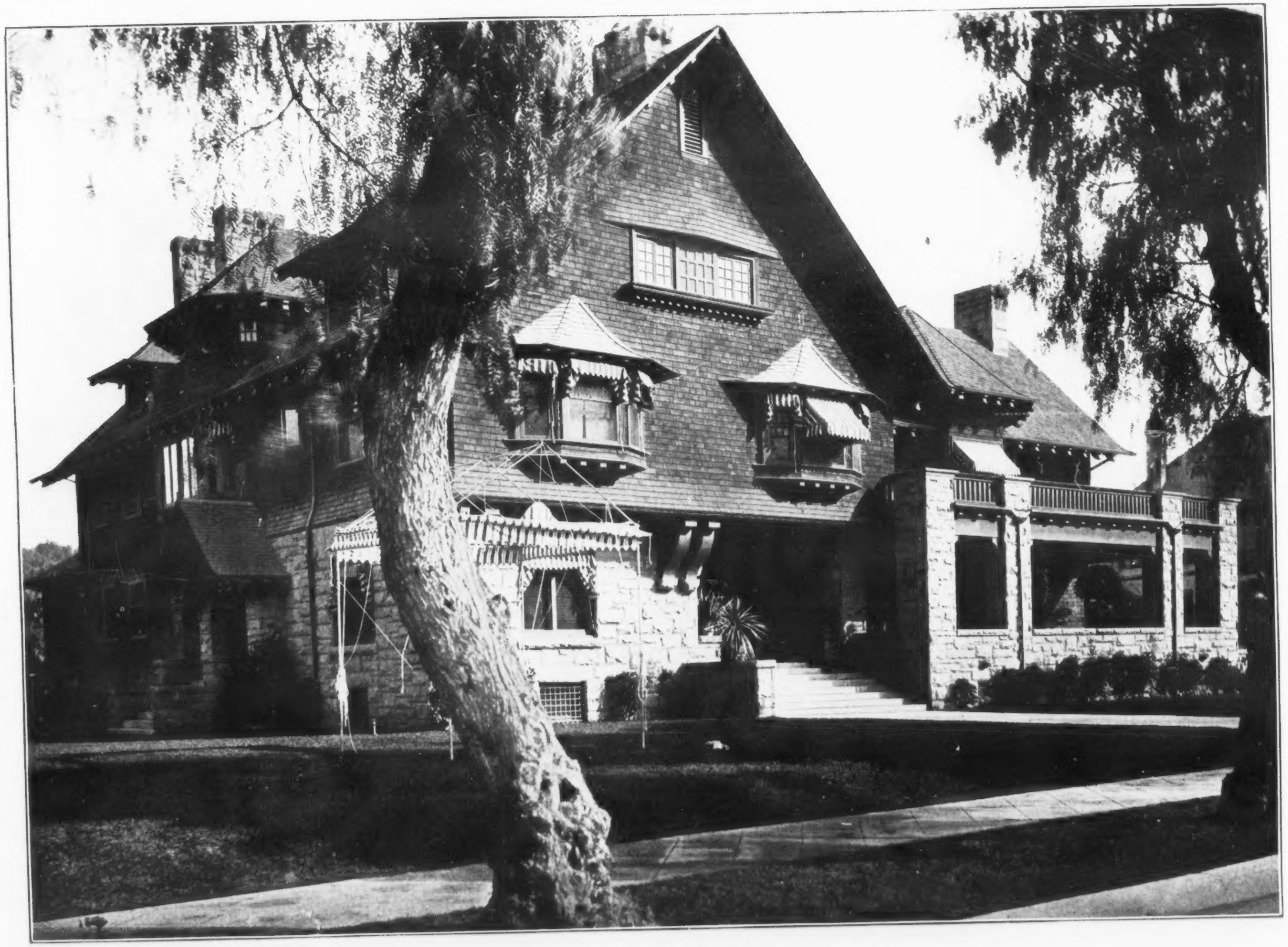


ECHHEIMER, WINNETKA, ILL.

ARCHITECT.

CARNEGIE LIBRARY, SHEBOYGAN, WIS.
PATTON & MILLER, ARCHITECTS, CHICAGO.

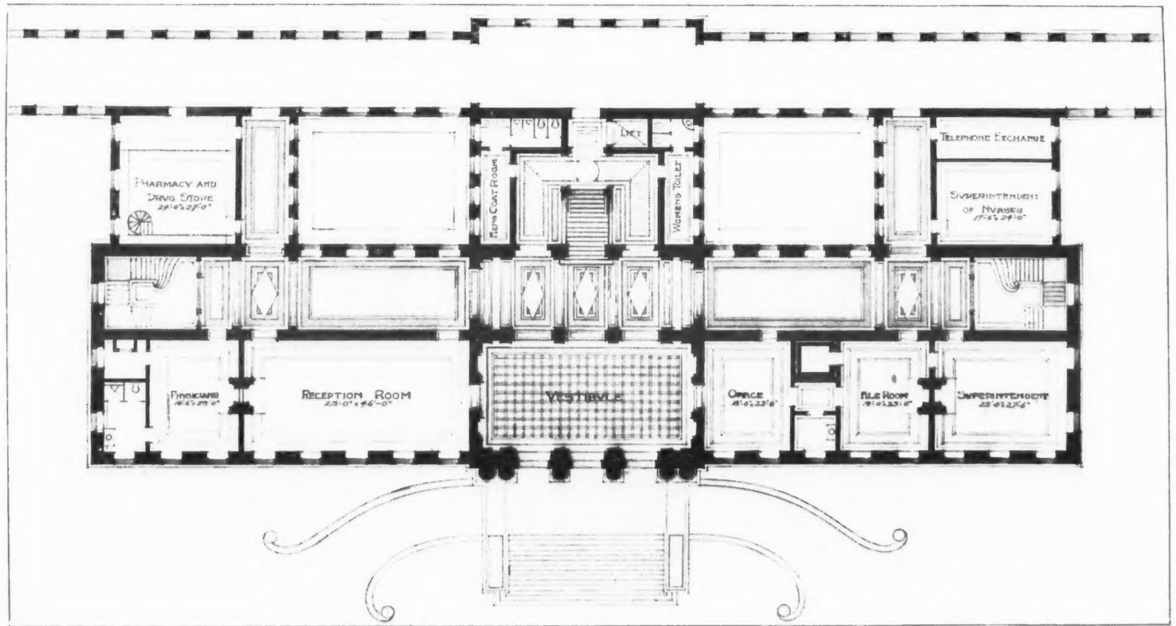
WOMEN'S DORMITORY, BELOIT COLLEGE.
PATTON & MILLER, ARCHITECTS, CHICAGO.



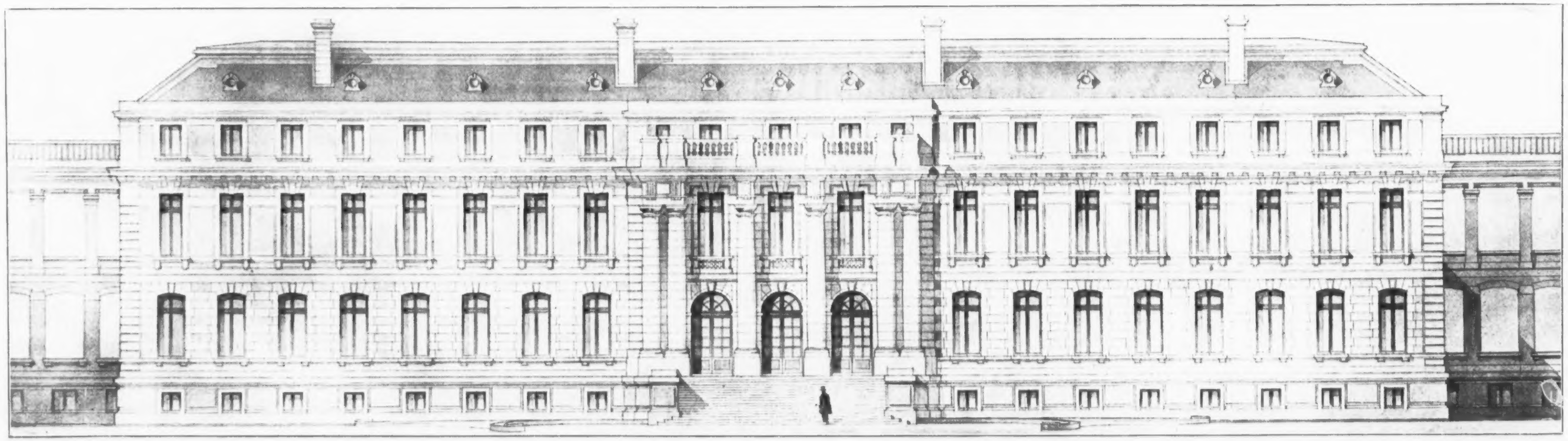
RESIDENCE AT LOS ANGELES, CAL.

LOCKE & MUNSELL, ARCHITECTS

RESIDENCE AT DENVER, COLO.



FIRST FLOOR PLAN.



COMPETITION DESIGN FOR ADMINISTRATION BUILDING, MUNICIPAL HOSPITAL, WASHINGTON, D. C.

T. G. D. FULLER AND THEODORE WELLS PIETSCH, ASSOCIATED ARCHITECTS.